UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232

Refer to NMFS No.:
WCR-2016-4089

July 15, 2016

Ron Dunton
Acting Oregon State Director
P.O. Box 2965
Portland, Oregon 97208

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat for the Resource Management Plan for Western Oregon

Dear Mr. Dunton:

Thank you for your letter of February 1, 2016, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Resource Management Plan for Western Oregon proposed by the Bureau of Land Management (BLM), under the authority of the section 202 of the Federal Land Policy and Management act of 1976, as amended [43 U.S.C. 1712 (a)].

In this biological opinion (opinion), NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*), Southern Oregon California Coast (SONCC) coho salmon, Lower Columbia River (LCR) Chinook salmon (*O. tshawytscha*), LCR steelhead (*O. mykiss*), LCR coho salmon, Columbia River chum salmon (*O. keta*), Upper Willamette River (UWR) Chinook salmon, UWR steelhead, Snake River (SR) spring/summer-run Chinook salmon, SR fall-run Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) sockeye salmon (*O. nerka*), Middle Columbia River steelhead, UCR steelhead, Snake River Basin (SRB) steelhead, southern distinct population of eulachon (*Thaleichthys pacificus*) (hereafter referred to as eulachon), and southern distinct population of green sturgeon (*Acipenser medirostris*), (hereafter referred to as green sturgeon), or result in the destruction or adverse modification of their designated critical habitats. During this consultation, we concluded the proposed action is not likely to adversely affect southern resident killer whales (*Orcinus orca*).

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the opinion for programs that do not require further BLM decisions. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal action agency must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

The proposed RMP is a "mixed programmatic" because it would approve some actions that would not be subject to further section 7 consultation, and would also approve a framework for the development of future actions that would be authorized by BLM at a later time (and with respect which, take of listed species would not occur until the subsequent authorization and the authorization would be subject to further section 7 consultation). For the non-framework actions, this biological opinion will serve as the final ESA consultation and, as required by section 7 of the ESA, with respect to those actions NMFS is providing an incidental take statement with the opinion.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. Both of these conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the BLM must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Please contact Ken Phippen at 541-957-3385 or Ken.Phippen@noaa.gov, Jim Muck at 541-957-3394 or Jim.B.Muck@noaa.gov, or Mischa Connine at 503-230-5401 or Mischa.Connine@noaa.gov if you have any questions concerning this section 7 consultation; or if you require additional information.

Sincerely,

for William W. Stelle, Jr.
Regional Administrator

cc: Mark Brown, Bureau of Land Management
Lee Folliard, Bureau of Land Management
Scott Lightcap, Bureau of Land Management
Cory Sipher, Bureau of Land Management
Richard Hardt, Bureau of Land Management
Brendan White, U.S. Fish and Wildlife Service
Pauly Bridges, U.S. Fish and Wildlife Service
Teresa Kubo, Environmental Protection Agency

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

for the

Resource Management Plan for Western Oregon

NMFS Consultation Number: WCR-2016-4089

Action Agency: Bureau of Land Management

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Oregon Coast coho salmon	T	Yes	No	No
Southern Oregon/Northern California Coasts coho salmon	T	Yes	No	No
Lower Columbia River coho salmon (*O. kisutch*)	T	Yes	No	No
Lower Columbia River steelhead (*O. mykiss*)	T	Yes	No	No
Lower Columbia River (LCR) Chinook salmon (*O. tshawytscha*)	T	Yes	No	No
Columbia River chum salmon (*O. keta*)	T	Yes	No	No
Upper Willamette River Chinook salmon	T	Yes	No	No
Upper Willamette River steelhead	T	Yes	No	No
Upper Columbia River spring-run Chinook salmon	E	Yes	No	No
Snake River spring/summer run Chinook salmon	T	Yes	No	No
Snake River fall-run Chinook salmon	T	Yes	No	No
Middle Columbia River steelhead	T	Yes	No	No
Upper Columbia River steelhead	T	Yes	No	No
Snake River Basin steelhead	T	Yes	No	No
Snake River sockeye salmon (*O. nerka*)	E	Yes	No	No
Eulachon (*Thaleichthys pacificus*)	T	Yes	No	No
Southern green sturgeon (*Acipenser medirostris*)	T	Yes	No	No
Southern Resident killer whale (*Orcinus orca*)	E	No	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes
Pacific Coast Groundfish	Yes	Yes
Coastal Pelagic Species	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

for William W. Stelle, Jr.
Regional Administrator

Date: July 15, 2016

TABLE OF CONTENTS

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Oregon Washington Coastal Office.

1.2 Consultation History

In June 2013, an ESA Consultation Agreement was signed by the Bureau of Land Management (BLM) (June 18, 2013), U.S. Fish and Wildlife Service (USFWS) (June 18, 2013), and NMFS (June 14, 2013) for the BLM Western Oregon Resource Management Plan (RMP). The goals of the ESA Consultation Agreement were to foster early coordination and integrate the ESA consultation with the National Environmental Policy Act (NEPA) process, and provide a process for ESA section 7 consultation for the RMP.

The BLM began a series of meetings with NMFS, USFWS, and the Environmental Protection Agency (EPA) to collaborate on designing a Riparian Conservation Strategy that would be part of the BLMs' proposed action for ESA section 7 consultation. The purpose and need identified for the Riparian Conservation Strategy is to protect and conserve threatened and endangered fish and provide clean water. The team met numerous times between August 22, 2013 and June 25, 2015, and developed two riparian management strategies that were evaluated in the Draft BLM Resource Management Plan Environmental Impact Statement (DEIS). In addition to the riparian management strategies developed for the alternatives of the DEIS, the team further developed a landscape level aquatic conservation strategy based on identifying sub-watersheds with specific ESA-listed habitat attributes.

Between June 25, 2015 and November 30, 2015, an ESA technical team, with members from the BLM, USFWS, and NMFS, met numerous times to facilitate development of the biological assessment (BA). The team reviewed and provided comments on several sections of the draft BA.

On January 8, 2016, NMFS staff completed review of a draft BA, and provided comments to the BLM. On February 1, 2016, NMFS received a request for ESA section 7 consultation from the BLM for the Western Oregon Resource Management Plan. On March 10, 2016, we completed our BA adequacy review and transmitted our conclusion the February 1, 2016 BA provided enough information to initiate formal consultation.

This opinion is based on information provided in the February 1, 2016 BA, the Final BLM Resource Management Plan Environmental Impact Statement (FEIS), and the written and oral correspondence during pre-consultation (August 22, 2013-February 1, 2016), including the clarification memo from Richard Hardt, BLM, to Ken Phippen, NMFS, written on April 26, 2016. A complete record of this consultation is on file in Portland, Oregon.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

The 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. The Proposed Resource Management Plan (PRMP) is the proposed alternative described in the final Environmental Impact Statement (EIS) with a "Lego block approach" for modification to the riparian reserves (RRs).

The BLM administers the use of a variety of natural resources on approximately 2.5 million acres within the western Oregon planning area of approximately 22 million acres. 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.

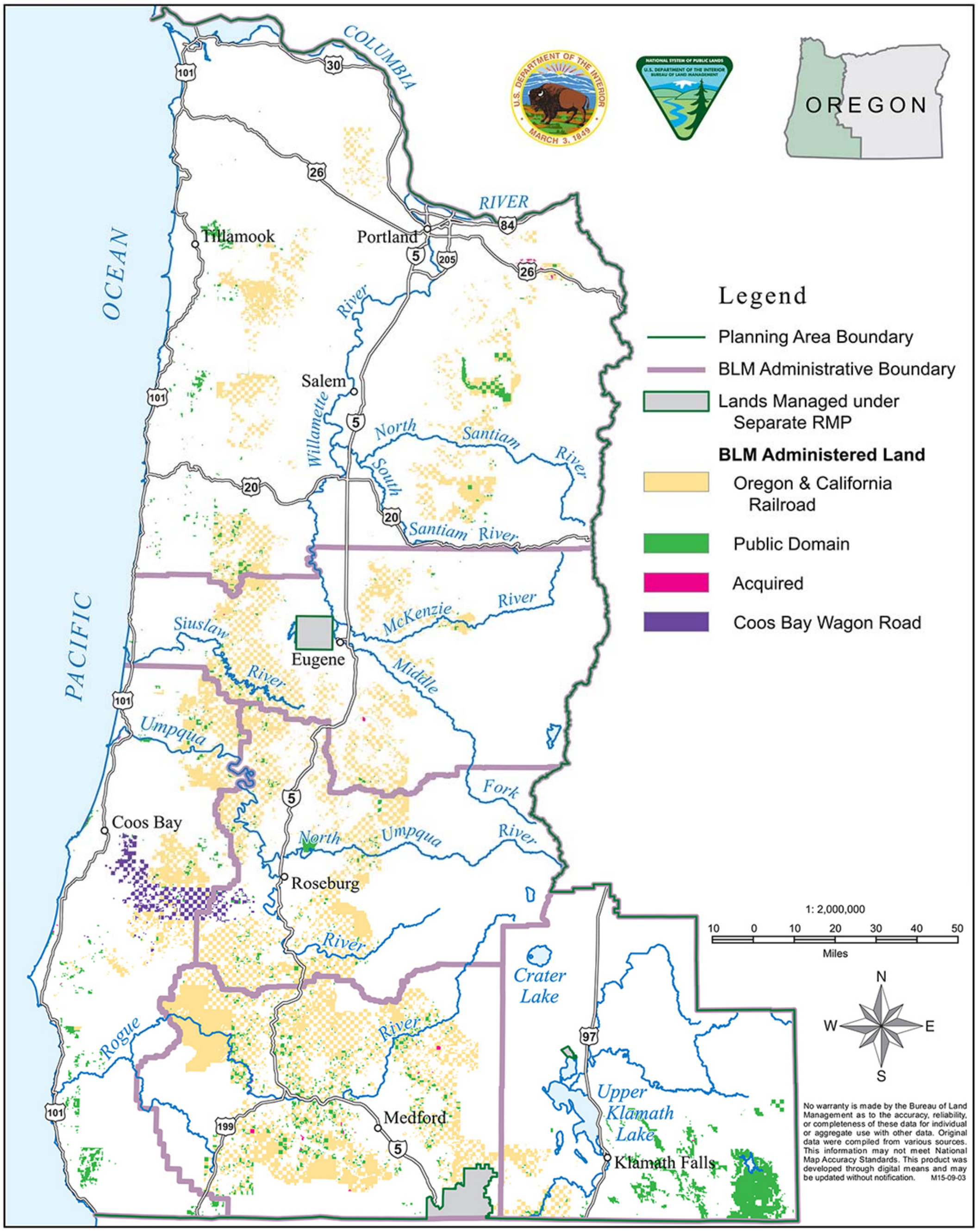

Figure 1. BLM-administered land within the ESA action area and planning area boundary (from BLM's BA).

While the PRMP does provide authorization for some on-the-ground actions that would not be subject to further section 7 consultations, for the most part, the BLM PRMP would approve a framework for the development of future actions, in particular, by way of BLM management direction. Individual consultation will occur when BLM District's implement on-the-ground actions consistent with the PRMP framework and the project is determined to have a "may affect" on ESA listed species. BLM District staff will implement these projects authorized under a subsequent National Environmental Policy Act (NEPA) and their own decision record.

The BLM PRMP will have indirect effects associated with the management of the Coquille Forest. By Federal law, the Coquille Forest is "subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future" per Title V of the Oregon Resource Conservation Act of 1996 (Pub. L. 104-208). We therefore assume that the BLM's adoption of the PRMP will result in the Coquille Tribe's Forest Management Plan (FMP) being amended (with approval by the BIA) so as to reflect the PRMP, and thus the PMRP will have indirect effects on the Coquille Forest land.[1]

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; and
    - Maintaining older and more structurally complex multi-layered conifer forests;
- Provide clean water in watersheds;
- Restore fire-adapted ecosystems;
- Provide recreation opportunities; and
- Coordinate management of lands surrounding the Coquille Forest with the Coquille Tribe.

The five major land use allocations (LUA) of the PRMP are 1) Late-Successional Reserve, 2) Riparian Reserve, 3) Other Reserves (District BLM designated or Congressionally reserved and National Landscape Conservation System), 4) Harvest Land Base, and 5) Eastside Management Area. The BLM-administered lands allocated all lands to one of the five major land use allocations within the planning area (Figure 1).

[1] Section 7 consultation on BIA's approval of the amended FMP would consider effects of that action to the extent that they are not considered in this PRMP plan-level consultation, e.g. of specific land use allocations.

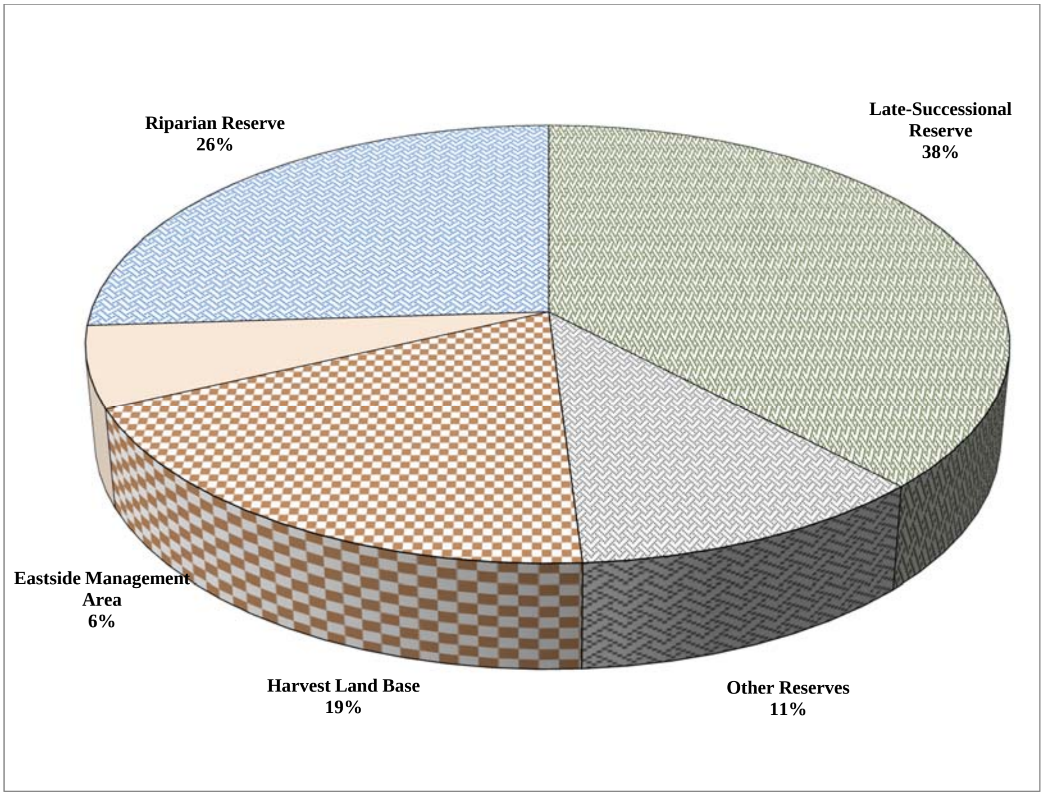

Figure 1. Land use allocations for the BLM's PRMP (from BLM's BA).

Congressionally Reserved lands are those lands that Congress has designated and defined management through law, including designated Wilderness and Wild and Scenic Rivers. In addition to Congressionally Reserved Lands, the BLM has also identified Wilderness Study Areas in the decision area. Until Congress makes a final determination on a Wilderness Study Area, the BLM manages these areas to preserve their suitability for designation as Wilderness. BLM 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.

Approximately 74 percent of the BLM land base in the PRMP planning area is in a reserve LUA (Table 1). 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. Riparian reserve allocations do not include acres adjacent to streams and other water bodies in LUA categories that are deemed by the BLM to be more protective. For example, acres adjacent to water bodies within the Congressionally Reserved LUA (noted in Other Reserves in Figure 1 and Table 1) designated as Wilderness or 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 1. Land use allocations for the BLM's PRMP.

Allocation	Acres
Late-Successional Reserve	948,466
Riparian Reserve	635,717
Other Reserves	263,647
Harvest Land Base	469,215
Eastside Management Area	161,810
Totals	**2,478,856**

The BLM further described their LUAs within each ESU for the various listed species in the planning area (Table 2).

Table 2. LUA acres for the PRMP for the various species ESU/DPS located in the BLM planning area.

Species ESU or DPS	Land Use Allocation	Acres	Percent of PRMP Acres	Percent of ESU Acres
LCR Chinook	Congressionally Reserved	6,568	18.4	0.14
	District-Designated Reserve	1,292	3.6	0.03
	Harvest Land Base	13,732	38.6	0.29
	Land Cover District-Designated Reserve	1,448	4.1	0.03
	Late-Successional Reserve	2,605	7.3	0.05
	Riparian Reserves	9,977	28.0	0.21
	Total	**35,622**		**0.75**
LCR coho salmon	Congressionally Reserved	6,568	18.4	0.14
	District-Designated Reserve	1,292	3.6	0.03
	Harvest Land Base	13,732	38.6	0.29
	Land Cover District-Designated Reserve	1,448	4.1	0.03
	Late-Successional Reserve	2,605	7.3	0.05
	Riparian Reserves	9,977	28.0	0.21
	Total	**35,622**		**0.75**
LCR steelhead	Congressionally Reserved	6,568	23.0	0.18
	District-Designated Reserve	1,292	4.5	0.04
	Harvest Land Base	9,570	33.4	0.26
	Land Cover District-Designated Reserve	1,289	4.5	0.04
	Late-Successional Reserve	2,558	8.9	0.07
	Riparian Reserves	7,339	25.6	0.20
	Total	**28,615**		**0.78**

Species ESU or DPS	Land Use Allocation	Acres	Percent of PRMP Acres	Percent of ESU Acres
UWR Chinook	Congressionally Reserved	7,217	3.1	0.17
	District-Designated Reserve	7,746	3.3	0.18
	Harvest Land Base	93,972	40.1	2.16
	Land Cover District-Designated Reserve	12,573	5.4	0.29
	Late-Successional Reserve	36,920	15.7	0.85
	Riparian Reserves	76,057	32.4	1.75
	Total	**234,485**		**5.4**
UWR steelhead	Congressionally Reserved	7,078	3.8	0.23
	District-Designated Reserve	7,273	3.9	0.23
	Harvest Land Base	65,147	35.3	2.10
	Land Cover District-Designated Reserve	10,441	5.7	0.34
	Late-Successional Reserve	27,539	14.9	0.89
	Riparian Reserves	66,926	36.3	2.15
	Total	**184,404**		**5.9**
OC coho salmon	Congressionally Reserved	2,445	0.2	0.04
	District-Designated Reserve	20,991	1.9	0.31
	Harvest Land Base	142,602	13.1	2.07
	Land Cover District-Designated Reserve	27,175	2.5	0.40
	Late-Successional Reserve	550,442	50.7	8.01
	Riparian Reserves	341,957	31.5	4.97
	Total	**1,085,611**		**15.79**
SONCC coho salmon	Congressionally Reserved	19,748	0.17	0.23
	District-Designated Reserve	25,757	0.22	0.23
	Harvest Land Base	162,720	1.42	2.10
	Land Cover District-Designated Reserve	114,815	1.00	0.34
	Late-Successional Reserve	239,947	2.10	0.89
	Riparian Reserves	166,583	1.45	2.15
	Total	**729,570**		**6.37**

Management direction was condensed from the Proposed RMP/Final Environmental Impact Statement (FEIS), the Biological Assessment (BA) for the Western Oregon PRMP, and the Management Objectives and Direction document (included with the BA) (USDI BLM FEIS 2016, USDI BLM BA 2016).

The following contains bulleted lists of the management objectives for the land use allocations and resource programs for the PRMP. For some allocations and programs, this section also contains brief descriptions of the allocation and abbreviated descriptions of the management direction.

1.3.1 Congressionally Reserved Lands and National Landscape Conservation System

Congressionally Reserved lands are those lands that Congress has designated and defined management through law, including designated Wilderness and Wild and Scenic Rivers. The mandated management of these lands requires that the BLM reserve these lands from sustained-yield timber production. In addition to Congressionally Reserved Lands, the BLM has also identified Wilderness Study Areas in the decision area, pursuant to Section 603 of the FLPMA. Until Congress makes a final determination on a Wilderness Study Area, the BLM manages these areas to preserve their suitability for designation as Wilderness. Congressionally Reserved lands and National Landscape Conservation System total 40,505 acres; 1.6 percent of the BLM-administered lands in the planning area.

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, until Congress either designates these lands as Wilderness or releases them for other purposes.

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, 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.

Under the PRMP, the BLM would recommend for inclusion in the National Wild and Scenic River System the six eligible Wild and Scenic River segments that the BLM found suitable during its administrative process.

1.3.2 District-Designated Reserves 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:

1. Areas that the BLM has constructed for specific purposes (such as roads, buildings, maintenance yards, and other facilities and infrastructure)
2. Areas that the BLM has identified through the Timber Production Capability Classification system as unsuitable for sustained-yield timber production (e.g., rock outcrops)
3. Areas of Critical Environmental Concern, including Research Natural Areas
4. Areas of road surface or water surface
5. 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 Objective

- 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).

1.3.3 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.

1.3.4 District-Designated Reserve – Lands Managed for their Wilderness Characteristics

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.

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 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.

1.3.5 Eastside Management Area (lands east of Highway 97)

BLM land east of Highway 97 lies within the Klamath River basin. All BLM administered lands in Oregon within the Klamath River basin and east of Highway 97 are located upstream of several Klamath River mainstem dams. Current distribution of SONCC coho salmon, the NMFS ESA-listed species in the upper Klamath Basin, are restricted to the Klamath River below Iron Gate Dam; therefore, actions proposed east of Highway 97 will not have an effect on any of the indictors described below. Forest Management east of Highway 97 will not have any effect on ESA-listed species or critical habitat.

1.3.6 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 1) Dry and very dry forest types identified by potential vegetation types in the Klamath Falls Field Office; 2) Dry forest types within northern spotted owl critical habitat designated in the 2012 final rule (77 FR 71908) and very dry forest types in the Medford District; and 3) Very dry forest types in the Roseburg District.

The Low Intensity Timber Area is located in areas within the Harvest Land Base. Timber harvest in the Low Intensity Timber Area includes thinning and regeneration harvest with retention of 15–30 percent of the stand. In delineating these areas, the BLM included 1)Northern spotted owl critical habitat designated in the 2012 final rule (77 FR 71908) in the Harvest Land Base outside of the Uneven-aged Timber Area; 2)Dry forest types outside of designated northern spotted owl critical habitat in the Harvest Land Base in the Medford District; and 3) 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 5-15 percent of the stand.

Management Objectives

- 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 following disturbances, 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 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 harvest,[2] except timber salvage, retain existing—
  - Snags > 20” DBH
  - Snags 6-20” DBH in decay classes III, IV, and V
  - 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 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.
- If not suitable for commercial removal, make felled hazard trees available for habitat restoration purposes in any land use allocation.
- When implementing commercial harvest [2] except timber salvage, create new snags 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.

1.3.6.1 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.

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[2] 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.

Management Direction

- Apply regeneration harvest[3] 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 (TPA) 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.
  - 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[4] to provide increased structural complexity in the post-treatment stand. Do not exceed 10 percent of the thinned

[3] For the purpose of management direction for the Harvest Land Base – Low Intensity Timber Area, regeneration harvest does not include timber salvage, which has separate management direction.
[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.

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 and no alternative harvesting method is economically viable or practically feasible. 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 TPA 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 TPA (including surviving green trees) within 10 years of the disturbance event, to the extent possible given safety and operational constraints.

1.3.6.2 Moderate Intensity Timber Area (MITA)

Management Objectives for Harvest Land Base

- 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 Direction

- Conduct regeneration harvest[5] 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.

[5] For the purpose of management direction for the Harvest Land Base – Moderate Intensity Timber Area, regeneration harvest does not include timber salvage, which has separate management direction.

    - 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 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 $\geq$ 40” DBH and that the BLM identifies were established prior to 1850, except where removal is necessary for safety or operational reasons and no alternative harvesting method is economically viable or practically feasible. 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 (TPA) 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.
    - 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 $\geq$ 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 TPA 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 TPA (including surviving green trees) within 10 years of the disturbance event, to the extent possible given safety and operational constraints.

1.3.6.3 Uneven-aged Timber Area

Management Objectives for Harvest Land Base

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

Management Direction

- Utilize integrated vegetation management[6] 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 TPA within 5 years of harvest.

[6] **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. For the purpose of management direction for the Harvest Land Base – Uneven-aged Timber Area, integrated vegetation management does not include timber salvage, which has separate management direction.

- 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 and no alternative harvesting method is economically viable or practically feasible.
    - 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.
- 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 TPA within 5 years of harvest.

1.3.7 Late-Successional Reserve Management Objectives

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 LSR. 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.[7]

Large Block Forest Reserves: Late-Successional Reserve – Moist and Late-Successional Reserve – Dry[8]

The PRMP includes within the Late-Successional Reserve blocks of functional and potential northern spotted owl habitat, sufficient to meet block size and spacing requirements 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 Late-Successional Reserve 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 thinning to promote the development of structurally-complex forest, which may include commercial removal of cut trees. In dry forests, the BLM would conduct 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.

1.3.7.1 LSR Management Objectives (Both LSR-Dry and LSR Moist)

- 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.

[7] 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.

[8] The Late-Successional Reserve – Dry and Riparian Reserve – Dry sub-allocations in the Proposed RMP 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.

- 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[9] 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 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.

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[9] **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.

- 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[10] 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[11] 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 reforest a mixture of species appropriate to the site to an average density across the group selection openings of at least 75 TPA within 5 years of harvest.

[10] **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.
[11] **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 conducting commercial harvest, create new snags within one year of completion of yarding the timber in the timber sale (Table 3). 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 3. 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 4 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 4. 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.

LSR-Dry

Management Objectives

- 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.

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.

1.3.8 Riparian Reserves

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.

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 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 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 (5th Field HUC or 10 Digit HUC as referred by BLM)—
    - 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[12] in any portion of the Outer Zone in a stand in all watershed classes, fall or tip from 0 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.
- 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).

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 critical habitat (CH) and the density of streams with a high intrinsic potential (HIP) (Burnett *et al*. 2003 and Agrawel *et a.l* 2005). 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" is the set of habitat features such as gradient, valley constraint, and annual discharge of water that most influence the productivity of a stream. "High intrinsic potential" streams are those streams with the habitat features that are known to be highly productive for an individual fish species.

The intrinsic potential (IP) analysis was performed for the 2008 BLM Western Oregon 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.

[12] 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.

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. BLM 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 sixth-field HUC 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. For sixth-field subwatersheds on the east side of the Willamette River, the BLM also included core-genetic and core-legacy populations in addition to designated CH. 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. Watershed classifications for the Class I, II, and III sixth field HUCs are shown in Figure 2.

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.

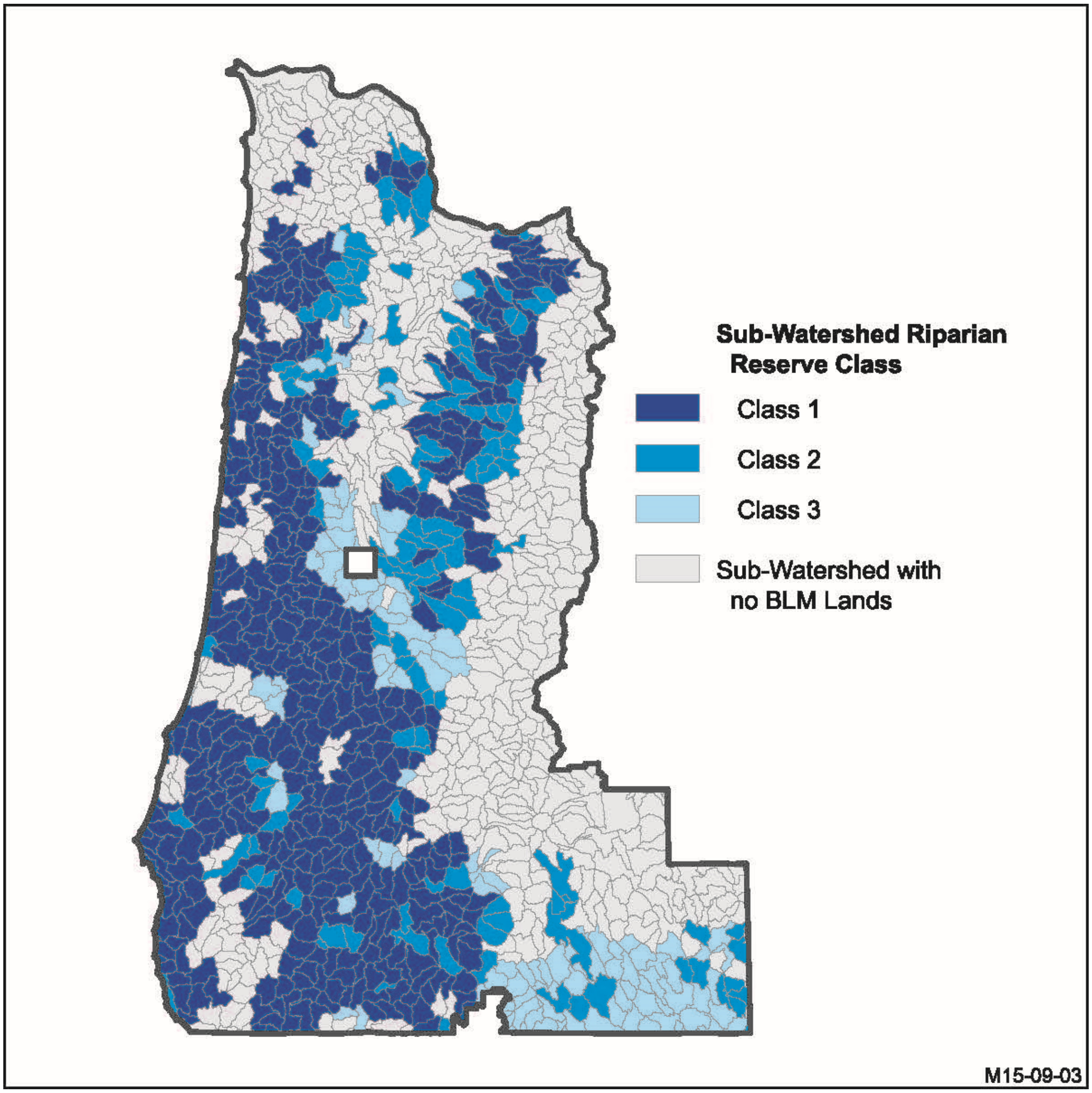

Figure 2. Map of the BLM subwatershed classification systems for riparian reserves (from USDI BLM BA 2016)

The design of riparian reserves set by BLM for the various water features for lands west of Highway 97 are presented in Table 5. 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 (SPTH)[13] riparian reserve width.

[13] Site-potential tree height is the average maximum height of the tallest dominant trees (200 years or older) for a given site class. Site-potential tree heights generally range from 140 feet to 240 feet across the decision area, depending on site productivity.

Table 5. Riparian reserve management distances by water feature for BLM 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 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 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 during slope failure	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 feet 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 feet extending from the ordinary high water line

[1]Reported distances are measured as slope distance.

1.3.8.1 Class I Subwatersheds

The riparian reserve for Class I subwatersheds is design with one SPTH on either side of all streams. The riparian reserve includes an inner zone in which thinning is generally not permitted. Inner zone widths are listed below:

- 120 feet on either side of perennial streams and fish-bearing intermittent streams, and
- 50 feet on either side of non-fish-bearing, intermittent streams.

The riparian reserve includes a middle zone from 50 to 120 feet on either side of non-fish-bearing, intermittent streams (Figure 3). No middle zone is delineated on perennial streams and fish-bearing intermittent streams. In the middle zone, the BLM would conduct thinning as needed to ensure that stands are able to provide trees to form stable instream structures. In the middle zone in moist forests, the BLM would conduct thinning without commercial removal of timber (i.e., down woody debris and snag creation only). In the middle zone in riparian reserves in dry forest, activities would include prescribed burning and thinning that would include removal of cut trees, including commercial removal, as needed to reduce the risk of stand-replacing, crown fires.

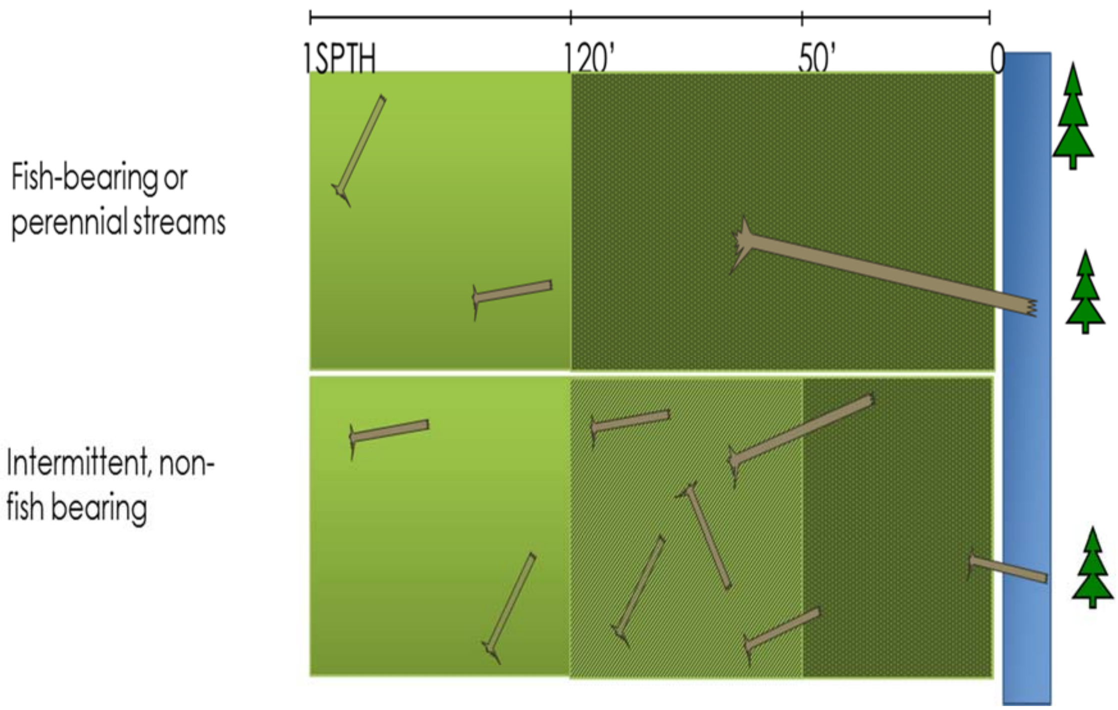

Figure 3. Class I subwatersheds riparian buffer designs within the riparian reserve.

The outer zone of the riparian reserve would be from 120 feet to one site-potential tree height on either side of all streams. In the outer zone, the BLM would conduct thinning, which may include commercial removal, as needed to ensure that stands are able to provide stable wood to the stream. All thinning in the riparian reserve will maintain at least 30 percent canopy cover and 60 TPA on the average.

The management direction for Class I watersheds are shown for moist forest in Table 6 and dry forest in Table 7.

Table 6. Zone-specific management direction for streams in Class I subwatersheds in the riparian reserve located in moist forest.

<table>
<tr><th>Fish-bearing streams and perennial streams</th></tr>
<tr><td>Inner Zone (0–120 feet)</td></tr>
<tr><td>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.</td></tr>
<tr><td>Outer Zone (120 feet to one site-potential tree height)</td></tr>
<tr><td>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 TPA 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 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.</td></tr>
<tr><th>Intermittent, non-fish-bearing streams</th></tr>
<tr><td>Inner Zone (0–50 feet)</td></tr>
<tr><td>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.</td></tr>
<tr><td>Middle Zone (50–120 feet)</td></tr>
<tr><td>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 TPA 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.</td></tr>
<tr><td>Outer Zone (120 feet to one site-potential tree height)</td></tr>
<tr><td>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 TPA 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 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.</td></tr>
</table>

Table 7. Zone-specific management direction for streams in Class I subwatersheds in the riparian reserve located in dry forest.

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 TPA 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 TPA, 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 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 TPA 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 TPA 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 TPA 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 TPA 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 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.

1.3.8.2 Class II Subwatersheds

The riparian reserve encompasses lands within one site-potential tree height on either side of all streams. The riparian reserve includes an inner zone in which thinning is generally not permitted (Figure 4). Inner zone widths are listed below:

- 120 feet on either side of perennial streams and fish-bearing intermittent streams, and
- 50 feet on either side of non-fish-bearing, intermittent streams.

In the outer zone, the BLM would conduct thinning, which may include commercial removal, as needed to develop diverse and structurally-complex riparian stands. All thinning in the riparian reserve will maintain at least 30 percent canopy cover and 60 TPA on the average.

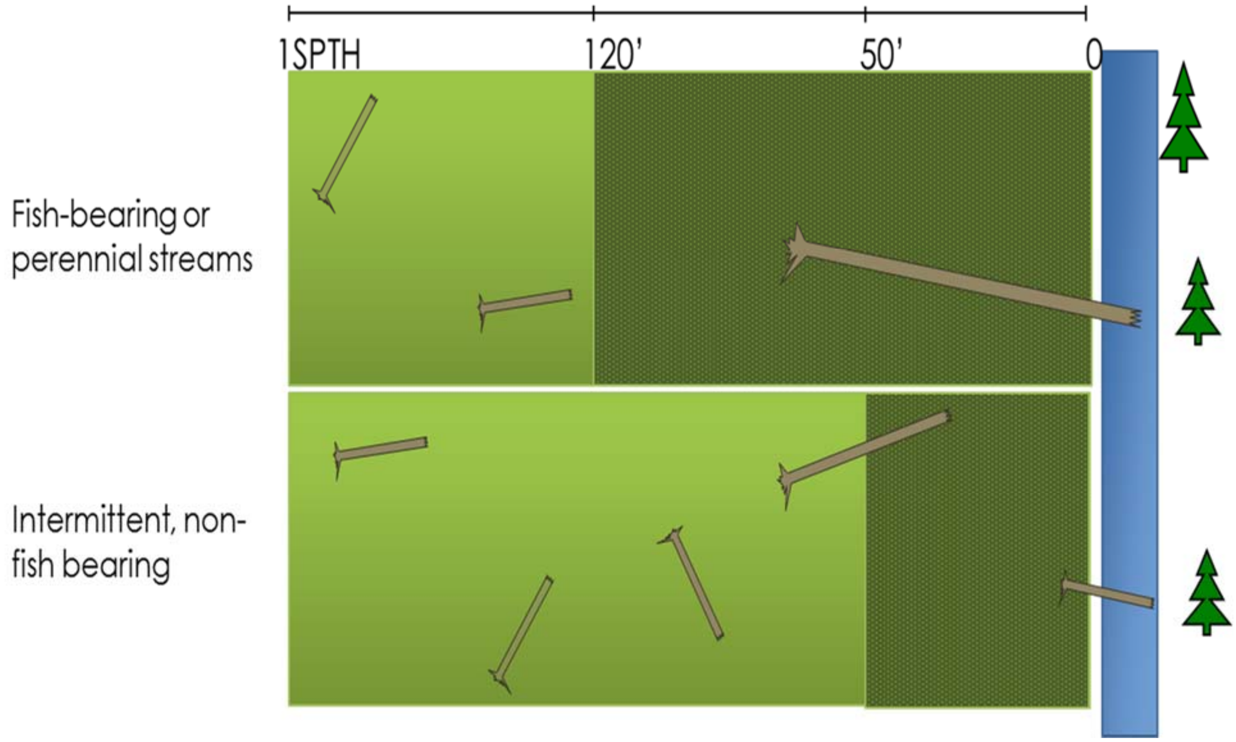

Figure 4. Class II subwatersheds riparian buffer designs within the riparian reserve.

The management direction for Class II watersheds are shown for moist forest in Table 8 and dry forest in Table 9.

Table 8. Zone-specific management direction for streams in Class II subwatersheds in the riparian reserve located in the moist forest.

<table>
<tr><th>Fish-bearing streams and perennial streams</th></tr>
<tr><td>Inner Zone (0–120 feet)</td></tr>
<tr><td>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.</td></tr>
<tr><td>Outer Zone (120 feet to one site-potential tree height)</td></tr>
<tr><td>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 TPA 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 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.</td></tr>
<tr><th>Intermittent, non-fish-bearing streams</th></tr>
<tr><td>Inner Zone (0–50 feet)</td></tr>
<tr><td>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.</td></tr>
<tr><td>Outer Zone (50 feet to one site-potential tree height)</td></tr>
<tr><td>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 TPA 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 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.</td></tr>
</table>

Table 9. Zone-specific management direction for streams in Class II subwatersheds in the riparian reserve located in dry forest.

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 TPA 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 TPA 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 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 TPA 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 TPA 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 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.

1.3.8.3 Class III Subwatersheds

The riparian reserve encompasses lands within one site-potential tree height on either side of perennial streams and fish-bearing intermittent streams, 50 feet on either side of non-fish-bearing, intermittent streams (Figure 5). Inner zone widths are listed below:

- One site-potential tree height on either side of perennial streams and fish-bearing intermittent streams, and
- 50 feet on either side of non-fish-bearing, intermittent streams. There is no outer zone on intermittent streams as the riparian reserve width is only 50 feet.

In the outer zone, the BLM would conduct thinning, which may include commercial removal, as needed to develop diverse and structurally-complex riparian stands. All thinning in the riparian reserve will maintain at least 30 percent canopy cover and 60 TPA on the average.

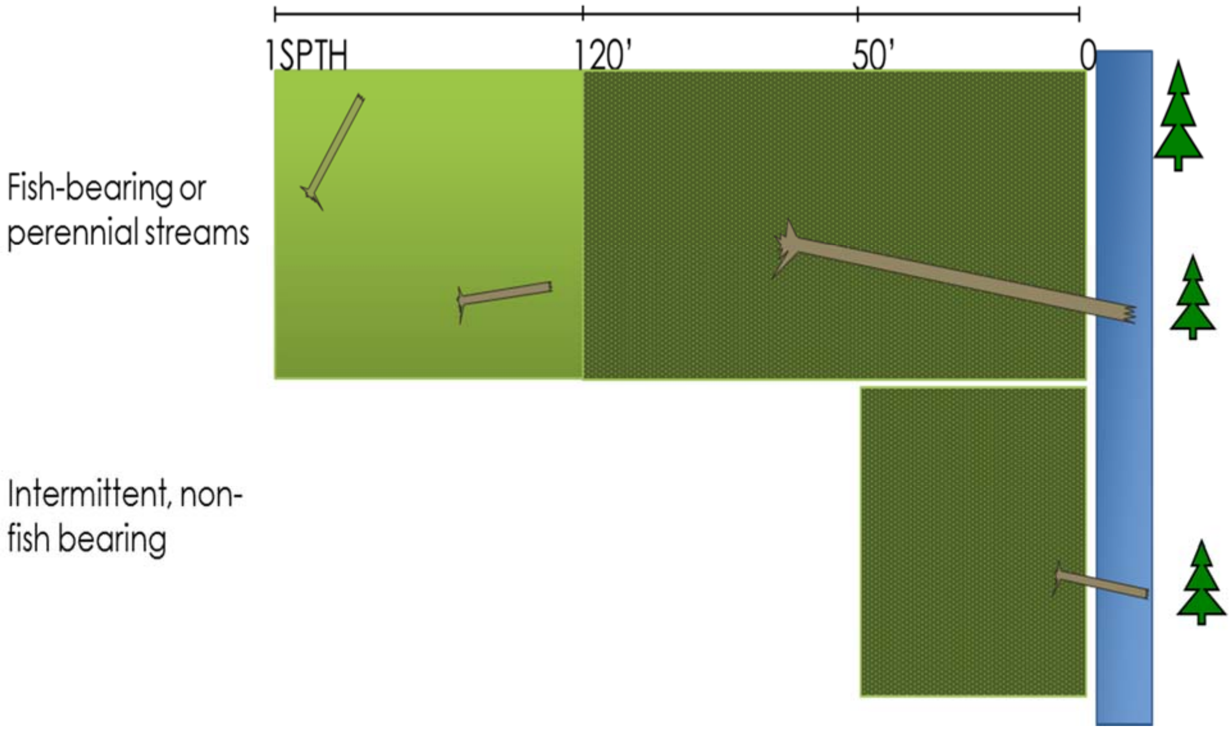

Figure 5. Class III subwatersheds riparian buffer designs within the riparian reserve.

The management direction for Class III watersheds are shown for moist forest in Table 10 and dry forest in Table 11.

Table 10. Zone-specific management direction for streams in Class III subwatersheds in the riparian reserve located in moist forest.

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 TPA 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 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 11. Zone-specific management direction for streams in Class III subwatersheds in the riparian reserve located in dry forest.

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 TPA 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 TPA 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 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.

Table 12 displays a count of Class I, II and III sixth-field HUC 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 12. Number of sixth-field subwatersheds with BLM land ownership by 6th Field HUC riparian reserve classification for salmon ESU and steelhead DPS within the PRMP Planning Area.

ESU/DPS	Number of 6th Field HUC Subwatersheds by Riparian Reserve Type			
	Class I	Class II	Class III	Eastside Management Area
LCR Chinook salmon	23	11	0	0
LCR coho salmon	23	11	0	0
LCR steelhead	20	8	0	0
UWR Chinook salmon	57	54	11	0
UWR steelhead	52	49	10	0
OC coho salmon	233	19	10	0
SONCC coho salmon	120	22	4	0

Aquatic Conservation Measures

Riparian Reserve

Please see narrative above in the Riparian Reserve Land Use Allocation.

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 fish passage to stream channels, restoration of in-stream habitat complexity, and restoration of riparian vegetation conditions.

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* (USDI BLM 2015b as referenced in BA) 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. 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.

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 the Final Environmental Impact Statement (USDI BLM FEIS 2016) Appendix V.

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 proposed monitoring plan by all BLM offices in the decision area is intended as 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 proposes to 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 proposes to make such changes to the monitoring plan through plan maintenance.

Effectiveness Monitoring
The BLM proposes to 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 from the BA (USDI BLM BA 2016) 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 subwatershed (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.

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 proposes to employ sampling or evaluation of a subset of implementation actions based on their rationale provided here. The BLM 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 proposes to select projects to be monitored based on those that would yield a large amount of information or be more beneficial to future decisions. 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 proposes to 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 proposes to 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.

BLM suggests 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, from the BA (USDI BLM BA 2016) for monitoring questions, requirements and intervals for the riparian reserve LUA and for other PRMP LUAs and programs.

Watershed-Scale Information for Implementation Actions

The BLM proposes to 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 proposes to 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 ESA 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 ESA compliance for specific projects. For example, such watershed-scale information will typically be relevant in the preparation of biological assessments for consultation with the NMFS and USFWS under Section 7(a)(2) of the ESA on the effects of implementation actions that may affect listed species or their designated CH.

1.3.9 Program Activities

1.3.9.1 Cultural Resources

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.

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 13.

Table 13. 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

1.3.9.2 Fire and Fuels

The Fire and Fuels Program includes wildfire suppression actions, and activities associated with fuel treatments applied to stands of any age. 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 BLM District/Field Office for the decade 2003-2012 are displayed in Table 14.

Table 14. 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.

Fuels reduction activities may occur within riparian reserves in the dry forest. Fuels treatment activities will follow the programmatic consultation requirement of ARBO II (NMFS ARBO 2013).

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[14] 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).

1.3.9.3 Fisheries

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. The BLM will follow the guidance of the BLM's Western Oregon Aquatic Restoration Strategy document (USDI BLM 2015b) for listed fish restoration activities in the action area.

[14] The Wildland Urban Interface includes wildland developed areas.

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 established in ARBO II programmatic (NMFS ARBO 2013) 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.

1.3.9.4 Forest Management

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.

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.

Management Direction

Timber Harvest falls into the Following Categories: 1) Commercial Thinning, Selection, Two-Age Regeneration, and Salvage. The four categories of harvest are defined below.

I. **Thinning**. Commercial thinning is the removal of some of the trees in a stand.

BLM management direction pertinent to commercial thinning in the Harvest Land Base (low intensity timber area (LITA) and moderate intensity timber area (MITA) land use sub-allocations is shown below.

BLM will conduct commercial thinning for any of the following reasons:

- Produce timber to contribute to the attainment of the declared Allowable Sale Quantity (ASQ).
- 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 BLM Special Status plant populations.
- Create growing space for hardwood and pine persistence and regeneration.

BLM will maintain stand densities through commercial thinning at levels above that needed to continue to occupy the site with trees, 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[15] 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.

BLM will commercial thin in the Harvest Land Base uneven-aged timber area (UTA) land use sub-allocation as 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[16] 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.

BLM will commercial thin in the LSR land use allocation as shown below:

- In stands ≥10 acres treated with selection harvest or commercial thinning,

[15] 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.

[16] 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.

- Apply harvest to result in stand average relative density percent between 20 percent and 45 percent after harvest.
- Do not create group selection openings[17] 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.

II. **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.

BLM will selection harvest in the UTA harvest land base sub-allocation as 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[18] 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 TPA within 5 years of harvest.

BLM will selection harvest in the LSR land use allocation as 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.
  - Do not create group selection openings[19] 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 TPA within 5 years of harvest.

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[17] 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.
[18] 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.
[19] 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.

III. **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 and no alternative harvesting method is economically viable or practically feasible. 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 regenerate a mixture of species appropriate to the site to a stand-level average of at least 130 TPA (LITA) or at least 150 TPA (MITA) within 5 years of harvest.

IV. **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 TPA (LITA) or at least 150 TPA (MITA and UTA) within 5 years of harvest.

PRMP Projected Thinning Acreages within Riparian Reserve

The total amount of riparian reserve thinning since 1995 (initiation of the Northwest Forest Plan) 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.

BLM projected thinning acres within the riparian reserve under the PRMP by decade beginning in 2013. These are presented for each ESA-listed Pacific salmon ESU or DPS (Table 15 to Table 21). 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., LCR 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, management direction does not explicitly prohibit thinning based on stand age.

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 15. Acres of PRMP riparian reserve thinning by decade (beginning from 2013) 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 16. 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 17. 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 18. 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 19. Acres of PRMP Riparian Reserve thinning by decade within the Southern Oregon / Northern California Coast 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 20. 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 21. 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/thousand board feet (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. This occurs due to the low volume of timber from thinning projects in LSR verses 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 22.

Table 22. 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**

The BA states that 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 the BA 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. These 66 miles are spread across the entire planning area.

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 23 and Table 24 summarize estimated permanent and long-term road closures by surface type for the first decade.

Table 23. PRMP estimated 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 24. PRMP estimated 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 of the Western Oregon road network 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 25.

Table 25. 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

1.3.9.5 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.

1.3.9.6 Invasive Species

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 ARBO 2013). The biological opinion, commonly known as ARBO II, is still in effect and the Project Design Criteria 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 ARBO II (NMFS ARBO 2013). This ARBO II description is incorporated here as representing the proposed action's description of this program.

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 blackberry 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.

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 ARBO 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 ARBO II 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.

- aminopyralid (e.g., *terrestrial*: Milestone VM)
- chlorsulfuron (e.g., *terrestrial*: Telar, Glean, Corsair)
- clopyralid (e.g., *terrestrial*: Transline)
- dicamba (e.g., *terrestrial*: Vanquish, Banvel)
- diflufenzopyr + dicamba (e.g., *terrestrial*: Overdrive)
- glyphosate (e.g., *aquatic*: Aquamaster, AquaPro, Rodeo, Accord)
- imazapic (e.g., *terrestrial*: Plateau)
- imazapyr (e.g., *aquatic*: Habitat; *terrestrial*: Arsenal, Chopper)
- metsulfuron methyl (e.g., *terrestrial*: Escort)
- picloram (e.g., *terrestrial*: Tordon, Outpost 22K)
- sethoxydim (e.g., *terrestrial*: Poast, Vantage)
- sulfometuron methyl (e.g., *terrestrial*: Oust, Oust XP)
- triclopyr (e.g., *aquatic*: Garlon 3A, Tahoe 3A, Renovate 3, Element 3A; *terrestrial*: Garlon 4A, Tahoe 4E, Pathfinder II)
- 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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(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.

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 26). 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 26. 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.

Management Directions

- 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.
- Apply state-of-the art, integrated pest management prescriptions for the treatment of all identified sudden oak death (*Phytophthora ramorum*) infection sites.

1.3.9.7 Lands and Realty

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 (defined below). The BLM sold these lands primarily to resolve unintentional encroachment cases, where an individual had unintentionally built a development on BLM-administered lands.

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

<u>Land Exchange and Disposal</u>

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

The PRMP proposes the following acres of land in each Land Tenure Zone (Table 27).

Table 27. Proposed land tenure zone acres for the PRMP.

Land Tenure Zone	Acres
Zone 1 – Lands Suitable for Retention	219,953
Zone 2 – Lands Suitable for Exchange	2,255,243
Zone 3 – Lands Suitable for Disposal	18,459

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 critical habitat (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 grant future 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.
- 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 they receive 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 456,801 acres of Right-Of-Way Avoidance Areas and 107,790 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.

1.3.9.8 Livestock Grazing

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.

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.

(Medford District)

- 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).
- Maintain current livestock grazing levels and management practices for allotments. 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.
- The BLM may authorize grazing through management agreements, nonrenewable grazing permits or leases, or special use permits consistent with the grazing regulations.

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 28. 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 28. 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	94	92	203,582	203,377	13,219	13,199
Medford	91	45	285,920	151,949	11,886	9,197
Totals	**189**	**137**	**490,046**	**355,326**	**25,225**	**22,396**

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 355,326 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 29).

Table 29. 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
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 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.

1.3.9.9 Minerals

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 30).

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 30. 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)[@]
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**

[@] 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).

- 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. 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 the BLM has completed consultation to the extent required under section 7(a)(2) of the ESA.

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.

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 681 developed BLM quarry sites in the decision area (Table 31). 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 to 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 6 shows the spatial distribution of quarry sites in the decision area.

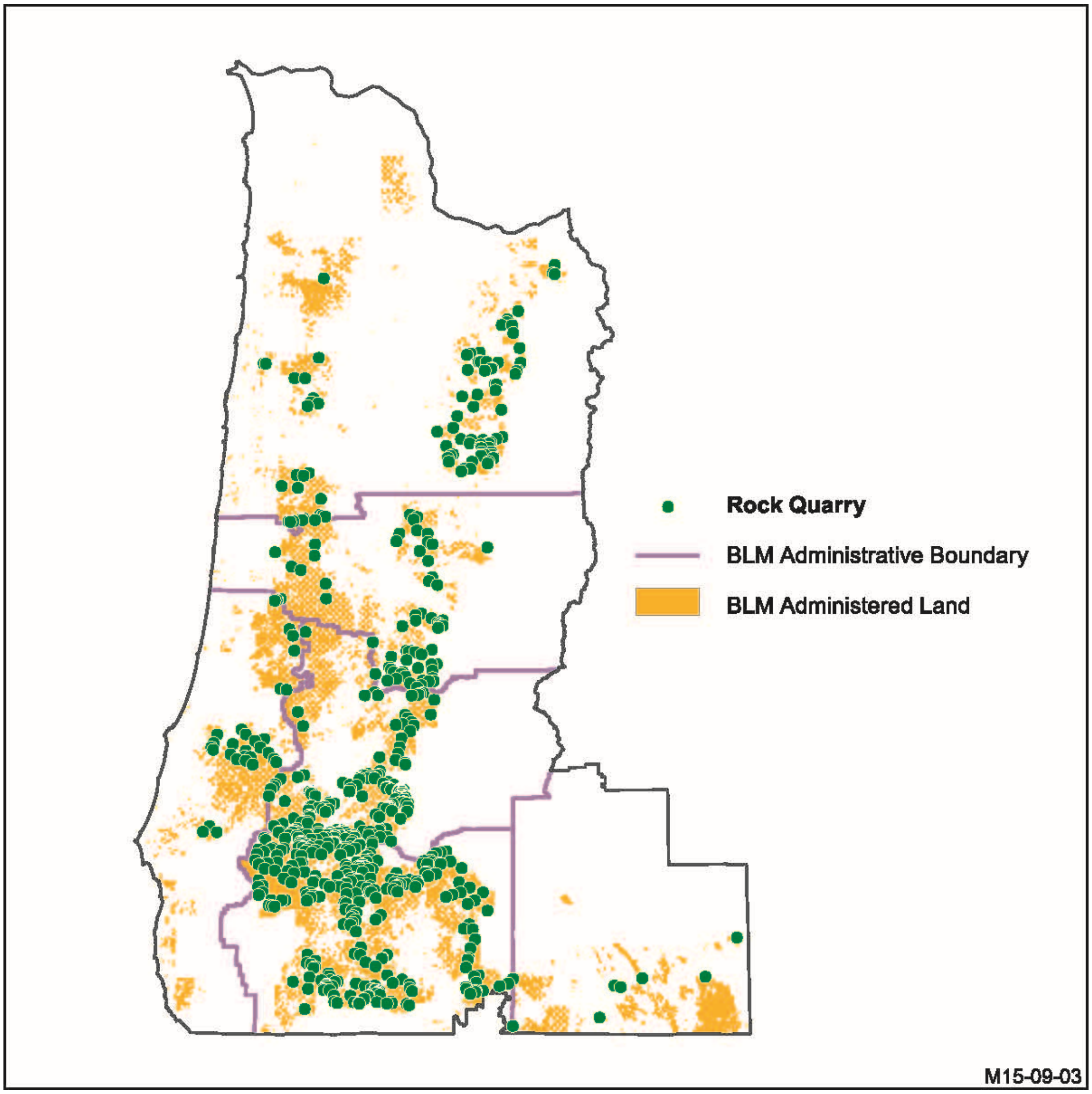

Figure 6. Spatial distribution of BLM rock quarry sites in the decision area from 2013 office inventories (from BLM's FEIS).

Table 31. 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	97
Totals	**681**

Figure 6 and Table 31 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.

The PRMP would close 217,711 acres to salable mineral material disposal in addition to the 31,530 acres of existing, non-discretionary closures, for a total of 249,241 acres that would be closed to salable mineral material disposal (Table 32). 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. 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 32. 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 33.

Table 33. 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. 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. Through the Proposed RMP, the BLM would make recommendations for withdrawals, but adoption of the Proposed RMP would not actually withdraw lands from locatable mineral entry because the BLM does not have the authority to withdraw lands from locatable mineral entry. Congress can designate withdrawals from locatable mineral entry or the BLM can begin a withdrawal process for a decision to be signed by the Secretary of Interior. Any such future withdrawals would affect only new claims and would not alter or affect valid existing claims.

The planning area contains over 3,300 occurrences of locatable mineral resources and has a long history of mineral development (USDI BLM BA 2016). 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 34 shows the number of mining claims, Notices, and pending or authorized Plans of Operation in the decision area by administrative unit. Figure 7 shows the general locations of active mining claims in the decision area.

Table 34. Mining claims, Notices, and pending or authorized Plans of Operation in the decision area as of 2015.

District/Field Office	Mining Claims	Notices	Plans of Operation - Pending or Authorized
Coos Bay	42	1	-
Eugene	47	1	-
Klamath Falls	1	-	-
Medford	1.039	21	8
Roseburg	149	-	1
Salem	14	1	-
Totals	**1,292**	**24**	**8**

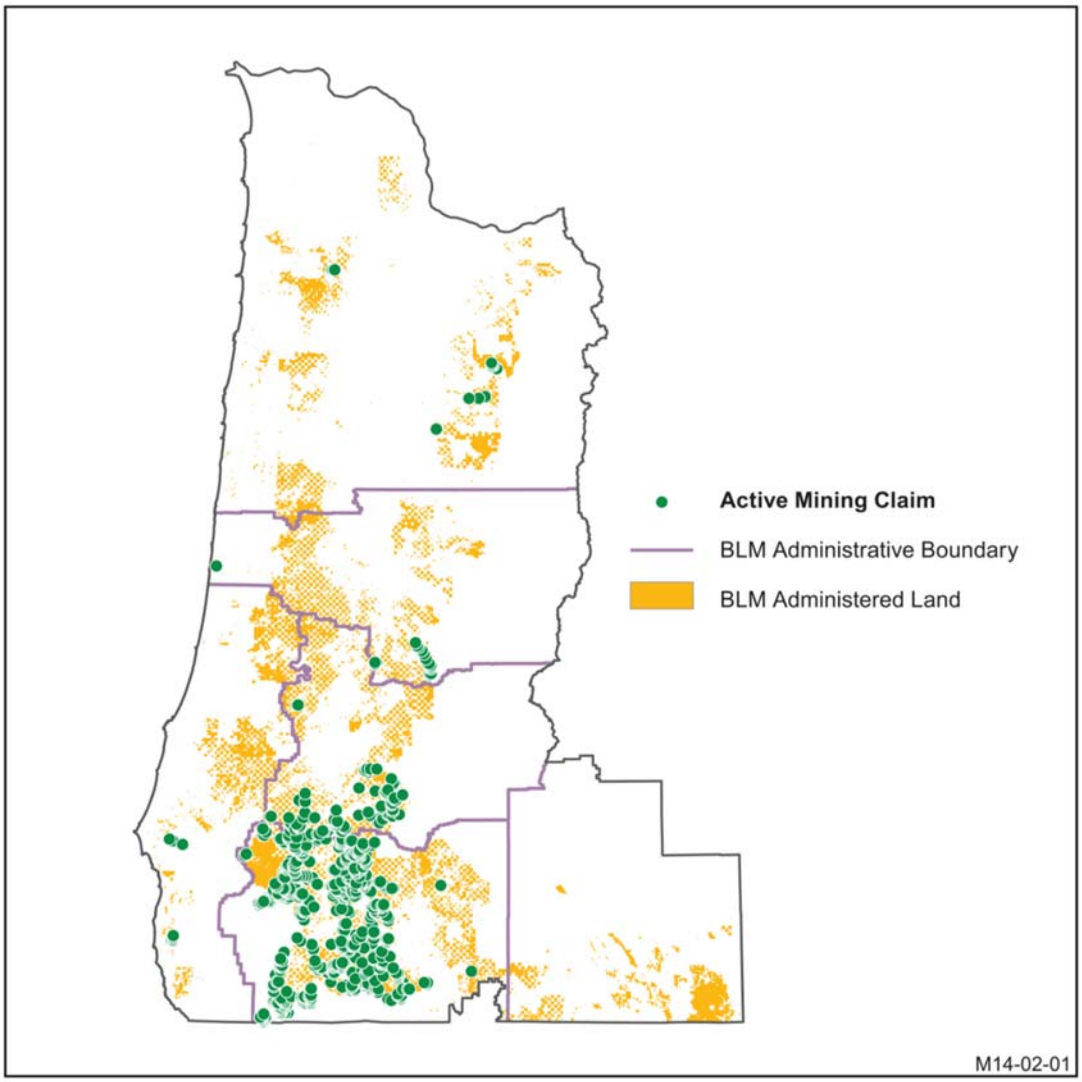

Figure 7. Locations of active mining claims in the decision area in 2013 (from BA).

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).

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 35). 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.

Table 35. 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. Additionally, 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.

BLM estimated the number of new and renewed notices of operation under the PRMP over a 10-year period in Table 36. BLM estimated number of new plans of operation under the PRMP over a 10-year period as shown in Table 37.

Table 36. 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 37. 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 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 2015a). 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 will 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 Direction

- 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.

1.3.9.10 Paleontological Resources

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. BLM 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.

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.
- Conduct public education, outreach activities, and develop materials to educate the public on paleontological resources existing within the decision area.

1.3.9.11 Recreation and Visitors Services

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 38 presents 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 38. 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 Coast 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

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).

Management Direction

- Manage Special Recreation Management Areas and Extensive Recreation Management Areas 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.

1.3.9.12 Soil Resources

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.

Management Direction

- Apply BMPs 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.

1.3.9.13 Special Forest Products

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.

1.3.9.14 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.

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.

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.

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.

1.3.9.15 Trails and Travel Management

This program includes three components: The road system; public motorized access designations; and the trail system.[20] As to the road 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, these features are 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 therefore focused on the other two components of the Trails and Travel Management program: 1) public motorized travel designations, and 2) 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[21]
  - *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, which the BA states will be completed within five years after the completion of the western Oregon RMPs. In subsequent discussions, BLM clarified[22] this schedule where "the BLM will initiate travel management plans in areas with listed fish or designated critical habitat within five years of the

[20] The BLM expressly did not seek Section 7 consultation with the Services regarding the existence of BLM's current roads and trail network on the basis that the RMP revision makes no affirmative decision with respect to the existence of the road and trail network in and of itself, and decisions (and ESA compliance, as appropriate) for construction of the existing roads and trails predate this RMP revision. In addition, BLM excluded from the consultation request commercial road use that has already been authorized and with respect to which BLM does not have discretion, such as timber haul from private lands by the holder of a reciprocal right-of-way within the terms of the reciprocal right-of-way agreement.

[21] 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.

[22] July 8, 2016, email from R. Hardt (BLM) to K. Phippen (NMFS) clarifying the travel management planning schedule.

effective date of the ROD. The BLM will complete all travel management plans in areas with listed fish or designated critical habitat within ten years of the effective dated of the ROD." 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 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 39).

Table 39. PRMP and No Action public motorized access designations.

Trails and Travel Management Designations	No Action (Acres)	PRMP (Acres)
Closed to public motorized Use	63,539	156,036
Limited	2,088,946	2,322,820
Open to Cross-country Travel	319,661	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 BLM's BA, 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.

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.

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.

1.3.9.16 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.

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.

<u>Wildlife – Bald and Golden Eagles</u>

- 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.

<u>Wildlife – Bats</u>

- 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.

<u>Wildlife – Deer or Elk Management Areas (Klamath Falls Field Office, Medford District, and Salem District)</u>

- 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[23] 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.
    - Assess the analysis area for **marbled murrelet nesting structure.**[24] 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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[23] 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.

[24] **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**[25] 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.

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

[25] 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.

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; and are **Either** (a) conifer-dominated stands that are ≥ 80 years old **or** (b) conifer-dominated stands that have ≥ 60 percent canopy cover and have ≥ 2 superdominant conifer trees[26] per acre.

[26] **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.

- 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.

Wildlife – Oregon Spotted Frog

- Manage livestock grazing at sites occupied by Oregon spotted frogs to prevent direct impacts to eggs, tadpoles, or adults.

Wildlife – Siskiyou Mountains Salamander

- 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.

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.

1.3.9.17 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. This HMA is located on the "eastside" and outside of the current range of NMFS trust resources.

1.3.9.18 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.

1.3.9.19 Areas of Critical Environmental Concern

This category is a designation explained in 1.3.1 above.

1.3.9.20 District-Designated Reserve – Lands Managed for their Wilderness Characteristics

This category is a designation explained in 1.3.2 above.

1.3.9.21 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.

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.

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.

1.3.9.22 Rare Plants and Fungi

Actions under this resource program typically involve surveys with little to no ground disturbance.

1.3.9.23 Tribal Interests

The BLM did not seek ESA consultation on this program element on the basis that BLM does not have discretion regarding such interests and uses.

1.3.9.24 Visual Resources

The management program does not result in ground-disturbing activities.

1.3.9.25 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.

Upon implementation of the PRMP, the BLM would recommend to Congress that a total of nineteen rivers be included in the WSR National System.

1.4 Action Area

“Action area” means 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 action area consists of all the areas where the environmental effects of actions authorized by BLM planning efforts may occur, including those effects resulting from management of the Coquille Forest consistent with the PRMP (Figure 8). This includes downstream effects from chemical contaminants entering rivers, coastal estuaries, and the Columbia River.

The PRMP 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.

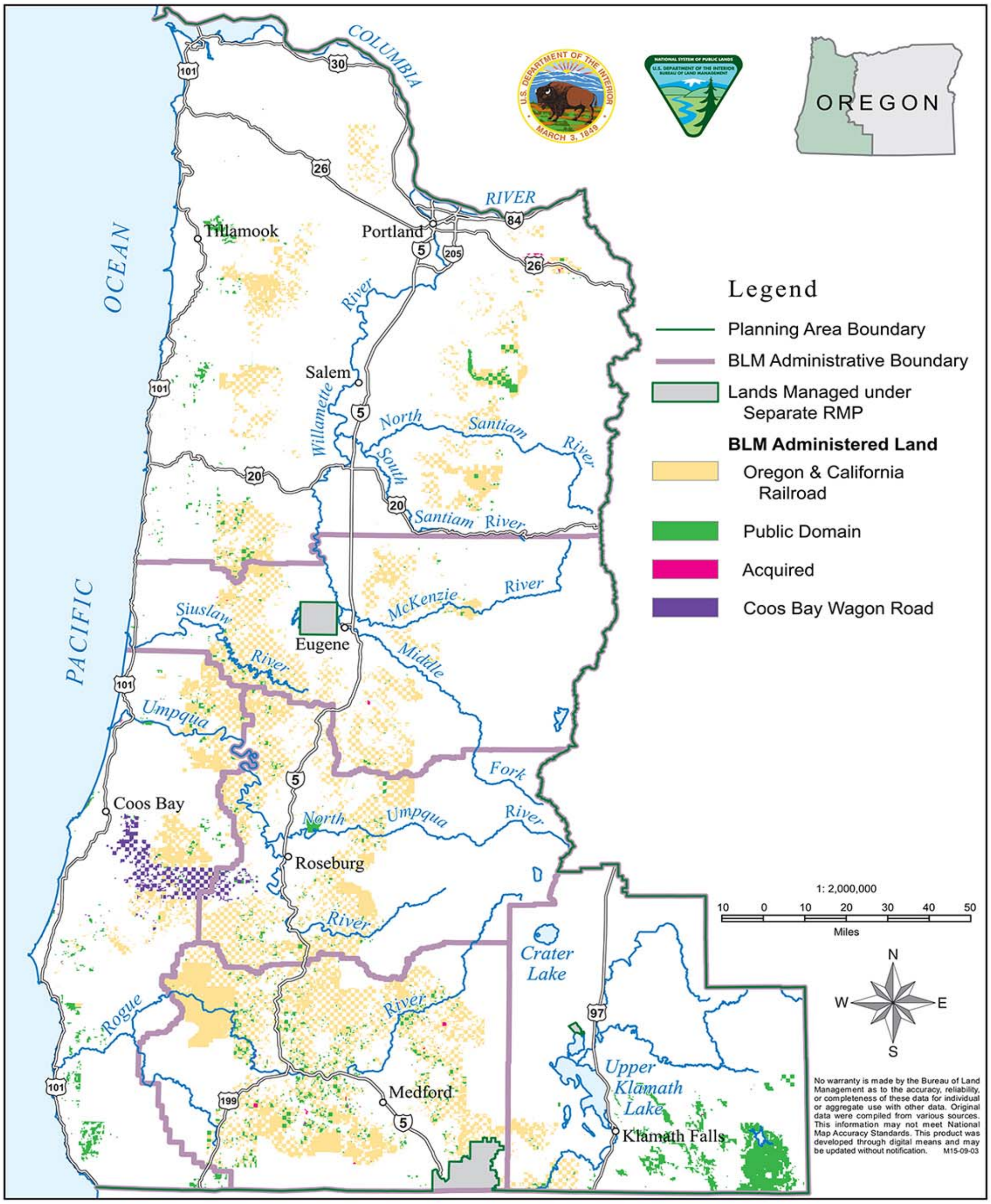

Figure 8. BLM land ownership within the ESA action area and planning area boundary. The action area for BLM PRMP includes the Coos Bay District, Eugene District, Medford District, Roseburg District, Salem District, and the Klamath Falls Field Office of the Lakeview District. The action area not only includes BLM ownership, but includes downstream watersheds adjacent to other lands not owned or administered by BLM (from BA).

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis.

The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

The adverse modification analysis considers the impacts of the Federal action on the conservation value of designated critical habitat. This biological opinion relies on the definition of "destruction or adverse modification", which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7414).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified primary constituent elements, physical or biological features, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.

- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

The proposed action for this consultation is a mixed programmatic action as defined by 50 CFR 402.02. A mixed programmatic action approves actions that will not be subject to further section 7 consultation, and also approves a framework for the development of future actions that are authorized, funded, or carried out at a later time. Take of a listed species would not occur unless and until those future actions are authorized, funded, or carried out and subject to further section 7 consultation. This proposed action approves the use of roads and recreational activities including campground use and administration and use of boat ramps. These activities will not be the subject of future individual consultations. We provide an incidental take exemption and associated reasonable and prudent measures and terms conditions for take resulting from these activities in the Incidental Take Statement in this document.

The reminder of the activities included in the proposed action will be addressed by individual or programmatic consultations if those actions may affect listed species or critical habitat. To complete our jeopardy and adverse modification analysis, we analyze effects of these activities considering how BLM's proposed management objectives and direction influence the nature of those effects. We then consider the BLM's projected level of activity (e.g., number of miles of roads built, or decommissioned) to predict, to the degree we can, the scale of any impact on listed species and critical habitat. For the activities that will be the subject of future consultations, we do not try to predict exactly what will happen at a particular action site in the future. Rather, our jeopardy and adverse modification analysis focuses on whether the management objectives and direction set sideboards that achieve an adequate level of conservation for listed species and critical habitat. We reserve the ability to conclude that any future site-specific action that appreciably reduces the likelihood of both the survival and recovery of a listed species would jeopardize the continued existence of listed species. Likewise, any future site-specific action that appreciably diminishes the value of critical habitat for the conservation of a listed species would adversely modify critical habitat.

Any take we determine will not jeopardize the continued existence of listed species resulting from activities that will be the subject of future consultations will be exempted in future Incidental Take Statements.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

One factor affecting the rangewide status of ESA-listed fish considered in this opinion, and aquatic habitat at large is climate change. Climate change is likely to play an increasingly important role in determining the abundance of listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early-spring will be less affected. Low-elevation areas are likely to be more affected. Some research suggests there may be more concern even for these higher elevations. Mantua et al. (2010) predicted basins strongly influenced by transient runoff (a mix of direct runoff from cool-season rainfall and springtime snowmelt) are most sensitive to climate change. Although this research focused on Washington, the Cascade range within this action area is dominated by these types of transient runoff basins. Coastal areas of the OC coho salmon and SONCC coho salmon ESUs may also include some basins with transient runoff. The anadromous salmonid species included in this analysis will be exposed to more intense winter flooding and more severe summer low flow periods due to climate change. In the following species specific discussions, for those species with identified limiting factors of summer water temperature or winter rearing habitat, climate change will pose the highest risk due to predicted shifting habitat conditions. The main predicted effects in terrestrial and freshwater habitats include warmer, drier summers, reduced snowpack, lower summer flows, higher summer stream temperatures, and increased winter floods, which would affect salmon by reducing available summer rearing habitat, increasing potential scour and egg loss in spawning habitat, increasing thermal stress, and increasing predation risk. In estuarine habitats, the main physical effects are predicted to be rising sea level and increasing water temperatures, which would lead to a reduction in intertidal wetland habitats, increasing thermal stress, increasing predation risk, and unpredictable changes in biological community composition.

During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas. Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F. Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

Precipitation trends during the next century are less certain than for temperature but more precipitation is likely to occur during October through March and less during summer months, and more of the winter precipitation is likely to fall as rain rather than snow (ISAB 2007; USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff so stream flows in late spring, summer, and fall will be lower and water temperatures will be warmer (ISAB 2007; USGCRP 2009).

Higher winter stream flows increase the risk that winter floods in sensitive watersheds will damage spawning redds and wash away incubating eggs. Earlier peak stream flows will also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation. Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, variation in quality and quantity of tributary rearing habitat, and increased competition and predation risk from warm-water, non-native species (ISAB 2007).

The earth's oceans are also warming, with considerable inter-annual and inter-decadal variability superimposed on the longer-term trend (Bindoff *et al.* 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005; Zabel *et al.* 2006; USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al.* 2006). Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Marine fish species have exhibited negative responses to ocean acidification conditions that include changes in growth, survivorship, and behavior. Marine phytoplankton, which are the base of the food web for many oceanic species, have shown varied responses to ocean acidification that include changes in growth rate and calcification (Feely *et al.* 2012).

2.2.1 Status of the Species

For Pacific salmon, steelhead, and certain other species, we commonly use 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, we assess 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 18 listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 1), and the status update (NWFSC 2015).

The status of species and critical habitat sections for salmon and steelhead are organized by recovery domains (Table 40) to better integrate into this consultation information in final and draft recovery plans on the conservation status of the listed species and their critical habitats. Recovery domains are the geographically-based areas within which we prepare recovery plans.

Table 40. Recovery domains identified by NMFS and their listed salmon and steelhead species.

Recovery Domain	Species
Willamette-Lower Columbia (WLC)	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
Interior Columbia (IC)	UCR spring-run Chinook salmon SR spring/summer-run Chinook salmon SR fall-run Chinook salmon SR sockeye salmon UCR steelhead MCR steelhead SRB 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) we 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 ESU that, if met, would indicate that an ESU will have a negligible risk of extinction over a 100-year time frame.[27]

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).

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

[27] 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.

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 41) (McElhany *et al.* 2006).

Table 41. 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

***Status of LCR Chinook* Salmon.** A recovery plan is available for this species NMFS 2013a). 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).

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

Overall, there was little change since the last status review (Ford et al. 2011) in the biological status of Chinook salmon populations in the Lower Columbia River ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall---run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the Recovery Plan (Dornbush 2013) there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.

These improved fall-run VSP scores reflect both changes in biological status and improved monitoring. Spring-run Chinook populations in this ESU are generally unchanged; most of the populations are at a high or very risk due to low abundances and the high proportion of hatchery-origin fish spawning naturally. In contrast, the spring-run Chinook salmon DIP in the Sandy River has an average of over a thousand natural-origin spawners and is at moderate risk. Additionally, the removal of Marmot Dam in the Sandy River eliminated migrational delays and holding injuries that were occurring at the fish ladder. Further, the removal of the diversion dam on the Little Sandy River restored access and flow to historical salmon habitat. Many of the spring-run populations rely upon passage programs at high head dams and downstream juvenile collection efficiencies are still too low to maintain self-sustaining natural runs. While limited numbers of naturally-produced spring run fish return to the Cowlitz and Cispus rivers, no spring-run fish are transported into the Tilton River Basin and it is not clear if there are any spring-run Chinook salmon remaining in the Toutle River Basin. The removal of Condit Dam on the White Salmon River provides an opportunity for the reestablishment of a spring-run population with volitional access to historical spawning grounds (abundance estimates prior to 2012 reflected fish spawning below Condit Dam during the spring run temporal spawning window). Spring-run Chinook salmon in the Hood River are largely of Deschutes River spring-run origin (Middle Columbia River Spring Run ESU) and provide no benefit to the status of the ESU; however, some Lower Columbia River spring-run Chinook salmon have been detected in the Hood River and their contribution (when sufficiently quantified) may need to be considered during future evaluations.

The majority of the populations in this ESU remain at high risk, with low natural---origin abundance levels. Hatchery contributions remain high for a number of populations, and it is likely that many returning unmarked adults are the progeny of hatchery-origin parents, especially where large hatchery programs operate. While overall hatchery production has been reduced slightly, hatchery-produced fish still represent a majority of fish returning to the ESU. The continued release of out-of-ESU stocks, including URB, Rogue River (SAB) fall run, Upper Willamette River spring run, Carson Hatchery spring run, and Deschutes River spring run, remains a concern. Relatively high harvest rates are a potential concern, especially for most spring-run and low abundance fall-run populations (NMFS 2012a). Although there have been a number of notable efforts to restore migratory access to areas upstream of dams, until efforts to improve juvenile passage systems bear fruition, it is unlikely that there will be significant improvements in the status of many spring-run populations.

Alternatively, dam removals (i.e. Condit Dam, Marmot Dam, and Powerdale Dam) not only improve/provide access, but allow the restoration of hydrological processes that may improve downstream habitat conditions. Removing dams provides some risk reduction due to climate change induced stream temperature increases by providing access to upstream reaches that provide colder water. Continued land development and habitat degradation in combination with the potential effects of climate change may present a continuing strong negative influence into the foreseeable future. In addition, coastal ocean conditions would suggest that recent outmigrant year classes will experience below average ocean survival with a corresponding drop in spawner abundance in the near term, depending on the duration and intensity of the existing situation (see Recent trends in marine and terrestrial environments section, below).

Table 42. LCR Chinook salmon strata, ecological subregions, run timing, populations, and scores for the extinction risk of the population (NWFSC 2015). Extinction risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

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

Limiting Factors. Limiting factors for all Lower Columbia River species are given in Table 43.

Table 43. 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	√	√	√[28]	√	√	√	√
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							

[28] The recovery plan for LCR species (NMFS 2013) lists riparian condition as a limiting factor for one of the two populations of late-fall Chinook salmon (Sandy).

Limiting Factor	Spring Chinook Salmon	Fall Chinook Salmon	Late-Fall Chinook Salmon	Chum Salmon	Coho Salmon	Winter Steelhead	Summer Steelhead
Direct Mortality (Land Use)	√	√	√	√	√	√	√
Direct Mortality (Dams)	√	√		√	√	√	√

Status of UWR Chinook Salmon. A recovery plan is available for this species (ODFW and NMFS 2011). This species includes all naturally spawned populations of spring-run Chinook salmon originating from the Clackamas River, from the Willamette River and its tributaries above Willamette Falls, and from 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 44).

Table 44. Scores for the current overall extinction risk for UWR Chinook salmon (NWFSC 2015). 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)	Overall Extinction Risk	Current Score
Clackamas River	M	2
Molalla River	VH	0
North Santiam River	VH	0
South Santiam River	VH	0
Calapooia River	VH	0
McKenzie River	L	3
Middle Fork Willamette River	VH	0

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status review update (NWFSC 2015).

In evaluating the status of Upper Willamette River spring-run Chinook salmon there are a number of general considerations that affect some or all of the populations. In addition to the prespawning mortalities monitored in the specific population basins, there is a shortfall in abundance between Willamette Falls and East side tributary census points[29] due to prespawning mortality or spawning in the unsurveyed lower reaches of east or west-side tributaries (Jepson et al. 2013; Jepson et al. 2014) where spawning and incubation conditions are less well-suited to spring-run Chinook salmon. Radio tagging results from 2014 suggest that few fish strayed into west-side tributaries (no detections) and relatively fewer fish were unaccounted for between Willamette Falls and the tributaries, 12.9% of clipped fish and 5.3% of unclipped fish (Jepson et al. 2015). Access to historical spawning and rearing areas is restricted by large dams in the four historically most productive tributaries, and in the absence of effective passage programs will continue to confine spawning to more lowland reaches where land development, water temperatures, and water quality may be limiting. Prespawning mortality levels are generally high in the lower tributary reaches where water temperatures and fish densities[30] are generally the highest. Areas immediately downstream of high head dams may also be subject to high levels of total dissolved gas (TDG). While the relationship between TDG levels and mortality is related to a complex interaction of fish species, age, depth, and history of exposure (Beeman & Maule

[29] Census points include: dams, traps, index reaches, or radio---tracking antennae stations.
[30] Reaches downstream of fish hatcheries contain relatively large numbers of hatchery fish, which may also be more susceptible to prespawning mortality.

2006), the relative risks are quite high in some reaches. For example, natural origin Chinook salmon and steelhead are passed above the barrier dam at the Minto fish facility into a short reach immediately below the Detroit/Big Cliff Dam complex. At certain times of the year, water spilled over Detroit and Big Cliff dams has the potential to produce high levels of TDG, which could affect a significant portion of the incubating embryos, in-stream juveniles, and adults in the basin, although the effect of this impact has not been quantified.

The apparent decline in the status of the McKenzie River DIP in the last 10 years is a source of concern given that this population was previously seen as a stronghold of natural production in the ESU. In contrast to most of the other populations in this ESU, McKenzie River Chinook salmon have access to much of their historical spawning habitat in the South Fork McKenzie above Cougar Dam, although access is still limited by poor downstream juvenile passage. Additionally, the installation of a temperature control structure in Cougar Dam in 2008 was thought to benefit downstream spawning, incubation, and rearing success. Similarly, natural-origin returns to the Clackamas River have remained flat, despite adults having access to much of their historical spawning habitat. Although returning adults have access to most of the Calapooia and Molalla basin, habitat conditions are such that the productivity of these systems is very low. Natural-origin spawners in the Middle Fork Willamette River consisted solely of adults returning to Fall Creek. While these fish contribute to the DIP and ESU, at best the contribution will be minor because of the small run size. Finally, improvements were noted in the North and South Santiam DIPs. The increase in abundance in both DIPs was in contrast to the other DIPs and the counts at Willamette Falls. While spring-run Chinook salmon in the South Santiam DIP have access to some of their historical spawning habitat, natural origin spawners in the North Santiam are still primarily confined to below Detroit Dam[31] and subject to relatively high prespawning mortality rates.

Although there has likely been an overall decrease in the VSP status of the ESU since the last review (Figure 9 in NWFSC 2015), the magnitude of this change in not sufficient to suggest a change in risk category. Given current climatic conditions and the prospect of long---term climatic change, the inability of many populations to access historical headwater spawning and rearing areas may put this ESU at greater risk in the near future.

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

[31] Some hatchery-origin spawners are currently transported above Detroit Dam; however downstream juvenile survival through existing passage outlets is extremely low and likely would not achieve replacement.

Status of CR Chum Salmon. Columbia River chum salmon are included in the Lower Columbia River recovery plan (NMFS 2013a). This species includes all naturally-spawned populations of chum salmon originating from the Columbia River and its tributaries in Washington and Oregon, and from two artificial propagation programs (USDC 2014). The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers *et al.* 2006) (Table 45).

Table 45. CR chum salmon strata, ecological subregions, run timing, populations, and scores for the current overall net persistence probability of the population (NWFSC 2015). Extinction risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Stratum		**Spawning Population (Watershed)**	**Overall Extinction Risk**
Ecological Subregion	**Run Timing**		
Coast Range	Fall	Young's Bay (OR)	VH
		Grays/Chinook rivers (WA)	M
		Big Creek (OR)	VH
		Elochoman/Skamakowa rivers (WA)	VH
		Clatskanie River (OR)	VH
		Mill, Abernathy and Germany creeks (WA)	VH
		Scappoose Creek (OR)	VH
Cascade Range	Summer	Cowlitz River (WA)	VH
	Fall	Cowlitz River (WA)	VH
		Kalama River (WA)	VH
		Lewis River (WA)	VH
		Salmon Creek (WA)	VH
		Clackamas River (OR)	VH
		Sandy River (OR)	VH
		Washougal River (WA)	VH
Columbia Gorge	Fall	Lower Gorge (WA & OR)	L
		Upper Gorge (WA & OR)	VH

<u>Updated Biological Risk Summary</u>. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

The majority of the populations in this ESU are at high to very high risk, with very low abundances. These populations are at risk of extirpation due to demographic stochasticity and Allee effects. One population, Grays River, is at low risk, with spawner abundances in the thousands and demonstrating a recent positive trend. The Washougal River and Lower Gorge populations maintain moderate numbers of spawners and appear to be relatively stable. The life history of chum salmon is such that ocean conditions have a strong influence on the survival of emigrating juveniles. The potential prospect of poor ocean conditions for the near future may put further pressure on these chum salmon populations.

Freshwater habitat conditions may be negatively influencing spawning and early rearing success in some basins, and contributing to the overall low productivity of the ESU. Land development, especially in the low gradient reaches that chum salmon prefer, will continue to be a threat to most chum populations due to projected increases in the population of the greater Vancouver---Portland area and the Lower Columbia River overall (Metro 2014). The viability of this ESU is relatively unchanged since the last review and the modest improvements in some populations do not warrant a change in risk category, especially given the uncertainty regarding climatic effects in the near future. This ESU therefore remains at moderate to high risk.

Limiting Factors. Limiting factors for this species are given in Table 43, above.

Status of LCR Coho Salmon. This species is included in the Lower Columbia River recovery plan (NMFS 2013a). This species includes naturally spawned coho salmon originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood Rivers (inclusive), any such fish originating from the Willamette River and its tributaries below Willamette Falls, and coho salmon from 21 artificial propagation programs (USDC 2014) (Table 46).

Table 46. LCR coho salmon ecological subregions, populations, and scores for the current overall extinction risk (NWFSC 2015); ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

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

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

The status of a number of coho populations have changed since the reviews by McElhany et al. (2006), Ford et al. (2011) and Dornbush (2013). Changes in abundance and productivity, diversity and spatial structure were generally positive; however, this appears to be mostly due to the improved level of monitoring (and therefore understanding of status) in Washington tributaries rather than a true change in status over time. In the absence of specific abundance and diversity data, earlier status reviews had concluded that hatchery origin fish dominated many of the coho populations in the Lower Columbia River ESU and that there was little natural productivity. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs are still far from that threshold and require supplementation with additional hatchery-origin spawners. Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon DIPs, abundances are still at low levels and the majority of the DIPs remain at moderate or high risk. For the Lower Columbia River region, land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years (Figure 69 in NWFSC 2015), recent poor ocean conditions suggest that population declines might occur in the upcoming return years. Regardless, this ESU is still considered to be at moderate risk.

Limiting Factors. Limiting factors for this species are given in Table 43, above.

Status of LCR Steelhead. This species is included in the Lower Columbia River recovery plan (NMFS 2013a). This species includes naturally spawned steelhead originating below natural and manmade impassable barriers from rivers between the Cowlitz and Wind Rivers (inclusive) and the Willamette and Hood Rivers (inclusive); it excludes such fish originating from the upper Willamette River basin above Willamette Falls (USDC 2014). 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 47).[32]

[32] 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 47. LCR steelhead strata, ecological subregions, run timing, populations, and scores for the current overall extinction risk (NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

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

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead DIPs were similarly stable, but at low abundance levels. The decline in the Wind River summer-run DIP is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Recent low winter-run returns to the Upper Cowlitz River may be anomalous, related more to the development of an integrated hatchery broodstock and temporary modifications at the Cowlitz Falls Dam to benefit Chinook salmon than to a decline in viability. Efforts to provide passage above North Fork Lewis River dams offer the opportunity for substantial improvements in the winter run steelhead population and the only opportunity to reestablish summer-run steelhead. Habitat degradation continues to be a concern for most populations. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability. The DPS therefore continues to be at moderate risk.

Limiting Factors. Limiting factors for this species are given in Table 43, above.

Status of UWR Steelhead. A recovery plan is available for this species (ODFW and NMFS 2011). This species includes naturally spawned anadromous winter-run steelhead originating below natural and manmade impassable barriers from the Willamette River and its tributaries upstream of Willamette Falls to and including the Calapooia River (USDC 2014). One stratum and four extant populations of UWR steelhead occur within the DPS (Table 48).

Table 48. Scores for the current overall extinction risk for UWR steelhead (NWFSC 2015). 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)	Overall Extinction Risk
Molalla River	3
North Santiam River	3
South Santiam River	3
Calapooia River	2

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

Overall, the declines in abundance noted during the previous review (Ford et al. 2011) continued through the period 2010-2015 (Figure 94 in NWFSC 2015). There is considerable uncertainty in many of the abundance estimates, except for perhaps the tributary dam counts. Radio-tagging studies suggest that a considerable proportion of winter steelhead ascending Willamette Falls do not enter the tributaries of demographically independent populations (DIPs) that constitute this DPS; these fish may be non-native early winter steelhead that appear to have colonized western tributaries, misidentified summer steelhead, or late-winter steelhead that have colonized tributaries not historically part of the DPS. More definitive genetic monitoring of steelhead ascending Willamette Falls in tandem with radio tagging work needs to be undertaken to estimate the total abundance of the DPS.

The release of non-native summer-run steelhead continues to be a concern. Genetic analysis suggests that there is some level introgression among native late-winter steelhead and summer-run steelhead (Van Doornik et al. 2015). Accessibility to historical spawning habitat is still limited, especially in the North Santiam River. Much of the accessible habitat in the Molalla, Calapooia, and lower reaches of North and South Santiam rivers is degraded and under continued development pressure. Although habitat restoration efforts are underway, the time scale to restore functional habitat is considerable.

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

Status of Southern DPS Green Sturgeon. We have 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 — 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. We are 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).

Status of Eulachon. On June 21, 2013, NMFS announced a Federal recovery plan outline, which is to serve as interim guidance for recovery efforts (USDC 2013b). The target month for completion of a recovery plan for eulachon is December, 2016. 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 BMPs, removing Klamath River dams, and completing research on life history and genetics, climate effects, and habitat effects (NMFS 2013b).

<u>Spatial Structure and Diversity</u>. Listed eulachon occur in three salmon recovery domains in Oregon: the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coast. The 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.

<u>Abundance and Productivity</u>. 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 to 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 to 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 9). We have not identified an abundance or productivity target for eulachon recovery, as sufficient data does not exist to parameterize a population viability analysis.[33]

[33] September 1, 2015 email from Robert Anderson, Eulachon Recovery Coordinator, NMFS, to Jeffrey Lockwood, Fishery Biologist, NMFS, regarding a eulachon recovery question from EPA.

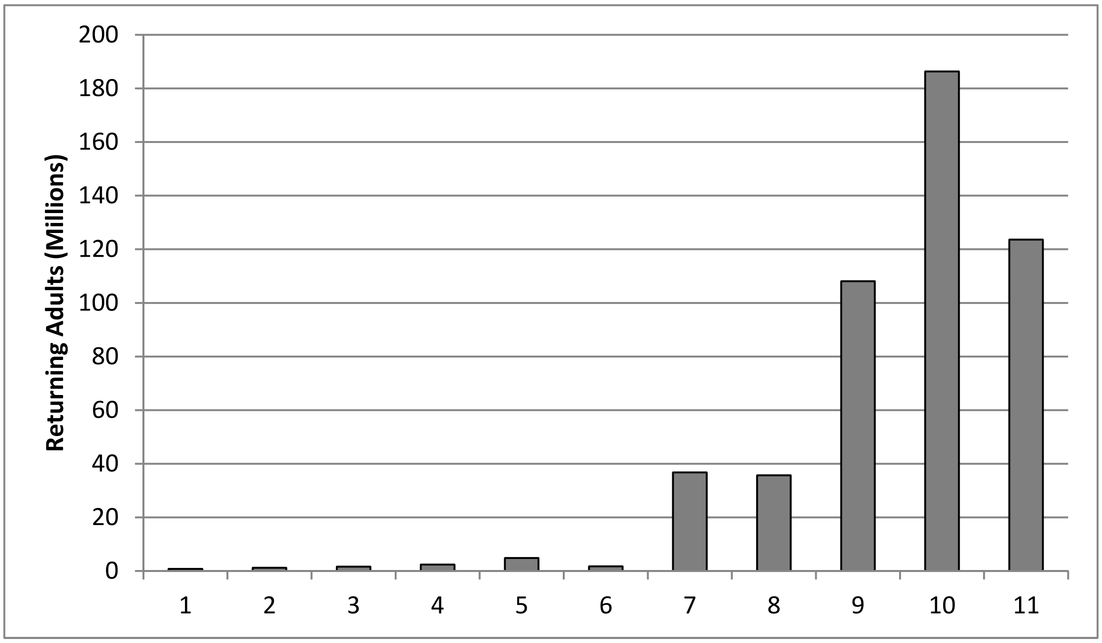

Figure 9. Annual Columbia River eulachon run size from 2000 to 2015 (mean of bootstrap estimates; pounds converted to numbers of fish at 11.16 fish pound^{-1}; [WDFW 2015]). The estimates were calculated based on methods developed by Parker (1985), Jackson and Cheng (2001), and Hay *et al.* (2002) to estimate spawning biomass of pelagic fishes. For 2000 through 2010, estimates were back-calculated using historical larval density data.

Threats. We have not identified limiting factors for this species. However, our status review for this species (Gustafson *et al.* 2010) listed threats to this species (Table 49).

Table 49. 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.

The likely effects of climate change on eulachon were summarized by Gustafson et al. (2010). Many populations of eulachon spawn in rivers fed by snowmelt or glacial runoff well before the peak of water inputs so that their eggs will have time to incubate before hatching during the peak spring discharge of the rivers. If peak runoff and river flows occur earlier due to warmer air temperatures, eulachon may spawn earlier or be flushed out to the ocean at an earlier date. Earlier emigration of eulachon from spawning areas, together with an anticipated delay in the onset of coastal upwelling, may result in a mismatch between entry of larval eulachon into the ocean and the peak of coastal upwelling, which could reduce marine survival of the larvae. Gustafson et al. (2010) also summarized anecdotal and quantitative data suggesting that, perhaps due to warming conditions or altered stream flow timing, adult eulachon are returning earlier in the season to several rivers within the southern DPS.

Interior Columbia Recovery Domain. Species in the Interior Columbia (IC) recovery domain include UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, MCR steelhead, and SRB steelhead (IC-TRT 2003; McClure *et al.* 2005) . The IC-TRT aggregated populations into "major groupings" based on dispersal distance and rate, and drainage structure, primarily the location and distribution of large tributaries. All IC populations use the mainstem of the Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

The IC-TRT recommended viability criteria that follow the VSP framework (IC-TRT 2007). The criteria include biological and physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period.

Status of UCR Spring-run Chinook Salmon. A recovery plan is available for this species (UCSRB 2007). This species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam (excluding the Okanogan River), the Columbia River upstream to Chief Joseph Dam, and progeny of six artificial propagation programs (USDC 2014). The IC-TRT identified four independent populations of UCR spring-run Chinook salmon in the upriver tributaries of the Wenatchee, Entiat, Methow, and Okanogan Rivers (one of which, the Okanogan, is extirpated), but no major groups due to the relatively small geographic area affected (IC-TRT 2003; McClure *et al.* 2005) (Table 50).

Table 50. Scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for spring-run UCR Chinook salmon (NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), very high (VH), and extirpated (E).

Population	A&P	Natural Processes Risk	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	H	L	H	H	H
Entiat River	H	M	H	H	H
Methow River	H	L	H	H	H
Okanogan River					E

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat and unchanged for the Methow. However abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations. Short-term patterns in those indicators appear to be largely driven by year-to year fluctuations in survival rates in areas outside of these watersheds. All three populations continued to be rated at low risk for spatial structure but at high risk for diversity criteria. Large-scale supplementation efforts in the Methow and Wenatchee Rivers are ongoing, intended to counter short-term demographic risks given current average survival levels and the associated year-to-year variability. Under the current recovery plan, habitat protection and restoration actions are being implemented that are directed at key limiting factors. Achieving natural origin abundance and productivity levels above the threshold viability curve corresponding to 5% risk in extinction will require substantial improvements in survival and/or natural production capacity (Figure 13 in NWFSC 2015). Given the high degree of year-to-year variability in life stage survivals and the time lags resulting from the 5 year life cycle of the populations, it is not possible to detect incremental gains from habitat actions implemented to date in population level measures of adult abundance or productivity. Efforts are underway to develop life stage specific estimates of performance (survival and capacities) and to use a life cycle model framework to evaluate progress. Based on the information available for this review, the risk category for the Upper Columbia Spring Chinook ESU remains unchanged from the prior review (Ford et al. 2011). Although the status of the ESU is improved relative to measures available at the time of listing, all three populations remain at high risk.

Limiting Factors. Limiting factors for this species include (UCSRB 2007; NOAA Fisheries 2011):

- Effects related to hydropower system in the mainstem Columbia River , including reduced upstream and downstream fish passage, altered ecosystem structure and function, altered flows, and degraded water quality
- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality
- Degraded estuarine and nearshore marine habitat
- Hatchery-related effects
- Persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species
- Harvest in Columbia River fisheries

Status of SR Spring/summer-run Chinook Salmon. We are developing a recovery plan for this species. This species includes all naturally-spawned populations of spring/summer-run Chinook salmon originating from the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins, and from 11 artificial propagation programs (USDC 2014). The IC-TRT recognized 27 extant and four extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into five MPGs that correspond to ecological subregions (Table 51) (IC-TRT 2003; McClure *et al.* 2005). All extant populations face a “high” risk of extinction (NWFSC 2015).

Table 51. MPGs, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for SR spring/summer-run Chinook salmon (NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), very high (VH), and extirpated (E).

Major Population Groups	Spawning Populations (Watershed)	A&P	Natural Processes Risk	Diversity	Integrated SS/D	Overall Viability Risk
Lower Snake River	Tucannon River	H	L	M	M	H
	Asotin River					E
Grande Ronde and Imnaha rivers	Wenaha River	H	L	M	M	H
	Lostine/Wallowa River	H	L	M	M	H
	Minam River	H	L	M	M	H
	Catherine Creek	H	M	M	M	H
	Upper Grande Ronde R.	H	H	M	H	H
	Imnaha River	H	L	M	M	H
	Lookingglass Creek					E
South Fork Salmon River	Little Salmon River	*	L	L	L	H
	South Fork mainstem	H	L	M	M	H
	Secesh River	H	L	L	L	H
	EF/Johnson Creek	H	L	L	L	H
Middle Fork Salmon River	Chamberlin Creek	M	L	L	L	MT
	Big Creek	H	VL	M	M	H
	Lower Mainstem MF	*	M	M	M	H
	Camas Creek	H	L	M	M	H
	Loon Creek	H	L	M	M	H
	Upper Mainstem MF	H	L	M	M	H
	Sulphur Creek	H	L	M	M	H
	Bear Valley Creek	H	VL	L	L	H
	Marsh Creek	H	L	L	L	H
Upper Salmon River	Salmon Lower Main	H	L	L	L	H
	Salmon Upper Main	H (M)	L	L	L	H
	Lemhi River	H	H	H	H	H
	Pahsimeroi River	H (M)	M	H	H	H
	Salmon East Fork	H	L	H	H	H
	Yankee Fork	H	M	H	H	H
	Valley Creek	H	L	M	M	H
	North Fork	*	L	L	L	H
	Panther Creek					E

* Insufficient data.

<u>Limiting Factors.</u> Limiting factors for this species include (NOAA Fisheries 2011):

- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality. Effects related to the hydropower system in the mainstem Columbia River, including reduced upstream and downstream fish passage, altered ecosystem structure and function, altered flows, and degraded water quality
- Harvest-related effects

- Predation

Status of SR Fall-run Chinook Salmon. We are developing a recovery plan for this species. This species includes all naturally-spawned populations of fall-run Chinook salmon originating from the mainstem Snake River below Hells Canyon Dam; from the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins; and from four artificial propagation programs (USDC 2014).

The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon rivers. The extant population of Snake River fall-run Chinook salmon is the only remaining population from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (IC-TRT 2003; McClure *et al.* 2005). The population is at moderate risk for diversity and spatial structure (NWFSC 2015).

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

Overall population viability for the Lower Mainstem Snake River fall Chinook salmon population is determined based on the combination of ratings for current abundance and productivity and combined spatial structure diversity (Table 52).

Table 52. Lower Mainstem Snake River fall Chinook salmon population risk ratings integrated across the four viable salmonid population (VSP) metrics. Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Green shaded cells – meets criteria for Highly Viable; Gray shaded cells – does not meet viability criteria (darkest cells are at greatest risk).

	Very Low	**Low**	**Moderate**	**High**
Very Low (<1%)	HV	HV	V	M
Low (1-5%)	V	V	V Lower Main. Snake	M
Moderate (6-25%)	M	M	M	HR
High (>25%)	HR	HR	HR	HR

Limiting Factors. Limiting factors for this species include (NOAA Fisheries 2011):

- Degradation of floodplain connectivity and function and channel structure and complexity
- Harvest-related effects
- Loss of access to historical habitat above Hells Canyon and other Snake River dams
- Impacts from mainstem Columbia River and Snake River hydropower systems

- Hatchery-related effects
- Degraded estuarine and nearshore habitat.

Status of SR Sockeye Salmon. We released a final recovery plan for this species on June 8, 2015 (NMFS 2015a). This species includes all anadromous and residual sockeye salmon from the Snake River basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake Captive Broodstock Program (USDC 2014). The IC-TRT identified historical sockeye salmon production in at least five Stanley Basin and Sawtooth Valley lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (*e.g.,* Wallowa and Payette Lakes). Current returns of SR sockeye salmon are extremely low and limited to Redfish Lake (IC-TRT 2007).

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

In terms of natural production, the Snake River Sockeye ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach-developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions. At this stage of the recovery program there is no basis for changing the ESU ratings assigned in prior reviews, but the trend in status appears to be positive.

Limiting Factors. The key factor limiting recovery of SR sockeye salmon ESU is survival outside of the Stanley Basin. Portions of the migration corridor in the Salmon River are impaired by reduced water quality and elevated temperatures (Idaho Department of Environmental Quality 2011). The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals. Survival rates from Lower Granite dam to the spawning grounds are low in some years (*e.g.*, average of 31%, range of 0-67% for 1991-1999) (Keefer *et al.* 2008). Keefer *et al.* (2008) conducted a radio tagging study on adult SR sockeye salmon passing upstream from Lower Granite Dam in 2000 and concluded that high in-river mortalities could be explained by “a combination of high migration corridor water temperatures and poor initial fish condition or parasite loads.” Keefer *et al.* (2008) also examined current run timing of SR sockeye salmon versus records from the early 1960s, and concluded that an apparent shift to earlier run timing recently may reflect increased mortalities for later migrating adults. In the Columbia and lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown, but terns and cormorants consume 12% of all salmon smolts reaching the estuary, and piscivorous fish consume an estimated 8% of migrating juvenile salmon (NOAA Fisheries 2011).

Status of MCR Steelhead. A recovery plan is available for this species (NMFS 2009). This species includes all naturally-spawned steelhead populations originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River; excluding steelhead originating from the Snake River basin. This DPS does include steelhead from seven artificial propagation programs (USDC 2014). The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project in the

Deschutes River Basin, Oregon (USDC 2013a). The IC-TRT identified 17 extant populations in this DPS (IC-TRT 2003; McClure *et al.* 2005). The populations fall into four MPGs: Cascade eastern slope tributaries (five extant and two extirpated populations), the, the John Day River (five extant populations), the Walla Walla and Umatilla rivers (three extant and one extirpated populations), and the Yakima River (four extant populations) (Table 13) (IC-TRT 2003; McClure *et al.* 2005). Viability ratings for these populations range from extirpated to viable (Table 53) (NMFS 2009; NWFSC 2015).

Limiting Factors. Limiting factors for this species include (NMFS 2009; NOAA Fisheries 2011):

- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas, fish passage, stream substrate, stream flow, and water quality
- Mainstem Columbia River hydropower-related impacts
- Degraded estuarine and nearshore marine habitat
- Hatchery-related effects
- Harvest-related effects
- Effects of predation, competition, and disease.

Table 53. MPGs, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for MCR steelhead (NMFS 2009; Ford 2011). Risk ratings included very low (VL), low (L), moderate (M), high (H), very high (VH), and extirpated (E). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

Major Population Group	Population (Watershed)	A&P	Natural Processes Risk	Diversity	Integrated SS/D	Overall Viability Risk
Cascade Eastern Slope Tributaries	Fifteenmile Creek	M	VL	L	L	MT
	Klickitat River	M??	L	M	M	MT?
	Deschutes Eastside	L	L	M	M	Viable
	Deschutes Westside	H	L	M	M	H
	Rock Creek	*	M	M	M	H?
	White Salmon					E
	Crooked River					E
John Day River	Upper John Day	M	VL	M	M	MT
	North Fork John Day	VL	VL	L	L	Highly Viable
	Middle Fork John Day	L	L	M	M	Viable
	South Fork John Day	L	VL	M	M	Viable
	Lower John Day Tribs	M	VL	M	M	MT
Walla Walla and Umatilla rivers	Umatilla River	M	M	M	M	MT
	Touchet River	H	L	M	M	H
	Walla Walla River	M	M	M	M	MT
Yakima River	Satus Creek	L	L	M	M	Viable
	Toppenish Creek	L	L	M	M	Viable
	Naches River	M	L	M	M	M
	Upper Yakima	M	M	H	H	H

* Re-introduction efforts underway (NMFS 2009).

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

There have been improvements in the viability ratings for some of the component populations, but the Mid-Columbia River Steelhead DPS is not currently meeting the viability criteria described in the Mid-Columbia Steelhead Recovery Plan. In addition, several of the factors cited by the 2005 BRT remain as concerns or key uncertainties. Natural origin returns to the majority of populations in two of the four MPGs in this DPS increased modestly relative to the levels reported in the previous five year review. Abundance estimates for 2 of 3 populations with sufficient data in the remaining two MPGs (Eastside Cascades and Umatilla/Walla-Walla) were marginally lower. Natural-origin spawning estimates are highly variable relative to minimum abundance thresholds across the populations in the DPS. Three of the four MPGs in this DPS include at least one population rated at low risk for abundance and productivity (Table 37 in NWFSC 2015). The survival gaps for the remaining populations are generally smaller than those for the other Interior Columbia Basin listed DPSs (Figure 52 in NWFSC 2015). Updated information indicates that stray levels into the John Day River populations have deceased in recent years. Out of basin hatchery stray proportions, although reduced, remain high in spawning reaches within the Deschutes River basin populations. In general, the majority of population level viability ratings remained unchanged from prior reviews for each MPG within the DPS.

Status of UCR Steelhead. A recovery plan is available for this species (UCSRB 2007).This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, and progeny of six artificial propagation programs (USDC 2014). Four independent populations of UCR steelhead were identified by the IC-TRT in the same upriver tributaries as for UC spring-run Chinook salmon (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan; and, similarly, no major population groupings were identified due to the relatively small geographic area involved (IC-TRT 2003; McClure *et al.* 2005). All extant populations are at high risk of extinction (NWFSC 2015). With the exception of the Okanogan population, the Upper Columbia populations rated as “low” risk for spatial structure. The “high” risk ratings for SS/D are largely driven by chronic high levels of hatchery spawners within natural spawning areas and lack of genetic diversity among the populations. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations.

Table 54. Summary of the key elements (A&P, diversity, and SS/D) and scores used to determine current overall viability risk for UCR steelhead populations (NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Population (Watershed)	A&P	Natural Processes Risk	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	L	L	H	H	MT
Entiat River	H	M	H	H	H
Methow River	H	L	H	H	H
Okanogan River	H	H	H	H	H

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

Overall population viability for the Upper Columbia River steelhead populations is determined based on the combination of ratings for current abundance and productivity and combined spatial structure diversity (Table 55).

Table 55. Upper Columbia Steelhead DPS Steelhead population viability ratings integrated across the four VSP parameters. Viability key: HV, highly viable; V, viable; M, maintained; and HR, high risk (does not meet viability criteria).

	Very Low	Low	Moderate	High
Very Low (<1%)	HV	HV	V	M
Low (1-5%)	V	V	V	M Wenatchee
Moderate (6-25%)	M	M	M	HR
High (>25%)	HR	HR	HR	HR Entiat Methow Okanogan

Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations (Table 13 in NWFSC 2015). The status of the Wenatchee River steelhead population continued to improve based on the additional years information available for this review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5% extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns. Application of the criteria for abundance/productivity results in relatively coarse scale ratings for each population. Across Interior Columbia DPSs, the populations differ in the relative changes in survival or limiting capacities that could lead to viable ratings (Figure 20 in NWFSC 2015). The required improvement to improve the abundance/productivity estimates for Upper Columbia Steelhead populations is at the high end of the range for all listed Interior populations (Figure 20 in NWFSC 2015).

Given the recent changes in hatchery practices in the Wenatchee River and the potential for reduced hatchery contributions or increased spatial separation of hatchery vs. natural origin spawners, it is possible that genetic composition could trend towards patterns consistent with strong natural selection influences in the future. Ongoing genetic sampling and analysis could provide information in the future to determine if the diversity risk is abating. The proportions of hatchery-origin returns in natural spawning areas remain high across the DPS, especially in the Methow and Okanogan river populations. The improvements in natural returns in recent years largely reflect several years of relatively good natural survival in the ocean and tributary habitats. Tributary habitat actions called for in the Upper Columbia Recovery Plan are anticipated to be implemented over the next 25 years and the benefits of some of those actions will require some time to be realized.

Limiting Factors. Limiting factors for this species include (UCSRB 2007; NOAA Fisheries 2011):

- Adverse effects related to the mainstem Columbia River hydropower system
- Impaired tributary fish passage
- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality
- Hatchery-related effects
- Predation and competition
- Harvest-related effects

Status of SRB Steelhead. We are developing a recovery plan for this species. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, and progeny of six artificial propagation programs (USDC 2014). The IC-TRT identified 24 populations in five major groups (Table 56) (IC-TRT 2003; McClure *et al.* 2005). The IC-TRT has not assessed the viability of this species. The relative proportion of hatchery fish in natural spawning areas near major hatchery release sites is highly uncertain. There is little evidence for substantial change in ESU viability relative to the previous BRT and IC-TRT reviews.

Table 56. MPGs, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for SRB steelhead (NWFSC 2015; NMFS 2011a). Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

Major Population Group	Spawning Populations (Watershed)	A&P	Natural Processes Risk	Diversity	Integrated SS/D	Overall Viability Risk*
Lower Snake River	Tucannon River	H?	L	M	M	H?
	Asotin Creek	M?	L	M	M	MT? (H??)
Grande Ronde River	Lower Grande Ronde	**	L	M	M	MT?
	Joseph Creek	VL	VL	L	L	Highly viable
	Upper Grande Ronde	Viable (M)	VL	M	M	Viable
	Wallowa River	H??	VL	L	L	M?
Clearwater River	Lower Main Clearwater R.	M?	VL	L	L	MT?
	South Fork Clearwater R.	H	L	M	M	MT/H?
	Lolo Creek	H	L	M	M	MT/H?
	Selway River	M?	VL	L	L	MT?
	Lochsa River	M?	VL	L	L	MT?
Salmon River	Little Salmon River	M?	L	M	M	MT?
	South Fork Salmon	M?	VL	L	L	MT?
	Secesh River	M?	VL	L	L	MT?
	Chamberlain Creek	M?	L	L	L	MT?
	Lower Middle Fork Salmon R.	M?	VL	L	L	MT?
	Upper Middle Fork Salmon R.	M?	VL	L	L	MT?
	Panther Creek	M	H	M	H	H?
	North Fork Salmon R.	M	L	M	M	MT?
	Lemhi River	M	L	M	M	MT?
	Pahsimeroi River	M	M	M	M	MT?
	East Fork Salmon	M	VL	M	M	MT?
	Up Main Salmon R.	M	VL	M	M	MT?
Imnaha	Imnaha River	M?	VL	M	M	M?

* There is uncertainty in these ratings due to a lack of population-specific data.

** Insufficient data.

<u>Updated Biological Risk Summary</u>. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

None of the major population groups in this DPS are meeting the specific objectives in the draft Recovery Plan based on the updated status information available for this review, and the status of many individual populations remains uncertain (Table 56). The additional monitoring programs instituted in the early 2000's to gain better information on natural origin abundance and related factors have significantly improved our ability to assess status at a more detailed level. The new information has resulted in an updated view of the relative abundance of natural origin spawners and life history diversity across the populations in the DPS. The more specific information on the distribution of natural returns among stock groups and populations indicates that differences in abundance/productivity status among populations may be more related to geography or elevation rather than A run vs. B run. Based on these results, the major life history category designations for populations in the DPS have been updated (Table). A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations. Overall, the information analyzed for this status review does not indicate a change in biological risk status.

Limiting Factors. Limiting factors for this species include (NMFS 2011a; NMFS 2011b):

- Adverse effects related to the mainstem Columbia River hydropower system
- Impaired tributary fish passage
- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality
- Increased water temperature
- Harvest-related effects, particularly for B-run steelhead
- Predation
- Genetic diversity effects from out-of-population hatchery releases

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. We covered the status of green sturgeon and eulachon earlier in this document, and cover the status of OC coho salmon below.

Status of OC Coho Salmon. We have completed a draft recovery plan for this species (NMFS 2015b). 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 21 independent and 35 dependent populations in five biogeographic strata (Table 57) (NWFSC 2015). 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.

Table 57. 'Minimum level of desired status' of each population under the Oregon Coast Coho Conservation Plan (NWFSC 2015).

	Population	OR Coast Coho Cons Plan Status*
North Coast	Necanicum River	F
	Nehalem River	P
	Tillamook Bay	P
	Nestucca River	P
Mid-Coast	Salmon River	F
	Siletz River	P
	Yaquina River	P
	Beaver Creek	P
	Alsea	P
	Siuslaw	P
Lakes	Siltcoos	P
	Tahkenitch	P
	Tenmile	F
Umpqua	Lower Umpqua	P
	Middle Umpqua	P
	North Umpqua	F
	South Umpqua	P
Mid-South Coast	Coos	P
	Coquille	P
	Floras	P
	Sixes	F

*For the Oregon Coast Coho Conservation Plan minimum level of desired status. This criterion is based on population viability modeling, and has not been updated since 2008 (Wainwright et al. 2008).

Updated Biological Risk Summary. The following is a summary from the status review update. More detailed information on the status and trends of these listed resources, and their biology and ecology are in the status update (NWFSC 2015).

Many positive improvements to Oregon Coast coho salmon are described by ODFW and WDFW (2015), including positive long---term abundance trends and escapement. Increases in ESU scores for persistence and sustainability also clearly indicate the biological status of the ESU is improving, due in large part to management decisions (reduced harvest and hatchery releases) and favorable environmental variation (i.e., high marine survival). However, as Lawson (1993) stated over two decades ago, “The true measure of success for such [stream restoration] projects is the continued survival of the population through subsequent episodes of low abundance” (Lawson 1993, p. 6), when discussing cycles in ocean productivity, habitat restoration, and the productivity of Oregon Coast coho salmon. Lawson (1993) cautioned that variation in ocean productivity can mask the true benefits of stream restoration projects; increased abundances are incorrectly attributed to stream restoration when the increases resulted from high marine survival. Consequently, it is only when marine survival is low that it becomes apparent whether habitat quality and quantity are sufficient to support self-sustaining populations. With marine survival rates expected to decrease for Oregon Coast coho salmon entering the ocean in 2014

(Peterson et al. 2014), 2015 and 2016, it may be advisable to wait to observe how populations fare during this potential downturn before deciding to change their status.

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, 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

According to the proposed recovery plan for OC coho salmon (NMFS 2015b), climate change is a threat, of medium-high concern, with effects on primary limiting factors including further habitat degradation and productivity; a biological review team (BRT) reached the broad conclusion that the rising temperatures anticipated with global climate change will have an overall negative effect on the status of the ESU (Stout *et al.* 2012).

Southern Oregon and Northern California Coast Recovery Domain. The SONCC recovery domain includes coho salmon, green sturgeon, and eulachon (we covered the status of green sturgeon and eulachon earlier in this document). 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.

Status of SONCC Coho Salmon. A recovery plan is available for this species (NMFS 2014a).

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 2014a). 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.* 2006; NMFS 2014a). 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 58).

NMFS (2014b) determined the role each of the independent populations will serve in recovery (Table 58). Independent populations likely to respond to recovery actions and achieve a low risk of extinction most quickly are designated “Core” populations. We 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 58. Independent and dependent SONCC coho salmon populations by stratum and role of each population in recovery (Williams *et al.* 2006). 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

We established biological recovery objectives and criteria for each population role (Table 59) in our recovery plan for this species (NMFS 2014a).

Table 59. Biological recovery objectives and criteria to measure whether recovery objectives are met for SONCC coho salmon (NMFS 2014a).

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 2014a).

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 2014a). 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

2.2.2 Status of the Critical Habitats – Fish

This section examines the status of designated critical habitat 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 critical habitat 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.[34] 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, 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 of 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 60 and Table 61). 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

[34] 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).

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 60. Physical and biological features (PBFs) of critical habitats designated for listed salmon and steelhead species considered in the opinion (except SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and SONCC coho salmon), and corresponding species life history events.

Physical and biological Features		**Species 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 61. Essential features of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONCC coho salmon, and corresponding species life history events.

Physical and Biological Features		Species 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 PBFs 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 PBFs 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 PBFs in the

HUC_5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PBF 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 62 lists the physical and biological features (PBFs) of critical habitat designated for southern green sturgeon and corresponding species life history events.

Table 62. 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, we 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 63 lists the physical or biological features of critical habitat designated for eulachon and corresponding species life history events

Table 63. 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 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 Department 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. 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.

The WLC recovery domain CHART determined that most HUC_5 watersheds with PBFs 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 64).

Table 64. Willamette-Lower Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST) (NOAA Fisheries 2005).[35] Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

Current PBF Condition	Potential PBF Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	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

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

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

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
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
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			
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103)	CK/ST	2/2	3/2

Current PBF Condition	Potential PBF Condition
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2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name(s) and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Clackamas rivers			
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

Interior Columbia Recovery Domain. Critical habitat has been designated in the IC recovery domain, which includes the Snake River Basin, for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead. Major tributaries in the Oregon portion of the IC recovery domain include the Deschutes, John Day, Umatilla, Walla Walla, Grande Ronde, and Imnaha rivers.

Habitat quality in tributary streams in the IC recovery domain varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (Wissmar *et al.* 1994; NMFS 2009). Critical habitat throughout much of the IC recovery domain has been degraded by intense agriculture, alteration of stream morphology (*i.e.*, channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems for critical habitat in developed areas.

Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System (FCRPS) in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia river basins. For example, construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al.* 2005), and Grand Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River.

A series of large regulating dams on the middle and upper Deschutes River affect flow and block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope major population. Also, the operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly modified flow regimes and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the IC recovery domain are over-allocated, with more allocated water rights than existing streamflow. Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this recovery domain except SR fall-run Chinook salmon and SR sockeye salmon (NMFS 2011b).

Many stream reaches designated as critical habitat are listed on Oregon's Clean Water Act section 303(d) list for water temperature. Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water all contribute to elevated stream temperatures. Contaminants such as insecticides and herbicides from agricultural runoff and heavy metals from mine waste are common in some areas of critical habitat.

The CHART determined that few watersheds with PBFs for Chinook salmon or steelhead are in good to excellent condition with no potential for improvement. Overall, most IC recovery domain watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or high potential for improvement. In Washington, the Upper Methow, Lost, White, and Chiwawa watersheds are in good-to-excellent condition with no potential for improvement. In Oregon, only the Lower Deschutes, Minam, Wenaha, and Upper and Lower Imnaha Rivers HUC_5 watersheds are in good-to-excellent condition with no potential for improvement. In Idaho, a number of watersheds with PBFs for steelhead (Upper Middle Salmon, Upper Salmon/Pahsimeroi, Middle Fork Salmon, Little Salmon, Selway, and Lochsa rivers) are in good-to-excellent condition with no potential for improvement. Additionally, several Lower Snake River HUC_5watersheds in the Hells Canyon area, straddling Oregon and Idaho, are in good-to-excellent condition with no potential for improvement (Table 65).

Table 65. **Interior Columbia Recovery Domain:** Current and potential quality of HUC5 watersheds identified as supporting historically independent populations of listed Chinook salmon (CK) and steelhead (ST) (NOAA Fisheries 2005). Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

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

Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Upper Columbia # 1702000xxx			
White (101), Chiwawa (102), Lost (801) & Upper Methow (802) rivers	CK/ST	3	3
Upper Chewuch (803) & Twisp rivers (805)	CK/ST	3	2
Lower Chewuch River (804); Middle (806) & Lower (807) Methow rivers	CK/ST	2	2
Salmon Creek (603) & Okanogan River/Omak Creek (604)	ST	2	2
Upper Columbia/Swamp Creek (505)	CK/ST	2	1
Foster Creek (503) & Jordan/Tumwater (504)	CK/ST	1	1
Upper (601) & Lower (602) Okanogan River; Okanogan River/Bonaparte Creek (605); Lower Similkameen River (704); & Lower Lake Chelan (903)	ST	1	1
Unoccupied habitat in Sinlahekin Creek (703)	ST Conservation Value "Possibly High"		
Upper Columbia #1702001xxx			
Entiat River (001); Nason/Tumwater (103); & Lower Wenatchee River (105)	CK/ST	2	2
Lake Entiat (002)	CK/ST	2	1
Columbia River/Lynch Coulee (003); Sand Hollow (004); Yakima/Hansen Creek (604), Middle Columbia/Priest Rapids (605), & Columbia River/Zintel Canyon (606)	ST	2	1
Icicle/Chumstick (104)	CK/ST	1	2
Lower Crab Creek (509)	ST	1	2
Rattlesnake Creek (204)	ST	0	1
Yakima #1703000xxx			
Upper (101) & Middle (102) Yakima rivers; Teanaway (103) & Little Naches (201) rivers; Naches River/Rattlesnake Creek (202); & Ahtanum (301) & Upper Toppenish (303) & Satus (305) creeks	ST	2	2
Umtanum/Wenas (104); Naches River/Tieton River (203); Upper Lower Yakima River (302); & Lower Toppenish Creek (304)	ST	1	2
Yakima River/Spring Creek (306)	ST	1	1
Lower Snake River #1706010xxx			
Snake River/Granite (101), Getta (102), & Divide (104) creeks; Upper (201) & Lower (205) Imnaha River; Snake River/Rogersburg (301); Minam (505) & Wenaha (603) rivers	ST	3	3
Grande Ronde River/Rondowa (601)	ST	3	2
Big (203) & Little (204) Sheep creeks; Asotin River (302); Catherine Creek (405); Lostine River (502); Bear Creek (504); & Upper (706) & Lower (707) Tucannon River	ST	2	3

Current PBF Condition	Potential PBF Condition
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2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Middle Imnaha River (202); Snake River/Captain John Creek (303); Upper Grande Ronde River (401); Meadow (402); Beaver (403); Indian (409), Lookingglass (410) & Cabin (411) creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) creeks	ST	2	2
Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	ST	1	3
Five Points (404); Lower Joseph (606) & Deadman (703) creeks	ST	1	2
Tucannon/Alpowa Creek (701)	ST	1	1
Mill Creek (407)	ST	0	3
Pataha Creek (705)	ST	0	2
Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	ST	0	1
Flat Creek (704) & Lower Palouse River (808)	ST	0	0
Upper Salmon and Pahsimeroi #1706020xxx			
Germania (111) & Warm Springs (114) creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) creeks	ST	3	3
Basin Creek (124)	ST	3	2
Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	ST	2	3
Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi River/Falls Creek (202)	ST	2	2
Yankee Fork/Jordan Creek (125)	ST	1	3
Salmon River/Kinnikinnick Creek (112); Garden Creek (129); Challis Creek/Mill Creek (130); & Patterson Creek (203)	ST	1	2
Road Creek (107)	ST	1	1
Unoccupied habitat in Hawley (410), Eighteenmile (411) & Big Timber (413) creeks	Conservation Value for ST "Possibly High"		
Middle Salmon, Panther and Lemhi #1706020xxx			
Salmon River/Colson (301), Pine (303) & Moose (305) creeks; Indian (304) & Carmen (308) creeks, North Fork Salmon River (306); & Texas Creek (412)	ST	3	3
Deep Creek (318)	ST	3	2
Salmon River/Cow Creek (312) & Hat (313), Iron (314), Upper Panther (315), Moyer (316) & Woodtick (317) creeks; Lemhi River/Whimpey Creek (402); Hayden (414), Big Eight Mile (408), & Canyon (408) creeks	ST	2	3
Salmon River/Tower (307) & Twelvemile (311) creeks; Lemhi River/Kenney Creek (403); Lemhi River/McDevitt (405), Lemhi River/Yearian Creek (406); & Peterson Creek (407)	ST	2	2
Owl (302) & Napias (319) creeks	ST	2	1

Current PBF Condition	Potential PBF Condition
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Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Salmon River/Jesse Creek (309); Panther Creek/Trail Creek (322); & Lemhi River/Bohannon Creek (401)	ST	1	3
Salmon River/Williams Creek (310)	ST	1	2
Agency Creek (404)	ST	1	1
Panther Creek/Spring Creek (320) & Clear Creek (323)	ST	0	3
Big Deer Creek (321)	ST	0	1
Mid-Salmon-Chamberlain, South Fork, Lower, and Middle Fork Salmon #1706020xxx			
Lower (501), Upper (503) & Little (504) Loon creeks; Warm Springs (502); Rapid River (505); Middle Fork Salmon River/Soldier (507) & Lower Marble Creek (513); & Sulphur (509), Pistol (510), Indian (511) & Upper Marble (512) creeks; Lower Middle Fork Salmon River (601); Wilson (602), Upper Camas (604), Rush (610), Monumental (611), Beaver (614), Big Ramey (615) & Lower Big (617) creeks; Middle Fork Salmon River/Brush (603) & Sheep (609) creeks; Big Creek/Little Marble (612); Crooked (616), Sheep (704), Bargamin (709), Sabe (711), Horse (714), Cottonwood (716) & Upper Chamberlain Creek (718); Salmon River/Hot Springs (712); Salmon River/Kitchen Creek (715); Lower Chamberlain/McCalla Creek (717); & Slate Creek (911)	ST	3	3
Marsh (506); Bear Valley (508) Yellow Jacket (604); West Fork Camas (607) & Lower Camas (608) creeks; & Salmon River/Disappointment Creek (713) & White Bird Creek (908)	ST	2	3
Upper Big Creek (613); Salmon River/Fall (701), California (703), Trout (708), Crooked (705) & Warren (719) creeks; Lower South Fork Salmon River (801); South Fork Salmon River/Cabin (809), Blackmare (810) & Fitsum (812) creeks; Lower Johnson Creek (805); & Lower (813), Middle (814) & Upper Secesh (815) rivers; Salmon River/China (901), Cottonwood (904), McKenzie (909), John Day (912) & Lake (913) creeks; Eagle (902), Deer (903), Skookumchuck (910), French (915) & Partridge (916) creeks	ST	2	2
Wind River (702), Salmon River/Rabbit (706) & Rattlesnake (710) creeks; & Big Mallard Creek (707); Burnt Log (806), Upper Johnson (807) & Buckhorn (811) creeks; Salmon River/Deep (905), Hammer (907) & Van (914) creeks	ST	2	1
Silver Creek (605)	ST	1	3
Lower (803) & Upper (804) East Fork South Fork Salmon River; Rock (906) & Rice (917) creeks	ST	1	2
Little Salmon #176021xxx			
Rapid River (005)	ST	3	3
Hazard Creek (003	ST	3	2
Boulder Creek (004)	ST	2	3
Lower Little Salmon River (001) & Little Salmon River/Hard Creek (002)	ST	2	2
Selway, Lochsa and Clearwater #1706030xxx			
Selway River/Pettibone (101) & Gardner (103) creeks; Bear (102), White Cap (104), Indian (105), Burnt Knob (107), Running (108) &	ST	3	3

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2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
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Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
Goat (109) creeks; & Upper Selway River (106); Gedney (202), Upper Three Links (204), Rhoda (205), North Fork Moose (207), Upper East Fork Moose (209) & Martin (210) creeks; Upper (211), Middle (212) & Lower Meadow (213) creeks; Selway River/Three Links Creek (203); & East Fork Moose Creek/Trout Creek (208); Fish (302), Storm (309), Warm Springs (311), Fish Lake (312), Boulder (313) & Old Man (314) creeks; Lochsa River/Stanley (303) & Squaw (304) creeks; Lower Crooked (305), Upper Crooked (306) & Brushy (307) forks; Lower (308), Upper (310) White Sands, Ten Mile (509) & John's (510) creeks			
Selway River/Goddard Creek (201); O'Hara Creek (214) Newsome (505) creeks; American (506), Red (507) & Crooked (508) rivers	ST	2	3
Lower Lochsa River (301); Middle Fork Clearwater River/Maggie Creek (401); South Fork Clearwater River/Meadow (502) & Leggett creeks; Mill (511), Big Bear (604), Upper Big Bear (605), Musselshell (617), Eldorado (619) & Mission (629) creeks, Potlatch River/Pine Creek (606); & Upper Potlatch River (607); Lower (615), Middle (616) & Upper (618) Lolo creeks	ST	2	2
South Fork Clearwater River/Peasley Creek (502)	ST	2	1
Upper Orofino Creek (613)	ST	2	0
Clear Creek (402)	ST	1	3
Three Mile (512), Cottonwood (513), Big Canyon (610), Little Canyon (611) & Jim Ford (614) creeks; Potlatch River/Middle Potlatch Creek (603); Clearwater River/Bedrock (608), Jack's (609) Lower Lawyer (623), Middle Lawyer (624), Cottonwood (627) & Upper Lapwai (628) creeks; & Upper (630) & Lower (631) Sweetwater creeks	ST	1	2
Lower Clearwater River (601) & Clearwater River/Lower Potlatch River (602), Fivemile Creek (620), Sixmile Creek (621) and Tom Taha (622) creeks	ST	1	1
Mid-Columbia #1707010xxx			
Wood Gulch (112); Rock Creek (113); Upper Walla Walla (201), Upper Touchet (203), & Upper Umatilla (301) rivers; Meacham (302) & Birch (306) creeks; Upper (601) & Middle (602) Klickitat River	ST	2	2
Glade (105) & Mill (202) creeks; Lower Klickitat River (604); Mosier Creek (505); White Salmon River (509); Middle Columbia/Grays Creek (512)	ST	2	1
Little White Salmon River (510)	ST	2	0
Middle Touchet River (204); McKay Creek (305); Little Klickitat River (603); Fifteenmile (502) & Fivemile (503) creeks	ST	1	2
Alder (110) & Pine (111) creeks; Lower Touchet River (207), Cottonwood (208), Pine (209) & Dry (210) creeks; Lower Walla Walla River (211); Umatilla River/Mission Creek (303) Wildhorse Creek (304); Umatilla River/Alkali Canyon (307); Lower Butter Creek (310); Upper Middle Columbia/Hood (501); Middle Columbia/Mill Creek (504)	ST	1	1
Stage Gulch (308) & Lower Umatilla River (313)	ST	0	1
John Day #170702xxx			

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Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Middle (103) & Lower (105) South Fork John Day rivers; Murderers (104) & Canyon (107) creeks; Upper John Day (106) & Upper North Fork John Day (201) rivers; & Desolation Creek (204)	ST	2	2
North Fork John Day/Big Creek (203); Cottonwood Creek (209) & Lower NF John Day River (210)	ST	2	1
Strawberry (108), Beech (109), Laycock (110), Fields (111), Mountain (113) & Rock (114) creeks; Upper Middle John Day River (112); Granite (202) & Wall (208) creeks; Upper (205) & Lower (206) Camas creeks; North Fork John Day/Potamus Creek (207); Upper Middle Fork John Day River (301) & Camp (302), Big (303) & Long (304) creeks; Bridge (403) & Upper Rock (411) creeks; & Pine Hollow (407)	ST	1	2
John Day/Johnson Creek (115); Lower Middle Fork John Day River (305); Lower John Day River/Kahler Creek (401), Service (402) & Muddy (404) creeks; Lower John Day River/Clarno (405); Butte (406), Thirtymile (408) & Lower Rock (412) creeks; Lower John Day River/Ferry (409) & Scott (410) canyons; & Lower John Day River/McDonald Ferry (414)	ST	1	1
Deschutes #1707030xxx			
Lower Deschutes River (612)	ST	3	3
Middle Deschutes River (607)	ST	3	2
Upper Deschutes River (603)	ST	2	1
Mill Creek (605) & Warm Springs River (606)	ST	2	1
Bakeoven (608) & Buck Hollow (611) creeks; Upper (701) & Lower (705) Trout Creek	ST	1	2
Beaver (605) & Antelope (702) creeks	ST	1	1
White River (610) & Mud Springs Creek (704)	ST	1	0
Unoccupied habitat in Deschutes River/McKenzie Canyon (107) & Haystack (311); Squaw Creek (108); Lower Metolius River (110), Headwaters Deschutes River (601)	ST Conservation Value "Possibly High"		

Oregon Coast Recovery Domain. In this recovery domain, critical habitat has been designated for OC coho salmon, southern green sturgeon, and eulachon. 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 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. 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 (DEQ 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. Many large and small rivers supporting significant populations of coho salmon flow through this area, including the Elk, Rogue, Chetco, Smith and Klamath.

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

As described above in the Status of the Species and Critical Habitat sections, factors that limit the recovery of anadromous species considered in this opinion vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the action area, many stream and riparian areas have been degraded by the effects of land and water use, including urbanization, road construction, forest management, agriculture, mining, transportation, and water development. Restoration actions within the action area, on balance, provide beneficial effects.

Development activities have contributed to a myriad of related factors within the action area, contributing to the decline of species considered in this opinion. Among the most important of these are changes in stream channel morphology; reduced instream roughness and cover; loss and degradation of off-channel areas, refugia, estuarine rearing habitats, riparian areas, spawning areas, and wetlands; degradation of water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants); and blocked fish passage.

Some of these activities and effects apply across the action area, whereas others relate more specifically to certain watersheds and/or recovery domains. The discussion below is organized accordingly.

Transportation system

The existing transportation system contributes to a poor environmental baseline condition in several ways. Many miles of roads and rail lines parallel streams, which has degraded stream bank conditions by encouraging bank armoring with rip rap, degraded floodplain connectivity by adding fill to floodplains, and resulted in discharge of untreated or marginally treated stormwater runoff to streams. Culvert and bridge stream crossings have similar effects and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

The BLM manages a large and complex road system within the action area, which includes approximately 15,000 miles of roads (USDI BLM FEIS 2016). The presence of these roads and the effects associate with the other non-BLM roads on the aquatic ecosystems influence the present conditions of the aquatic environment. Roads can deliver up to 90 percent of the total sediment production from forestry activities (USDI BLM BA 2016). This especially occurs on older legacy roads where older practices, such as side casting of excess soil material was common (GLEC 2008). 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 (GLEC 2008). In general, modern road construction practices produce less sediment delivered to streams from forest roads than older road construction practices (Copstead and Johansen 1998, GLEC 2008).

Roads within a watershed cause disruptions to processes; such as hydrology, sediment transport, stream channel morphology, and wood delivery (USDI BLM FEIS 2016, GLEC 2008, Jones et al. 2000, Jones and Grant 1996, Furniss et al. 1991). All four of these processes are important to fish habitat conditions. Water quality is influenced by the presence of roads, especially those within the riparian area, due to sedimentation, a reduction in stream shade, and stormwater contaminants.

Fine sediments transport from road surfaces and inside ditchlines during storm events. Where cross drains do not interrupt this sediment transport, fine sediments directly enter streams. Roads running parallel to the stream also provide sediment transport paths to the streams. Within the planning area, approximately 5,096 miles (36 percent) of existing BLM-controlled roads are located within this 200-foot delivery zone and produce 60,265 tons/year of fine sediment that could be delivered to streams (USDI BLM 2008). 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 while private roads contribute 11.17 tons/mi^2/year as shown in Table 66 (USDI BLM 2008, p. 347, Table 3-59). This is approximately 17 percent of all sediment delivered to stream channels from roads of all ownerships within the planning area. The highest potential fine sediment yield is from natural surface roads, while the lowest potential fine sediment yield is from paved roads.

Table 66. 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. The HUC 10 watershed in this reference is a 5th field HUC or commonly referenced as a watershed.

Watersheds within each recovery domain are influenced by BLM and non-BLM roads. In terms of the existing road system, best available modeling evaluates roads that were within 200 feet from a stream as the delivery zone for sediment (USDI BLM BA 2016). 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. In addition to roads as a sediment source, the stormwater contaminants are also derived from the road system. These BLM roads include surface types of aggregate, natural, paved, and unknown, within the database (Table 66); where generation of sediment is most prevalent with natural surface roads and stormwater discharge from paved and aggregate. The greater the number of road miles within 200 feet of a stream, the greater the impact on ecological processes, such as hydrology, sediment and contaminant transport, wood recruitment, and stream temperature.

In addition to increased sedimentation due to road use, chemical contaminants from vehicles degrade water quality. Stormwater runoff from impervious surfaces delivers a wide variety of pollutants to aquatic ecosystems, such as metals (*e.g.* copper and zinc), petroleum-related compounds (polynuclear aromatic hydrocarbons), along with the sediment washed off the road surface (Driscoll *et al.* 1990; Buckler and Granato 1999; Colman *et al.* 2001; Kayhanian *et al.* 2003). Aquatic contaminants often travel long distances in solution or attached to suspended sediments, or gather in sediments until they are mobilized and transported by the next high flow (Anderson *et al*. 1996; Alpers *et al.* 2000a, 2000b). Paved roads are the primary source, yet aggregate roads, which can also be impervious and reduce water infiltration, are likely to deliver some contaminants. Some road systems include stormwater treatment systems, while many do not. Vegetated road side ditches and cross drains routing water to vegetated hillslopes may provide some stormwater treatment, but the large magnitude of road miles within the decision area contribute to the loading of these identified contaminants.

Restoration Actions
There are a variety of restoration activities that have had impacts within the action area and/or that have already undergone formal consultation. One suite of restoration activities that merits specific mention are those covered by the 2013 ARBO II biological opinion (NMFS ARBO 2013).

Project Categories within the ARBO II programmatic opinion.

a. Fish Passage Restoration (Stream Simulation Culvert and Bridge Projects; Headcut and Grade Stabilization; Fish Ladders; Irrigation Diversion Replacement/Relocation and Screen Installation/Replacement).
b. 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).
c. Dam, Tide gate, and Legacy Structure Removal.
d. Channel Reconstruction/Relocation.
e. Off- and Side-Channel Habitat Restoration.
f. Streambank Restoration.
g. Set-back or Removal of Existing Berms, Dikes, and Levees.
h. Reduction/Relocation of Recreation Impacts.
i. Livestock Fencing, Stream Crossings and Off-Channel Livestock Watering.
j. Piling and other Structure Removal.
k. In-channel Nutrient Enhancement.
l. Road and Trail Erosion Control and Decommissioning.
m. Non-native Invasive Plant Control.
n. Juniper Removal.
o. Riparian Vegetation Treatment (including fuels reduction and controlled burning).
p. Riparian Vegetative Planting.
q. Bull Trout Protection.
r. Beaver Habitat Restoration.
s. Sudden Oak Death (SOD) Treatments.
t. Fisheries, Hydrology, Geomorphology Wildlife, Botany, and Cultural Surveys in Support of Aquatic Restoration.

The detailed discussions of effects of the ARBO II action, as set out in the ARBO II Opinion, are incorporated by reference here (NMFS ARBO 2013). In summary, the ARBO II Opinion in the long term will contribute to a lessening of many of the factors limiting the recovery of listed species, particularly those factors related to fish passage, degraded floodplain connectivity, reduced aquatic habitat complexity, and riparian conditions, and improve the currently-degraded environmental baseline, particularly at the site scale. A very small number of individual fish, far too few to affect the abundance, productivity, distribution, or genetic diversity of any salmon or steelhead population, will be negatively affected by the adverse effects of any single action permitted under the ARBO II Opinion. Because the VSP characteristics at the population scale will not be affected, the ARBO II Opinion concluded that the likelihood of survival and recovery of the listed species will not be appreciably reduced by the activities it covers.

BLM's articulation of the proposed action included restoration activities that have already been consulted on in ARBO II, e.g., fuels reduction; fish passage; large wood placement; tree tipping; invasive species control. To the extent that is the case, those activities are appropriately considered to be in the environmental baseline and are covered by the ARBO II opinion, although we address applicable programmatic direction as effects of the proposed action.

Activities on Federal and Tribal Land

There are a number of activities that impact the environmental baseline, are authorized by and occur on Forest Service, BLM and/or Coquille Tribal land, and have been addressed via prior programmatic opinions. These activities include:

a. Road Maintenance
b. Repair of Storm-Damaged Roads
c. Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use
d. Fisheries, Wildlife, Botany, Cultural and Environmental Education Programs
e. Pump Chance/Helipond Maintenance and Non-Emergency Use
f. Road Prism and Road-side Hazard Tree Removal
g. Miscellaneous Special Use Permits and Leases
h. Commercial Rafting Permits
i. Renewal of Existing Telephone Line and Power Line Special Use Permits
j. Rock Quarry Operations

The effects of these activities were described in the NMFS 2011 Western Oregon Programmatic Opinion (WORP) (NMFS WORP 2011c) and predecessor programmatic opinions issued in 2003 and 2006. To the extent that these activities are already authorized and consulted on, they form part of the environmental baseline;[36] [37]however, to the extent that the proposed action provides programmatic direction applicable to these activities they are analyzed at a plan-level in this Opinion.

Climate Change

Climate change is likely to play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. Changes in climate have occurred throughout history and species have adapted to a wide variety of climatic conditions, therefore species may survive changes in climate provided these changes occur over a period of time and in the absence of anthropogenic stressors (NWFSC 2015). The previous general discussion and following domain specific discussion describes environmental stressors identifying current habitat conditions that have stressed the species considered in this document. Climate change is an on-going process and the predicted changes on the aquatic environment relate to thermal and hydrologic regimes (Mantua *et al*. 2010). The response by the different species to these changes to the current conditions of the environment depend on the species, their life history strategies, the life stage, watershed characteristics, and stock-specific adaptations to local environmental factors (Mantua *et al*. 2010, Beechie *et al*. 2008). As previously mentioned in the stock status section (2.2), changes in summer low flow and frequency of winter high flows have likely occurred and are predicted to increase due to climate change.

Willamette-Lower Columbia Recovery Domain.

Ownership in the project area is generally in a checkerboard pattern, with private timber company lands interspersed with BLM lands. The majority of this landscape is composed of early- and mid-seral forest habitats with very little late-seral and old-growth remaining, except for a few patches on BLM lands outside the project area. The action area was intensively logged from the late 1940s through early 1960s. As a result, the structural characteristics of late-seral and old-growth forests, such as large snags, abundant down logs, and complex forest canopies are lacking across the landscape. The intervening parcels of private ownership are dominated by young forest stands that are currently being managed on 40- to 60-year rotations.

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

[36] There are four project categories under the Recreational and Visitor Services project element that overlap with the WORP. The Non-Motorized Travel (hiking, biking, and horseback riding), and the Camping and Picnicking project categories are covered under the Recreation Site, Trail, and Administrative Structure Maintenance and Associated Public Use; and the Miscellaneous Special Use Permits and Leases project elements in the WORP opinion. The Fishing project category is covered under the Commercial Rafting Permits project element in the WORP. The Wildlife Viewing, Interpretation, and Nature Study project category is covered under the Fisheries, Wildlife, Botany, Cultural and Environmental Education Programs in the WORP.

[37] We understand that no project-specific authorizations have been issued since the 2011 WORP opinion expired (in April 2011) and none will be until a replacement Opinion is issued (anticipated later in 2017).

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.

Watersheds within this recovery domain are influenced by BLM and non-BLM roads (Table 66). Roads within this area are inhabited by CR chum salmon (Table 67), LCR Chinook salmon (Table 68), LCR coho salmon (Table 69), and LCR steelhead (Table 70), UWR steelhead (Table 71), and UWR Chinook salmon (Table 72).

Table 67. CR Chum

CR Chum	Total highway/road miles (all ownership)	Average road density (all ownership)	BLM road miles within 200 feet of streams
Total	9902	5.8	BLM roads
Aggregate (BLM)			28.8
Natural (BLM)			5.7
Paved (BLM)			2.9
Unknown (BLM)			7.2

Table 68. LCR Chinook.

LCR Chinook	Total highway/road miles (all ownership)	Average road density (all ownership)	Road miles within 200 feet of streams
Total	11917	4.9	BLM roads
Aggregate (BLM)			36.0
Natural (BLM)			5.8
Paved (BLM)			6.7
Unknown (BLM)			8.0

Table 69. LCR coho salmon

LCR coho	Total highway/road miles (all ownership)	Average road density (all ownership)	Road miles within 200 feet of streams
Total	11917	4.9	BLM roads
Aggregate (BLM)			36.0
Natural (BLM)			5.8
Paved (BLM)			6.7
Unknown (BLM)			8.0

Table 70. LCR steelhead

LCR steelhead	Total highway/road miles (all ownership)	Average road density (all ownership)	Road miles within 200 feet of streams
Total	7774	4.9	BLM roads
Aggregate (BLM)			29.5
Natural (BLM)			1.7
Paved (BLM)			6.7
Unknown (BLM)			6.7

Table 71. UWR steelhead

UWR steelhead	Total highway/road miles (all ownership)	Average road density (all ownership)	Road miles within 200 feet of streams
Total	22836	4.7	BLM roads
Aggregate (BLM)			364.9
Natural (BLM)			27.3
Paved (BLM)			21.3
Unknown (BLM)			36.7

Table 72. UWR Chinook

UWR Chinook	Total highway/road miles (all ownership)	Average road density (all ownership)	Road miles within 200 feet of streams
Total	26918	4.0	BLM roads
Aggregate (BLM)			436.4
Natural (BLM)			25.2
Paved (BLM)			42.3
Unknown (BLM)			23.3

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).

On July 11, 2008, we issued a biological opinion on the Willamette River Basin Flood Control Project (NMFS NWR-2000-2117). This project is carried out by the ACOE, Bonneville Power Administration and Bureau of Reclamation. In our opinion, we concluded the proposed would result in jeopardy to listed species and adverse modification of critical habitat. The opinion provides a reasonable and alternative to the proposed action, which is in the implementation phase, and exempts associated incidental take

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.

Gregory *et al.* (2002c) described the changes in riparian vegetation in river reaches from the mouth to Newberg, from Newberg to Albany, and from Albany to Eugene. They noted that the riparian forests were formerly a mosaic of brush, marsh, and ash tree openings maintained by annual flood inundation. Below the City of Newberg, the most noticeable change was that conifers were almost eliminated. Above Newberg, the formerly hardwood-dominated riparian forests along with mixed forest made up less than half of the riparian vegetation by 1990, while agriculture dominated. This conversion has reduced river shading and the potential for recruitment of wood to the river, reducing channel complexity and the quality of rearing, migration and spawning habitats.

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 FCRPS, have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011d; 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.

The Federal Columbia River Power System (FCRPS) consists of 14 projects, each composed of dams, powerhouses, and reservoirs, that are operated as a coordinated system for power production, flood control, and navigation on behalf of the Federal government under various Congressional authorities. The plan for operation of the FCRPS through 2018 was described in a "Comprehensive Analysis" (USACE et al. 2007a) and a Biological Assessment (USACE et al. 2007b). Information relevant to the environmental baseline is discussed in detail in Chapter 5 of the Supplemental Comprehensive Analysis (SCA) (NOAA Fisheries 2008), which cross-references back to the related 2008 FCRPS biological opinion (NMFS 2008b). Chapter 5 of the SCA and related portions of the FCRPS Opinion provide an analysis of the effects of past and ongoing human and natural factors on the current status of the species, their habitats and ecosystems, within the Columbia River Basin. In addition, Chapter 5 of the SCA, and related portions of the FCRPS Opinion evaluate the effects of those ongoing actions on designated critical habitat. Chapter 5 of the SCA and the environmental baseline section of the FCRPS Opinion are hereby incorporated by reference. NMFS' 2008 Biological Opinion (NMFS 2008a) provided a reasonable and prudent alternative to the proposed action that recommended operations to provide flow and water quality to improve juvenile and adult fish survival; physical modifications at the lower Columbia and Snake River dams to maximize juvenile and adult fish survival such as the installation of surface passage routes; spill levels and juvenile transportation improvements; and piscivorous fish, avian, and pinniped predation control measures. The RPA also included habitat improvement programs to address limiting factors in areas used for spawning, incubation and rearing in the Interior Columbia basin and in areas used for migration and rearing in the lower Columbia River estuary. The 2008 FCRPS opinion was updated with the Adaptive Management Implementation Plan in 2009, and a supplemental Biological Opinion in 2010.

NMFS developed a 2014 Supplemental FCRPS Biological Opinion to address a 2011 Court Remand Order requiring the agency to re-examine the 2008 and 2010 biological opinions, which directs NMFS to identify more specific habitat actions for the 2014-2018 period. On May 4, 2016, the U.S. District Court issued a decision invalidating NOAA Fisheries' 2014 FCRPS Biological Opinion (NMFS 2014b). The Court remanded the 2014 Opinion to NMFS for further consultation with a new opinion due in 2018. The Court directed NMFS and the FCRPS Action Agencies (USACE, U.S. Bureau of Reclamation, and the Bonneville Power Administration) to keep the 2014 Opinion and its incidental take statement in place and also directed the Action Agencies to continue to fund and implement the 2014 biological opinion until a 2018 opinion is prepared and filed.

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 2011d; 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. On July 12, 2012, we issued a biological opinion on the USACE maintenance of the Columbia River navigation channel (NMFS 2011/02095). This opinion concluded the proposed channel maintenance will not jeopardize the continued existence of listed species or adversely modify critical habitats. 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 2011d; 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 (LCREP 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.

The Northwest Forest Plan (NWFP) Aquatic and Riparian Effectiveness Monitoring Program (AREMP) evaluates the environmental outcomes of management actions under the NWFP (USDA FS and USDI BLM AREMP 2015). AREMP assesses watershed condition status and trends at two different scales, stream and upslope/riparian. Stream conditions are based on surveys in watersheds randomly selected from the NWFP area. The surveys describe current condition for fish and other aquatic biota. Upslope/riparian conditions are evaluated based on GIS and remote sensing data.

The AREMP concluded that average stream conditions for physical habitat for the Willamette/LCR Domain were maintained and did not show improvements at the watershed scale. Physical habitat included wood recruitment, substrate, and pool formation. Temperature across the planning area of the Willamette/LCR Domain had a slight decrease, but is still not properly functioning.

Oregon Coast Recovery Domain.

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 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. 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 in the action area inhabited by 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 (DEQ 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.

Action area watersheds within this recovery domain are influenced by BLM and non-BLM roads (Table 73). This recovery domain is a large geographic area with diverse geology, urban and rural development and climate. In general, a higher proportion of BLM roads are paved in the portion of this geography with high precipitation.

Table 73. BLM planning area roads within the OC recovery domain

OC coho	Total highway/road miles (all ownership)	Average road density (all ownership)	Road miles within 200 feet of streams
Total	47414	4.4	BLM roads
Aggregate (BLM)			1711.1
Natural (BLM)			439.5
Paved (BLM)			302.7
Unknown (BLM)			148.7

The AREMP concluded that average stream conditions for physical habitat for the OC Domain were maintained and did not show improvements at the watershed scale (USDA FS and USDI BLM AREMP 2015). Temperature data for the OC Domain did not have enough sample size for a conclusion.

Southern Oregon/Northern California Coast Recovery Domain.

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.

On April 2, 2012, we issued a biological opinion on the Bureau of Reclamation's operation and maintenance of the Rogue River Basin Project (NMFS 20013-01098). Although this action has some adverse effects on SONCC coho salmon, we concluded the action would not jeopardize the continued existence of this species or adversely modify its designated critical habitat.

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).

On October 6, 2014, we issued a biological opinion on the ACOE's issuance of permits for gravel mining in the Chetco River (NMFS 2013-10441). In this opinion, we concluded the proposed action would not jeopardize the continued existence of SONCC coho salmon or destroy or adversely modify their critical habitat.

Watersheds within this recovery domain are influenced by BLM and non-BLM roads (Table 74). This recovery domain is a large geographic area with diverse geology, urban and rural development and climate. In general, much of this area is within the drier interior Rogue River basin.

Table 74. Roads within the BLM Planning area in the SONCC recovery domain.

SONCC coho	Total highway/road miles (all ownership)	Average road density (all ownership)	Road miles within 200 feet of streams
Total	18821	3.5	BLM roads
Aggregate (BLM)			1073.4
Natural (BLM)			455.0
Paved (BLM)			143.3
Unknown (BLM)			172.2

The AREMP concluded that average stream conditions for physical habitat for the SONCC Domain were maintained and did not show improvements at the watershed scale (USDA FS and USDI BLM AREMP 2015). Temperature across the planning area of the SONCC Domain had a slight increase and warranted further evaluation.

Miscellaneous Prior Actions

The BLM sent an email to us on 4/26-16 clarifying that with, respect to certain actions, BLM is not requesting ESA consultation because BLM complied with ESA section 7 on these actions prior to signing the records of decision and is not taking any affirmative action regarding them in the Proposed RMP. However, BLM acknowledged that these actions and their impacts would be relevant in the environmental baseline. The list of these actions is as follows:

- Record of Decision for Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments
- Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States
- Approved Resource Plan Amendments/Record of Decision for Designation of Energy Corridors on Bureau of Land Management-administered lands in the 11 Western States
- Vegetation Treatments Using Herbicides on BLM Lands in Oregon Record of Decision
- Record of Decision for Management of Port-Orford-cedar in Southwest Oregon
- Seed Orchard Records of Decision for Integrated Pest Management (Eugene, Medford and Salem Districts)
- Pokegama Wild Horse Herd Management Area Plan (Klamath Falls Field Office)
- Rogue National Wild and Scenic River Comprehensive Management Plan (Medford District; 37 FR 13408)
- Rogue National Wild and Scenic River: Hellgate Recreation Area Recreation Area Management Plan (Medford District)
- North Bank Habitat Management Area and Area of Critical Environmental Concern Record of Decision (Roseburg District)
- North Umpqua River Management Plan (Roseburg District)
- Molalla River-Table Rock Recreation Area Management Plan (Salem District)
- Quartzville Creek National Wild and Scenic River Management Plan (Salem District)
- Salmon National Wild and Scenic River Management Plan (Salem District)
- Sandy Wild and Scenic River and State Scenic Waterway Management Plan (Salem District)
- Table Rock Wilderness Management Plan (Salem District)
- Yaquina Head Outstanding Natural Area Management Plan (Salem District)

We incorporate by reference all NMFS consultations on these actions, and also BLM's summary of the decisions and their supporting analyses in Chapter 3 of the Proposed RMP/Final EIS (USDI BLM FEIS 2016).

2.4 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. In the following analysis, we start by assessing generally the effects of the proposed action to the environment, then move on to more specifically consider effects to the species, and to critical habitat.

The BLM's PRMP components include land use allocations, management objectives, and management directions. They are defined as follows 1) **Land use allocations.** Areas where specific activities are allowed, restricted, or excluded in all or part of a planning area, 2) **Management Objectives.** Describe the desired outcomes from the management of particular resources, and 3) **Management Direction.** Provide measures that will be applied to planning activities to achieve the management objectives for resources.

We present our effects analysis below with reference to each program and associated activities of the PRMPs, but the LUAs, management objectives, and management directions are integral in our overall examination. LUAs are especially important for understanding the magnitude of a given effect of a project activity. Management Direction provides the plan-level constraints that allow us to analyze the anticipated effects as a result of the proposed action.

Effects to the Environment

In this effects to the environment section we analyze each of the BLM land use allocations integrated with the proposed resource programs described in the proposed action (Section 1.3). Proposed action subsections 1.3.9.1 through 1.3.9.25 provide detail of these land use allocations and resource programs identified in the PRMP and Sections 2.4.1 through 2.4.20 analyze these resource programs (Table 75). In this section, we conduct the analysis by considering the described resource program integrated with associated land use allocations, management objectives, and management direction to understand how the BLM's PRMP will affect ecological processes, environmental indicators, and biotic resources. The analysis uses a variety of analytical tools and surrogates to describe how the proposed action affects important fish habitat components such as water temperature, suspended sediment, substrate, large wood recruitment, flow (hydrologic processes), forage for fish, and chemical contaminants.

Table 75. PRMP programs and the Effects on the Environment subsections.

Subsection	**2.4.1**	**2.4.2**	**2.4.3**	**2.4.4**	**2.4.5**	**2.4.6**	**2.4.7**
Program	Forest Management	Fire & Fuels	Fisheries	Invasive Species	Livestock Grazing	Minerals	Recreation & Visitor Services
Subsection	**2.4.8**	**2.4.9**	**2.4.10**	**2.4.11**	**2.4.12**	**2.4.13**	**2.4.14**
Program	Sustainable Energy (fuel biomass)	Trails and Travel Management	Wildlife	Wild Horses	BLM Designations	Air Quality	National Trails System
Subsection	**2.4.15**	**2.4.16**	**2.4.17**	**2.4.18**	**2.4.19**	**2.4.20**	
Program	Rare Plants and Fungi	Tribal Interests	Visual Resources	Special Forest Products	Land and Realty	Sustainable Energy (wind and geothermal)	

2.4.1 Forest Management

BLM's proposed Forest Management program is a large, landscape level program involving managing forests to achieve a variety of stated goals. Forest management in the proposed action is primarily described in Sections 1.3.6 Harvest Land Base and 1.3.7 LSR, but may also occur within other land allocations, such as the described in Section 1.3.8 Riparian Reserves. Implementing this program results in a variety of actions that have the potential to influence ecological processes within each watershed.

Due to the Forest Management program's complexity and large number of activities, this analysis uses a number of environmental indicators and surrogates to assess the program's effects on the environment (Table 76). Much of the analysis of the Forest Management program includes identifying the various program activities (Table 75) and analyzing the effects of those activities on environmental indicators and surrogates (Table 77). This analytical approach is similar to the analytical procedures developed to analyze Federal actions affecting fish within the Northwest Forest Plan area (USDA *et al*. 2004).

Table 76. Environmental indicators and surrogates used to describe the effects of the Forest Management program.

Temperature	**Suspended sediment**	**Chemical contaminants**	**Physical barriers**	**Large wood**
Pool frequency and quality	**Off-channel**	**Refugia**	**Stream width – depth ratio**	**Streambank condition**
Floodplain connectivity	**Change in peak/base flow**	**Drainage network increase**	**Disturbance history**	**Riparian Reserves**

Table 77. Forest Management program activities identified for this analysis that may have an effect on environmental parameters.

Timber Felling and Yarding	**Road work – construction**	**Road work – renovation**
Road work – decommissioning	**Timber hauling**	**Rock Hauling**

The BLM proposes Forest Management in Western Oregon and Eastern Oregon, east of Highway 97. BLM land east of Highway 97 lies within the Klamath River basin. All BLM administered lands in Oregon within the Klamath River basin and east of Highway 97 are located upstream of several Klamath River mainstem dams. Current distribution of SONCC coho salmon, the NMFS ESA-listed species and designated critical habitat in the upper Klamath Basin, are restricted to the Klamath River below Iron Gate Dam; therefore, actions proposed east of Highway 97 will not have an effect on any of the indictors listed in Table 76 and described below. Forest Management east of Highway 97 will not be discussed further. Forest Management for BLM land west of Highway 97 is discussed below.

Land use allocation acres within each ESU/DPS were previously presented in Table 2. For purposes of this analysis, BLM provided projected future timber harvest within each ESA/DPS by decade (Table 15 – Table 21). Although these are not hard targets these projections provide a general expectation of the magnitude of the harvest by decade for each ESU/DPS. Site specific information is not available at the plan level phase, but the projections of harvest by ESU/DPS is informative to this plan level consultation.

Our analysis considers each of the forest management associated activities and the resulting effects. These forest management associated activities include such actions as timber felling and yarding; road and landing construction, reconstruction, and decommissioning; and timber haul. Our analysis focuses on the primary ecological indicators affected by these activities and include: water temperature; suspended sediment and embededdness; chemical contamination/nutrients; physical barriers; large wood recruitment; pool frequency and quality, large pools, off-channel habitat, refugia, width to depth ratio, streambank condition, floodplain connectivity; change in peak/base flow, increase in drainage network; road density and location; disturbance history and regime; and riparian reserves. Our assessment of these proposed activities and their effects on the ecological indicators are necessarily of a generalized nature for this plan level consultation.

The Coquille Forest consists of 5,000 acres of forest land located in the Middle Fork of the Coquille River. Although we do not know the land use allocations for the Coquille Forest, we anticipate that the indirect effects of such allocations, particularly to the riparian reserves, will be materially similar to the direct effects of the PRMP due to the statutory requirement that the Coquille Forest is "subject to the standards and guidelines of Federal forest plans on adjacent or nearby Federal lands, now and in the future" per Title V of the Oregon Resource Conservation Act of 1996 (Pub. L. 104-208). The PRMP does not determine which specific land use allocations apply to which specific portions of the Coquille Forest or the specific rate or extent of timber harvest on the Coquille Forest. However, the PMRP's subwatershed classifications will apply to all riparian reserves within the 5,000 acres of tribal forest. We therefore assume in general that there will be indirect effects from Coquille Forest management, which will be similar to the direct effects of the PRMP, albeit on a smaller scale. We have incorporated those indirect effects in the analysis below.

Forest Management effects on Temperature. Forest Management associated activities can influence water temperature at a sub-reach or reach scale and potentially at a watershed scale.

Timber Felling and Yarding effects on temperature. Removing trees in riparian areas reduces the amount of shade which leads to increases in thermal loading to the stream (Moore and Wondzell 2005). Substantial effects on shade in clearcut systems have been observed with no-cut buffers ranging from 20-30 meters (m) (66-99 feet) (Brosofske et al. 1997; Kiffney et al. 2003; Groom et al. 2011b), and small effects were observed in studies that examined no-cut buffers 46 m (151 feet) wide (Science Team Review 2008; Groom et al. 2011a). For no-cut buffer widths of 46-69 m (151-227 feet), the effects of tree removal on shade and temperature were either not detected or were minimal (Anderson et al. 2007; Science Team Review 2008; Groom et al. 2011a; Groom et al. 2011b). The limited response observed in these studies can be attributed to the lack of trees that were capable of casting a shadow > 46 m (150 feet) during most of the day in the summer (Leinenbach 2011).

Some of the best available science is found in EPA modeling used to evaluate the effects of thinning prescriptions on stream shade (EPA 2013). The EPA addressed the following riparian vegetation attributes when evaluating the effects of riparian management on stream shade conditions: 1) Total width of the riparian buffer management zone (or RR); 2) width of the no-harvest buffer; 3) density of the vegetation within the no-harvest (expressed as canopy cover); 4) pre-harvest vegetation density within the outer "thinned" buffer; and 5) post-harvest vegetation density within the outer buffer.

For EPA's modeling results, they referenced a BACI (before-after-control-impact) study on 33 streams exposed to riparian harvest (EPA 2013). Results showed an increase in stream temperature for streams that had a shade loss of greater than 6%. Based on the BACI results, the EPA developed a defensible shade loss Assimilative Capacity that used a maximum of 3% shade loss of streams to add a margin of safety. The 120 foot wide no-cut buffer width scenario results (Table 78) indicates that the shade loss thresholds will not be exceeded for essentially all scenarios. There is a slight exceedance for only one model run (e.g., sparse initial canopy cover at an east-west stream aspect condition).

Table 78. Modeled shade loss for a 180 ft wide RR with a 120 ft no-cut buffer at various thinning intensities and initial canopy cover conditions (EPA 2013).

	Percent Shade Loss			
	Stream Aspect			
Pre-harvest Condition-80% Canopy Cover	**North South**	**NW/SE**	**East West**	**Average**
60ft - Outer Thinning Zone 70CC; 120ft - Inner Zone 80CC; Stream	0.1	0.0	0.0	0.0
60ft - Outer Thinning Zone 50CC; 120ft - Inner Zone 80CC; Stream	0.2	0.1	0.0	0.1
60ft - Outer Thinning Zone 30CC; 120ft - Inner Zone 80CC; Stream	0.4	0.2	0.0	0.2
Pre-harvest Condition - 60% Canopy Cover				
60ft - Outer Thinning Zone 50CC; 120ft - Inner Zone 60CC; Stream	0.6	0.4	0.6	0.5
60ft - Outer Thinning Zone 30CC; 120ft - Inner Zone 60CC; Stream	1.5	0.9	0.6	1.0
Pre-harvest Condition - 40% Canopy Cover				
60ft - Outer Thinning Zone 30CC; 120ft - Inner Zone 40CC; Stream	2.3	1.8	3.5	2.5

While stream shade correlates with the width of no-cut buffers, the relationship is quite variable, depending on site-specific factors such as stream size, substrate type, stream discharge, topography (Caissie 2006), channel aspect, and forest structure and species composition. Inputs of cold water from the streambed, seepage areas on the stream bank, and tributaries can help cool the stream on hot summer days if they are sufficiently large relative to the stream discharge (Wondzell 2012). The density of vegetation in riparian areas affects shade and thermal loading to a stream due to the penetration of solar radiation through gaps in the canopy and among the branches and stems (Brazier and Brown 1973; DeWalle 2010). In some instances (such as narrow streams with dense, overhanging streamside vegetation, or stands on the north sides of streams with an east-west orientation), no-cut buffers as narrow as 30 feet adjacent to clearcuts can maintain stream shade (Brazier and Brown 1973). Wider buffers, in general will provide increased protection of stream temperature (Anderson *et al.* 2007, Science Team Review 2008, Groom *et al.* 2011a, Groom *et al*. 2011b).

The BLM proposes thinning, selection harvest, regeneration harvest, and salvage in the Harvest Land Base under the PRMP. Selection harvest is the removal of individual trees or groups of trees up to 4 acres in size. Regeneration harvest is the removal of trees with a retention of 5-30% pre-harvest basal area. Salvage harvest is the removal of trees with a retention of at least 5% pre-harvest basal area. The BLM proposes thinning in the Late-Successional Reserve and Riparian Reserves under the PRMP.

The BLM proposes Management Direction with different harvest prescriptions in the Riparian Reserve based on the three different sub-watershed classes. These sub-watershed classes are distributed across the planning area and previously described by ESU/DPS in Table 6 and 8. Class I, II, and III sub-watersheds have a 1 SPTH riparian reserve (RR) on fish-bearing and perennial streams. The fish-bearing and perennial streams in these classes will maintain a minimum 120-foot no-cut buffer. In the Riparian Reserve – Dry Forest, fuels treatments can occur within these inner zones to reduce the risk of stand-replacing crown fires. Thinning can occur between 120 feet and 1 SPTH, with a minimum of 30% canopy cover and 60 trees per acre (TPA). Thinning, selection harvest, regeneration harvest, and salvage can occur outside of 1 SPTH in the Harvest Land Base. Thinning can occur outside of 1 SPTH in the Late-Successional Reserve. Thinning and selection harvest can occur outside of 1 SPTH in the Late-Successional Reserve – Dry. Class I and II sub-watersheds have a 1 SPTH RR on intermittent, non-fish-bearing streams. The intermittent, non-fish-bearing streams will maintain a minimum 50-foot no-cut buffer and, in the Riparian Reserve – Dry Forest, fuels treatments can occur to reduce the risk of stand-replacing crown fires. In Class I sub-watersheds on non-fish-bearing intermittent streams, non-commercial thinning can occur between the 50-feet and 120-feet, and, in the Riparian Reserve – Dry Forest, fuels treatments can occur to reduce the risk of stand-replacing crown fires. Commercial thinning can occur between 120 feet and 1 SPTH, with a minimum of 30% canopy cover and 60 TPA. In Class II sub-watersheds, commercial thinning can occur between 50 feet and 1 SPTH, with a minimum of 30% canopy cover and 60 TPA. Class III sub-watersheds have a 50-foot RR on intermittent, non-fish-bearing streams. Thinning, selection harvest, regeneration harvest, and salvage can occur outside of the 50-foot no-cut buffer. Table 79 summarizes the no-cut buffers and RR based on watershed type.

Table 79. No-cut buffers and riparian reserves for the three classes of watersheds.

Stream Type	Sub-watershed Class	Riparian Reserve* (ft)	No-cut Buffer (ft)
Fish-bearing and perennial	I	1 SPTH	120
Intermittent, non-fish-bearing	I	1 SPTH	50
Fish-bearing and perennial	II	1 SPTH	120
Intermittent, non-fish-bearing	II	1 SPTH	50
Fish-bearing and perennial	III	1 SPTH	120
Intermittent, non-fish-bearing	III	50	50

* The RR ranges from 140-240 feet, depending on the SPTH.

Yarding corridors will result in the removal of trees in the upland and the riparian area. Trees felled for yarding corridors within 1 SPTH of a stream will be directionally felled toward the stream, retained within adjacent stands as down woody material or moved for placement in streams for fish habitat restoration. The PRMP would allow yarding corridors in the Riparian Reserve where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives. The PRMP includes a BMP that, when applied, would limit yarding corridors to 15 foot widths and at least 100 feet apart when physical topography or operational constraints demand; however, this BMP would limit the yarding corridors to 200 feet apart when there are no constraints.

Based on EPA's assessment (Table 78), the modeled scenarios suggest if we apply these model results on the BLM's proposed riparian strategy, it is reasonable to conclude temperature will not increase in streams as a result of the PRMP. The logic underpinning this conclusion is as follows: The BLM proposes a 120-foot no-cut buffer with a minimum of 30% canopy cover on all perennial streams. EPA's modeling shows that maintaining a 120-foot no-cut buffer on perennial streams with a post-harvest canopy cover of 30% in the outer zone protects shade loss (less than 3%) in most cases. EPA's modeling shows one scenario where shade loss could exceed 3%; a pre-harvest canopy cover of 40% in the inner zone on streams with an east/west aspect. If thinning were to occur with these conditions, an increase in stream temperature could occur. Some likely scenarios where existing low canopy cover may occur include past burns, rock out cropping in the riparian reserve, and disease areas. Areas with low canopy cover are not expected to occur in large areas. In general, most forest conditions where proposed thinning will occur have existing canopy cover between 60-80% (USDI BLM BA 2016). Therefore, thinning will not increase stream temperatures in most cases as a result of the PRMP.

Yarding corridors within the no-cut buffers on perennial streams can decrease stream shade and increase stream temperatures; however, on a much smaller magnitude than timber harvest. This is because yarding corridors are relatively narrow (12 feet wide) when compared to the size of a typical timber harvest unit. The effects will continue for decades until the vegetation recovers.

Road Work effects on temperature. The proposed road work consists of road construction, road renovation, and road decommissioning. BLM projected this work across the planning area for this plan level assessment.

Road Construction. Removing trees in riparian areas reduces the amount of shade which leads to increases in thermal loading to the stream (Moore and Wondzell 2005). Road construction in the RR would remove trees and could cause a decrease in shade and a subsequent increase in stream temperature.

The BLM proposes the following Management Direction that limits road construction in the RRs: Allow road construction, and stream crossings where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives. In addition to the Management Direction that limits road construction in the RR, the BA says "It is extremely unlikely that any new road or landing construction would occur within the inner zone of a RR. 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 (at least 120-feet from perennial streams), or entirely outside of the RR." As described in the timber harvest section, above, the no-cut buffers will be protective of shade in most conditions.

Limits on road construction within RRs, and particularly within the no-cut buffers will protect stream shade and maintain stream temperature in most instances. There will still likely be some roads constructed within the no-cut buffers that could decrease stream shade; however, the number of miles of roads is expected to be small based on the Management Direction and assumptions built into the proposed action. Depending on the location of the stream crossings, the increased stream temperature could affect LFH. The effects will continue as long as the road is in place for permanent roads, and continue for decades for temporary roads until the vegetation recovers.

Road Renovation. Removing trees in riparian areas reduces the amount of shade which leads to increases in thermal loading to the stream (Moore and Wondzell 2005). Road renovation in the RR could remove trees and could cause a decrease in shade and a subsequent increase in stream temperature.

The BLM proposes the following Management Direction that limits road renovation in the RRs: Allow road maintenance where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives.

Road renovation will include brushing, removal of hazard trees, ditchline and culvert cleaning, installation and replacement of cross drains, culvert replacement, rock surface replacement, and pot hole patching on paved roads. Limits on road renovation within the RRs will help protect stream shade and maintain stream temperature. There will still likely be some road renovation within the RRs that could decrease stream shade; however the effects are likely to be minor. This is because the majority of road renovation elements, e.g. brushing and ditchline cleaning, will only require the removal of understory vegetation, which does not affect shade. Although hazard tree removal could require the removal of overstory vegetation, this will occur intermittently and will be spaced throughout the landscape. It is therefore unlikely there will be a measureable effect on stream shade from the removal of hazard trees, even when they are adjacent to the stream.

Culvert replacement could require the removal of a small amount of overstory vegetation, and cause a minor, localized increase in stream temperature. The BLM proposes the following BMPs to minimize shade loss from culvert replacement: 1) Minimize width of fill needed for safe travel and adequate cover for culverts; and 2) Locate stream crossings as perpendicular to the streamflow as stream allows. Limits on road maintenance, specifically culvert replacements, within the RRs, and the implementation of these BMPs will help protect stream shade and maintain stream temperature. This is because minimizing the width of the culverts and placing them perpendicular to the stream requires the removal of fewer overstory trees. There will still likely be some culvert replacements on streams that could decrease stream shade; however the effects are likely to be minor. This is because only a small amount of overstory vegetation will be removed, and some of the vegetation will recover over time. In addition, there will be a spatial and temporal separation of culvert replacement across the action area which will prevent an aggregation of increases in stream temperature.

Road Decommissioning. Removing trees in riparian areas reduces the amount of shade which leads to increases in thermal loading to the stream (Moore and Wondzell 2005). Road decommissioning activities that involve removal of overstory vegetation can decrease stream shade on perennial streams from the removal of vegetation adjacent to streams.

There is no specific Management Direction for road decommissioning that would minimize the effects of shade loss from culvert removal; however, the BLM proposed the following BMPs: 1) Reestablish stream crossings to the natural stream gradient; 2) Excavate sideslopes back to the natural bank profile; and 3) Reestablish natural channel width and floodplain.

Road decommissioning will include blocking the road, out-sloping and adding waterbars for drainage control, culvert removal, and replanting the roadbed. The only type of road decommissioning that could require the removal of overstory vegetation would be culvert removal.

The effects on stream temperature from culvert replacement are discussed in the paragraph above, and the effects of culvert removal would be similar to these effects. The BMPs proposed by the BLM, specifically excavating slideslopes back to the natural bank profile, and reestablishing the natural channel width and floodplain would provide a long-term benefit to stream shade. This is because restoring the stream and bank back to natural conditions would allow for the reestablishment of overstory vegetation. Once the overstory vegetation is reestablished, there will be a recovery of stream shade, and a subsequent decrease in stream temperature. There will be a long-term beneficial effects from removing roads adjacent to streams. Removal of roads and replanting the road bed will establish overstory vegetation, increase stream shade, and decrease stream temperature. These long-term benefits of road decommissioning on stream temperature will outweigh the temporary effects of on stream temperature for removing culverts.

Timber Hauling effects on temperature. There will not be any vegetation removed from timber hauling. Since there is no causal mechanism to affect stream shade, timber hauling will not have an effect on temperature.

Forest Management effects on Suspended Sediment and Substrate Embeddedness. Forest Management associated activities can increase suspended sediment at a sub-reach or reach scale and potentially at a watershed scale.

Timber Felling and yarding effects on suspended sediment and embeddedness. Timber felling and yarding disturbs soils and increases their potential for sediment transport to area stream channels. Living tree roots help stabilize soil. Timber felling kills the roots, which increases the probability of slope failure (Swanston and Swanson 1976), particularly on steep slopes (i.e., >70% concave, >80% planar or convex slopes) (Robison *et al*. 1999). This also increases the potential of sediment delivery to the stream network. The occurrence probability is related to the harvest intensity, soil properties, geology, unit slope, and precipitation level. Depending on the prescription used, timber harvest will greatly reduce the number of living trees within the treated stands, particularly for regeneration harvest. As the roots of harvested trees die and decompose, their effectiveness in stabilizing soils will decrease over time. For thinning prescriptions, the remaining trees are likely to experience rapid growth from decreased competition and, as a result, increase their root mass and ability to stabilize soils in the treated stand. All timber sales will be field reviewed by BLM staff for slope stability. Under the proposed action, any units that show signs of shallow or deep-seated slope instability in the project area will be avoided for timber harvest.

Ground-based yarding has the highest risk of causing an increase in suspended sediment and substrate embeddedness, particularly where yarding corridors cross streams (Rice et al. 1972). Ground-based yarding can be accomplished with relatively little damage to the existing shrub and herbaceous ground cover, thus limiting the exposure of bare soil and maintaining important root structure that holds soil in place. Skyline or multi-spanning yarding systems reduce soil impacts because the logs are suspended above the ground throughout much or all of the yarding process. Helicopter yarding also reduce soil impacts because logs are fully suspended above the ground.

Several studies document the ability of buffer strips to reduce erosion and sediment delivery. Vegetated buffer areas ranging in width from 40 to 100 feet appear to prevent sediment from reaching streams (Burroughs and King 1989, Corbett and Lynch 1985, Gomi et al. 2005). Lakel et al. (2010) concluded that streamside management zones (buffers) between 25 and 100 feet were effective in trapping sediment before it could enter streams.

The BLM proposes Management Direction that maintain no-cut buffers of either 50 and 120 feet for streams in the action area, depending on stream type and subwatershed class; limits ground-based yarding to slopes less than 35%, and will exclude ground-based machinery for timber harvest from at least 50 feet from streams. In addition, the PRMP includes the following BMPs to minimize the likelihood of sediment reaching streams:

- Maintain the minimum percent of effective ground cover needed (20-75% depending on Natural Resources Conservation Services Erosion Hazard Rating[38] to control surface erosion, following forest management operations. Ground cover may be provided by vegetation, slash, duff, medium to large gravels, cobbles, or biological crusts.
- Apply erosion control measures to skid trails and other disturbed areas with potential for erosion and subsequent sediment delivery to waterbodies, floodplains, or wetlands. These practices may include seeding, mulching, water barring, tillage, and woody debris placement.
- Design yarding corridors crossing streams to limit the number of such corridors, using narrow widths (12-15 feet), and using the most perpendicular orientation to the stream feasible. Set yarding corridor spacing where they cross the streams to no less than 100 feet apart when physical, topography, or operational constrains demand, with an overall desire to keep an average spacing of 200 feet apart.
- Restrict non-road, in-unit ground-based equipment used for harvesting operations to periods of low soil moisture; generally from May 15 to October 15.

The Management Direction and BMPs in the PRMP will ensure that most fine sediment generated by timber harvest will not reach streams. This is because management direction limiting ground based yarding to slopes less than 35%, excluding ground-based machinery for timber harvest from at least 50 feet from streams, and the application of the BMP, when appropriate, limiting operations to periods of low soil moisture content will minimize the amount of sediment generated from timber harvest and yarding. In addition, maintaining no-cut buffers of either 50 and 120 feet for streams in the action area, depending on stream type and subwatershed class, and implementing erosion control techniques (Burroughs and King 1989, Corbett and Lynch 1985, Gomi et al. 2005, and Lakel et al. 2010) will minimize the amount of the sediment reaching the stream.

Road Work effects on suspended sediment and embeddedness. The proposed road work consists of road and landing construction, road and landing renovation, and road decommissioning. Road and landing construction includes the construction of new, temporary and permanent roads. Road renovation includes brushing, removal of hazard trees, ditchline and culvert cleaning, installation and replacement of cross drains, culvert replacement, surface blading, rock surface replacement, and pot hole patching on paved roads. Road decommissioning will include blocking the road, out-sloping and adding waterbars for drainage control, culvert removal, and replanting the roadbed.

There is a high probability that road work will introduce sediment into ditch lines and in some instances, into streams. At greatest risk of contributing sediment to LFH are: (1) Road and landing construction on road segments draining to LFH; (2) Road renovation and maintenance on road segments draining to LFH; and (3) stream culvert installation, replacement, and removal in close proximity to LFH.

The BLM proposes the following Management Direction that minimizes the amount of sediment generated from road work and minimizes the amount of sediment reaching streams:

[38] Rating obtained from Natural Resources Conservation Services County Soil Survey information by map unit.

- In the Riparian Reserve, allow road construction, and stream crossings where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives. In addition to the Management Direction that limits road construction in the RR, the BA says “It is extremely unlikely that any new road or landing construction would occur within the inner zone of a RR. BLM’s recent experience is that most road construction or renovation to provide access for RR thinning projects occurs in what would be the outer zone (at least 50 feet from intermittent streams and 120 feet from perennial streams), or entirely outside of the RR.”
- 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.
- 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.

The following are a subset of the BMPs that could be implemented for road work:

- Limit road and landing construction, reconstruction, or renovation activities to the dry season.
- Locate roads and landings on stable locations, ridge tops, stable benches, or flats, and gentle-moderate slopes.
- 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.
- Design road cut and fill slopes with stable angles, to reduce erosion and prevent slope failure.
- 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.
- Construct road fills to prevent fill failure using inorganic material, compaction, buttressing, sub-surface drainage, rock facing, or other effective means.
- 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.
- 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.
- 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.

- 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.
- 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.
- 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.
- 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.
- Retain ground cover in ditch lines, except where sediment deposition or obstructions require maintenance.
- After ditch cleaning prior to hauling, allow vegetation to reestablish or use sediment entrapment measures (e.g., sediment trapping blankets or silt fences).
- 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.
- 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.
- Do not sidecast loose ditch or surface material where it can enter wetlands, Riparian Reserve, floodplains, and waters of the State.
- Conduct in-water work, including culvert installation, replacement, and re moval during the ODFW in-water work window.

Road maintenance BMPs, including adding and maintaining cross drains and ditches were 93% effective in minimizing sediment to streams (Luce and Black 1999). Forest vegetation buffers flow and prevents sediment from reaching streams (Copstead and Johansen 1998). The integrity of the road surface can be enhanced during high runoff periods by gravel to produce well-aggregated surfaces. Roads that were well-graded and graveled did not show signs of surface runoff during storm events (Copstead and Johansen 1998).

The Management Direction proposed by the BLM and the appropriate use of BMPs included in the PRMP, in particular, the construction and spacing of cross drains and ditches (Luce and Black 1999), adding aggregate surface to roads (Copstead and Johansen 1998), retaining ground cover in ditch lines, and conducting in-water work during the ODFW in-water work window will minimize the amount of fine sediment from roads reaching streams. This is because adding and spacing cross drains appropriately ensures that only a small portion of the road (less than 200 feet) is capable of routing water and sediment through the ditch lines to streams. Retaining ground cover in ditch lines traps and stores the majority of sediment and minimizes the amount of sediment reaching streams. Conducting in-water work during the ODFW in-water work window minimizes the amount of sediment mobilized in the stream because this occurs during low water periods in the streams, and dry weather in the summer.

Although the application of a number of BMPs, as stated above, will minimize the amount of sediment delivery to streams, it is still likely that road work will introduce some sediment into streams. Some of the streams will have the capacity to store sediment due to low stream gradient, in pools behind wood structures and boulders, and along the banks where flows are slower (Skidmore *et al*. 2011). The storage capacity of those streams would minimize the amount of sediment reaching LFH at one time. However, roads and landings that are constructed adjacent to, or drain to LFH will likely deliver a low-level, chronic source of sediment for as long as the roads are in place. The effects of road work on suspended sediment will also be spatially and temporally separated, and will help ameliorate some of these effects.

Timber and Rock Hauling effects on suspended sediment and embeddedness. There is a high probability that the use of hauling roads will introduce some sediment into roadside ditches and, in some cases, into streams. The amount of sediment eroded from road surfaces depends on the amount of traffic, the durability of the surface, the level of maintenance, the condition of the ditches and the amount of precipitation. Hauling can increase suspended sediment in streams during both dry and wet season use. Hauling during the dry season can store sediment on the road surface and ditches that will mobilize during the first freshets in the fall. Hauling during the wet season will mobilize sediment that could potentially be delivered to streams.

The BLM proposes to authorize contractors to haul timber and rock on roads. This includes BLM and non-BLM roads. The BLM identified the number of roads that could potentially deliver sediment to streams. The BLM identified roads within a 200-foot distance from streams that could deliver sediment, and includes existing roads paralleling streams and existing roads with inside ditches that carry concentrated flows from roads that lack ditch relief culverts. Table 80 identifies the number of miles of BLM roads in the 200-foot sediment delivery distance for the planning area. Table 81 identifies the number of miles of non-BLM roads in the 200-foot sediment delivery distance for the planning area.

Table 80. Total miles of BLM roads within 200 feet of a stream presented by surface type and located within sub-watersheds of the various species within the planning area.

	Road miles								
Road Surface	CR chum	LCR coho	LCR Chinook	LCR steelhead	UW Chinook	UW steelhead	OC coho	SONCC coho	Total
Natural	5.7	5.8	5.8	1.7	25.2	27.3	439.5	455.0	966
Aggregate	28.8	36.0	36.0	29.5	436.4	364.9	1711.1	1073.4	3716.1
Paved	2.9	6.7	6.7	6.7	42.3	21.3	302.7	143.3	532.6
Unknown	7.2	8.0	8.0	6.7	23.3	36.7	148.7	172.2	410.8

Table 81. Number of miles of roads within the decision area 200-foot sediment delivery distance for the planning area.

Road Type	Other (miles_
Natural	15,874
Aggregate	22,938
Paved	2,436
Total	**21,249**

Although the BLM identified paved roads as a potential pathway for sediment delivery to streams, the paved roads are the smallest contributors of sedimentation to streams. Hauling on native-surfaced and aggregate-surfaced roads that either cross or drain to streams have the highest likelihood of delivering sediment to LFH.

The Management Direction proposed by the BLM and the appropriate use of BMPs described in the road renovation section, including adding durable rock to the roads prior to hauling (Copstead and Johansen 1998), installation of sediment traps, and placement of cross drains (Luce and Black 1999) will minimize sediment generated from hauling from reaching streams. In addition, the Management Direction requires the BLM will 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. The Management Direction applies to all roads, including the non-BLM roads that could be used for hauling, as would BMPs when applied. Roads that are adjacent to LFH will have higher likelihood of adverse effects. Some of the streams upstream of LFH will have the capacity to store sediment due to low stream gradient, in pools behind wood structures and boulders, and along the banks where flows are slower (Skidmore *et al*. 2011). Sediment transport and routing is a complex process driven by variables such as water discharge, stream storage capability, and sediment characteristics. The storage capacity of the streams would minimize the amount of sediment reaching LFH at one time. Roads adjacent to or in close proximity to LFH will likely deliver a chronic source of sediment for as long as the roads are in place. Although the Management Direction and application of BMPs described above will minimize the amount of sediment delivered to streams, it will not be prevented in all cases. Hauling will be spatially and temporally separated throughout the decision area. This will ameliorate some of the effects of increased suspended sediment and substrate embeddedness in LFH.

Forest Management effects on Chemical Contamination/Nutrients. Timber felling, timber yarding, timber hauling, and road work can potentially affect the chemicals and nutrients habitat indicator due to the operation of machinery near streams (chemicals) and the use of fertilizers (nutrients). The BLM proposes to use fertilizers, which could result in an effect to nutrients from Forest Management. However, the BLM proposes to use fertilizers only by manual application and only in the Harvest Land Base. Furthermore, the BMPs available to be implemented by the BLM, including ensuring fertilizer application does not result in direct entry to riparian areas, the implementation of a spill containment plan, and 100-foot setbacks for refueling, make the aquatic contamination risk very low. In addition, the 100-foot setbacks will likely provide an adequate vegetated buffer that would prevent any fertilizer or materials from a spill from reaching the stream.

<u>Forest Management effects on Physical Barriers</u>. The only project category that could affect physical barriers under Forest Management is Road Work, specifically culvert replacement, installation, and removal. On LFH, the BLM will design new and replacement culverts to meet NMFS fish passage criteria (NMFS 2011e). Meeting the NMFS fish passage criteria will ensure that culverts are designed to maintain hydraulic conditions, including hydrology, velocities, and slopes that pass juvenile and adult fish.

<u>Forest Management effects on Large Wood Recruitment</u>. The Forest Management program influences the character of tree stands. The development of these tree stands throughout the planning area then relates to the availability of trees recruited to stream channels and adjacent riparian areas. In this document, we refer to these trees as large wood, for their function and role in ecological processes within a watershed, both within the stream and on the upslope. Large wood is a critical habitat element of Pacific Northwest streams and forest that historically was abundant throughout the Pacific Northwest. Over the years, large wood has been removed from streams through timber salvage, splash damming, and stream cleaning. Additionally, large wood has been removed from riparian forest through commercial harvest, road building, forest clearing for agriculture and other land uses, and forest thinning to improve tree growth.

In this section we discuss the effects of Forest Management on Wood Recruitment. Sudden Oak Death (SOD) treatments and Fuels Reduction are discussed later in the document under Invasive Species (Section 2.4.4) and Fire and Fuels (Section 2.4.2) respectively.

Large living and dead wood provides important habitat for a range of ESA fish species. Large riparian trees that die and fall into and near streams, such as within floodplains and wetlands, regulate sediment and flow routing, influence stream channel complexity and stability, increase pool volume and area, and provide hydraulic refugia and cover for fish (Bisson et al. 1987, Gregory et al. 1987, Hicks et al. 1991, Ralph et al. 1994, Bilby and Bisson 1998). The loss of wood is a primary limiting factor for salmonid production in almost all watersheds west of the Cascade Mountains (ODFW and NMFS 2011, NMFS ARBO 2013).

Sediment retention is particularly important because it helps to create and maintain alluvial aquifers, which in turn help to modulate stream temperatures through the process of hyporheic exchange, while sediment storage in upstream reaches reduces fine sediment that degrades and entombs salmon redds. The ability of large wood and other obstructions to attenuate peak flows also helps to reduce bed scour, which can also destroy redds. Within spawning areas, large wood also helps to reduce bed mobility, which also helps to keep redds intact and minimize their loss through the movement of the spawning substrate during high flows.

The majority of the wood recruited to a stream channel from adjacent riparian areas comes from within 30 meters (98 ft) of the channel (McDade et al. 1990, Van Sickle and Gregory 1990, Spies et al. 2013) (Figure 10). Wood recruitment to streams occurs either from near-stream tree mortality events (e.g. bank erosion, windthrow or windsnap) or from upstream landslides and debris flows. At a watershed scale, near-stream inputs are relatively regular in space and time while landslides and debris flows are episodic, adding large amounts of wood to low-gradient streams, but also removing large amounts of wood from higher gradient streams. Upslope, episodic delivery can account for a substantial portion (up to 80%) of the large wood in small to mid-sized streams (Reeves et al. 2003, Bigelow et al. 2007) in mountainous setting. Near-stream recruitment is the dominant source (up to 100%) in low gradient streams with floodplains. Topographic features of a watershed influence the relative contribution of upslope sources of wood. Steeper, more highly dissected watersheds will likely have a greater proportion of wood coming from upslope sources than will watersheds that are less dissected or steep (Martin and Benda 2001). However, in any watershed only a small subset of the upslope channels will deliver wood to valley floors and fish-bearing streams via debris flows.

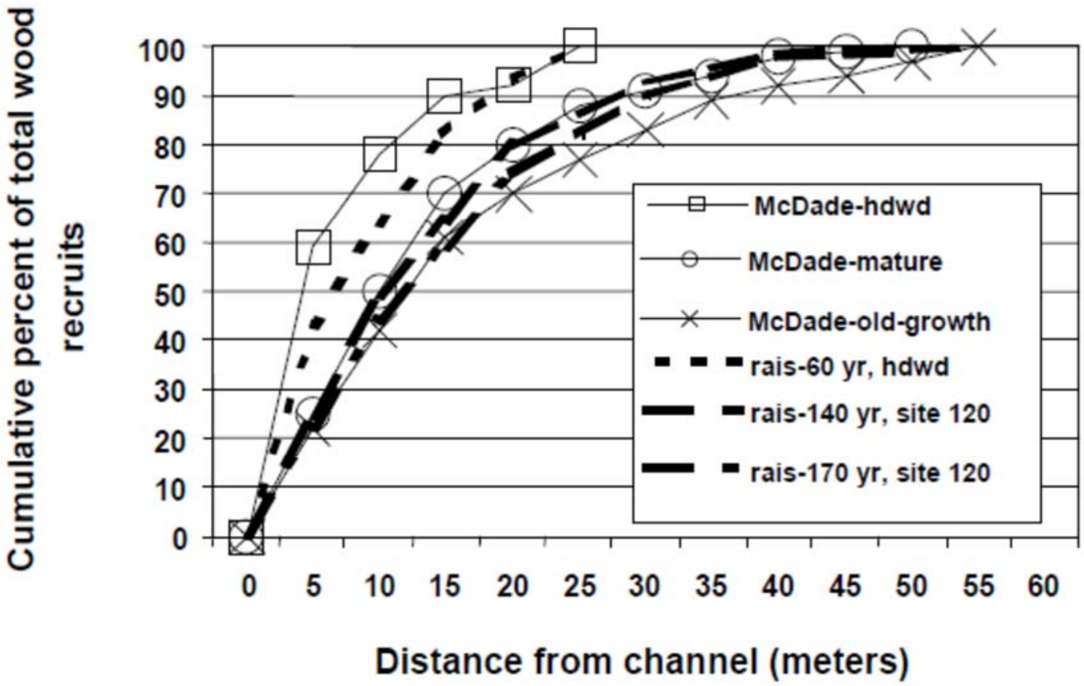

Figure 10. Comparison of predictions of total wood accumulation with distance from channel using the Organon forest growth model and RAIS instream wood recruitment model verse the observations of McDade et al (1990) for streams in the Cascade Mountains of Oregon and Washington. (Taken from Spies et al. 2013, page 18)

Near-stream wood recruitment tends to be more evenly distributed throughout a drainage network, whereas episodic landslides tend to create large concentrations of wood at tributary junctions, which contributes to habitat complexity and ecological productivity (Bigelow et al. 2007). The presence of large wood in debris flows slows the speed of the flow and reduces the run-out distance of debris flows on the valley floors (Lancaster et al. 2003). Stream-side sources of wood can provide the largest key pieces to streams, and contribute to gravel storage that converts bedrock reaches to alluvial reaches, and create smaller, more numerous pools, and create habitat complexity (Montgomery et al. 1996, Bigelow et al. 2007). Both types of wood delivery are necessary for functioning and productive stream ecosystems.

We evaluate the effects to wood recruitment within each proposed class of subwatersheds for the BLM's PRMP. The riparian management varies by subwatershed class; therefore, wood recruitment may vary by subwatershed class. Note that programmatic direction for large wood restoration activities is analyzed below. Many related specific activities have already been addressed in the ARBO II consultation, and others such as tree tipping or tree falling activities associated with commercial thinnings will not occur until further authorization and section 7 analysis; thus, all are analyzed at a framework programmatic level here.

Class I Subwatersheds

Class I subwatersheds have an inner zone of 120 feet for all perennial and fish bearing streams. The management direction (see proposed action, section 1.3.8) in the inner zone limits activities to SOD treatments, individual tree falling or tipping for restoration, or to meet the tree-tipping management direction associated with outer zone commercial thinning, and dry forest fuel reduction treatments. The outer zone for all perennial and fish bearing streams is 120 feet to one SPTH. The management direction requires that thinning of stands is limited to provide trees that would function as stable wood in the stream (and fuel reduction treatments). Stands must 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. Thinning operations must retain existing snags and down woody material and create new snags.

The NMFS modeled effects of thinning on large wood production and recruitment from the riparian reserves in the context of the three subwatershed riparian strategies (Pollock 2016). The modeling method included using stand data, the Forest Vegetation Simulator and the post processor FFE, as described in Pollock (2016). The model simulated forest growth and ultimately large wood production using simulated thin from below prescriptions and projected that growth out 100 years. In general, Pollock concluded, that in terms of large wood production, drier forest responded more favorable to thinning compared to moist forest. Pollock also concluded moist forests usually did not benefit from thinning in terms of large wood production. For dry forest, increased wood production generally occurred in the range of 120-180 TPA, and varied with forest. Large wood tabulation in the model simulations included "any live tree currently standing or a large tree that had died over the course of the simulation." A large tree was any tree greater than or equal to 20 inches diameter breast height (dbh) and live trees between 16 to 20 inches dbh because at year 100 these would likely grow to 20 inches (Pollock 2016). The modeling resulted in considerable variability of stand responses depending on the geographic area, the thinning intensity, and the starting conditions.

Spies et al. (2013) produced a scientific synthesis on the effects of riparian thinning on wood recruitment to streams, which noted that there is very little published science about the effects of thinning on wood recruitment in riparian zones. Spies et al. (2013) concluded that the effects of thinning are variable depending on site-specific conditions, but that thinning can accelerate the development of very large diameter trees. Riparian stands may benefit in moist forests where the stands are over-stocked and moderate thinning reduces competition among the small trees. In a simulation study, Pollock and Beechie (2014) concluded that passive management resulted in the most rapid development of small and medium diameter deadwood, whereas heavy thinning most rapidly developed large live trees. In headwater streams, small and medium diameter wood provides ecological functions related to sediment and water routing, as well as nutrient storage and processing.

The inner zone (120 feet or 30 meters) for perennial and fish bearing streams of the Class I subwatersheds have about 90% of all potential wood recruited to the stream (Figure 3). Since the management direction for thinning of the outer zone is limited to increased wood production, it is unlikely to have adverse effects to wood production (except fuels reduction in dry forest and SOD treatments discussed later in the document). Additionally, the tree tipping and tree falling component of the inner zone will add immediate wood recruitment to the stream, such that this restoration component will have a beneficial effect to the large wood indicator.

Intermittent streams for the Class I subwatersheds have a 50’ inner zone, with a 50’ to 120’ middle zone, and 120 to one SPTH outside zone. Again, actions in the inner zone are limited to SOD treatments and tree tipping or falling and dry forest fuel reduction treatments. The middle zone and outer zone of the Class I subwatersheds for intermittent streams are constrained by management direction to ensure stands are able to provide trees that would function as stable wood in the stream (except SOD treatments and fuels reduction in dry forest). Additionally, the middle zone also has a no commercial removal limitation (except fuels reduction in dry forest discussed later). It is unlikely implementing the proposed Forest Management program in Class I subwatersheds will result in adverse effects to the large wood indicator due to these imposed limitations adjacent to the intermittent streams.

Therefore, the management direction of the all streams in Class I subwatersheds under the BLM’s PRMP will not adversely affect the large wood indicator. Tree tipping and tree falling will have an overall beneficial effect to the large wood indicator such that the overall effect to the large wood indicator in Class I subwatersheds are beneficial.

Class II Subwatersheds

The inner zone of perennial and fish bearing streams for Class II subwatersheds is similar to the Class I subwatersheds. The difference is in the outer zone. The management direction for the outer zone for perennial and fish bearing streams allows stands thinned as needed to promote the development of large, open grown trees (areas of multi-branches in the crown due to open space), develop layered canopies and multi-cohort stands, develop diverse understory plant communities, and allow for hardwood vigor and persistence. Additionally, the management direction requires at least a 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. Thinning operations must retain existing snags and down woody material and create new snags.

Pollock (2016) found that for Class II subwatersheds, thinning to 60 TPA may decrease the wood production in the riparian reserve from 25 to 37%. However, since 90% of wood recruitment occurs in the first 120’ of the riparian reserve, only 10% of wood recruitment is expected in the outer zone. Taller trees greater than 120’ in height is needed just to reach the stream. Thinning can accelerate the development of very large diameter trees (Spies *et al.* 2013). Smaller trees in the outer zone are likely to die from suppressed mortality before they can obtain the size as functional wood and height such to reach the stream. Thus this potential wood reduction from thinning will not have a consequential effect to the stream and in heavily stocked stands the thinning may accelerate growth and increase large trees available for wood recruitment. The inner zone also allows tree tipping and tree falling, this will have a beneficial effect. Therefore, on balance, the management direction for the inner zone of perennial and fish bearing streams for Class II subwatershed is expected to be beneficial.

Intermittent streams for the Class II subwatersheds have a 50’ inner zone, with a 50’ to one SPTH outside zone. Again, the inner zone is limited to SOD treatments and tree tipping or falling, and fuels treatment in the dry forest. The management direction for the outer zone for perennial and fish bearing streams allows stands thinned 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 (except fuels treatment discussed later in the document). Management direction includes applying silvicultural treatments to increase diversity of riparian species and develop structurally-complex stands while maintaining 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.

As in Class I subwatersheds, the NMFS modeling resulted in a 25 to 37% reduction in wood recruitment in the outer zone of intermittent streams (Pollock 2016). However, intermittent streams that are fishless usually occur in high gradient (greater than 16%) mountain areas with steep canyons. These intermittent streams contribute wood to the fish bearing streams through landslides. The management direction includes extending the intermittent stream to the landslide prone areas to include this additional wood of a 100’ swath (50 feet on both sides). The data for width of these landslide prone areas is not clear, but most likely occurs in a 100’ swath when the hillside fails, resulting in delivering wood down the intermittent stream channel.

Landslide prone areas can deliver wood from the top of the steep canyon to listed fish habitat below. The 100’ inner zone (both sides) of the Class II subwatersheds intermittent streams will retain most wood, but the outer zone reduction of 25 to 27% reduction will likely reduce wood recruiting to the inner zone swath. The reduction may also reduce the available wood that functions to hold sediment in these headwater streams. Instream wood in this area aids to secure the landslide prone stream until a heavy winter storm dislodges the area. The reduction of wood from thinning in the outer zone and a resultant reduction of wood in the intermittent stream’s riparian reserve will cause a reduction on the large wood indicator (wood recruitment). Since the majority of wood recruitment comes from the 100’ swath adjacent to the stream channel this reduction of wood in the outer zone of Class II subwatershed intermittent streams is likely a very small proportion of the overall wood recruitment volume.

Class III Subwatersheds

There is an extremely low potential for wood recruitment from these Class III subwatershed streams to downstream reaches containing valuable LFH (high IP or critical habitat). This is because streams in Class III subwatersheds were designated in areas upstream of LFH, and are often separated by dams, natural barriers, gorges or other natural constraints that limit fish passage. These constraints also limit wood production to downstream reaches where LFH occurs.

*<u>New Road Construction effects on Wood Recruitment within Riparian Reserves of all subwatersheds</u>***.**

The BLM has developed management direction (see bullet below) that limits the amount of new roads that will be constructed within the no-cut buffer of the RRs, and that most road construction would occur in the outer zone of the RR. BLM's past consultations with NMFS has demonstrated the desire from BLM to severely limit the construction of new roads in the riparian reserves, and we assume similar results in the future from the BLM's PRMP. However, some stream crossings will occur and such that removal of trees within the road width (12' to 14') will also occur.

The BLM management direction for riparian reserves includes the following:

- Allow yarding corridors, skid trails, road construction, stream crossings, and road maintenance and improvement where there is no operationally feasible and economic viable alternatives to accomplish other resource management objectives.

Because this management direction limits road construction to areas where no operational feasible and economic viable alternatives exist, we assume that construction of new roads will be very limited as indicated in the paragraph above. Notwithstanding, within the action area, we expect there will be some decrease in wood recruitment potential from the removal of vegetation in the RR, especially when those roads are located adjacent to streams. This will result is a minor reduction of trees available for wood recruitment to the stream. The effects will continue as long as the road is in place for permanent roads, and continue for several decades for temporary roads until the trees recover. The volume of these trees are limited to 12' to 14' width of the entire roadway length with stream adjacent roads, and 12' to 14' width for 100' both sides of a roadway stream crossing. Again, we only expect limited new road construction, due to our experience with past timber sales within BLM and the new management constraint. This reduction in wood volume within the sixth field HUC watershed is relatively small, and with the recruitment of wood from tree tipping and falling from the commercial timber harvest, the adverse effect is expected to be minimal.

<u>Forest Management effects on Pool Frequency and Quality; Large Pools; Off-Channel Habitat; Refugia; Width to Depth Ratio; Streambank Condition; and Floodplain Connectivity</u>. Changes in these channel-associated habitat indicators are dependent on changes to the physical processes that shape and develop these features (i.e., suspended sediment, substrate character, woody material). Large pools, off-channel habitat, refugia, streambank condition, and floodplain connectivity are habitat features related to woody material and the process of in-stream wood recruitment. From the analysis above, the amount of wood recruitment affected by the PRMP is minimal, mainly caused by new road construction, and is offset by tree tipping and restoration actions. Because the potential overall reduction of wood is minimal to in-stream woody recruitment, we do not expect there will not be an adverse effect to these indicators.

Pool quality and width to depth ratio are habitat features related to suspended sediment. Because there will be a negative effect to increases suspended sediment, as described in the road work and mining sections, there will be an adverse effect to these indicators. Pool quality will be degraded from suspended sediment filling pools. Increased suspended sediment can also cause a negative effect on width to depth ratios. In areas where excessive sediment aggradation occurs, the channels could widen, causing a wider, shallower stream channel. As described above, in the sections that describe effects from suspended sediment, sediment inputs to streams will be minimized by Management Direction and the application of BMPs proposed by the BLM. In addition, actions that cause an increase in suspended sediment will be spatially and temporally separated, which will help ameliorate some of these effects.

Forest Management effects on Change in Peak/Base Flows.

Timber Felling and Yarding effects on peak/base flows. Forest management activities can affect the rate that water is stored or discharged from a watershed. Total water yield typically increases due to reduced evapotranspiration (Harr *et al*. 1975, Harr 1976, Hetherington 1982, Duncan 1986, Keppler and Zeimer 1990, Jones 2000), and decreased water interception (Reid and Lewis 2007). Timber felling may result in winter flows with higher peak volumes, and potentially result in earlier peak discharge times (Satterlund and Adams 1992, Jones and Grant 1996). Elevated peak flows occur when a high proportion of timber basal area has been removed by forest harvest, particularly within rain-on-snow (ROS) watersheds (Grant et al. 2008). Studies suggest that flow changes are not measureable when <19% of the watershed is clearcut (Grant et al. 2008). Where there is no snow component, water yield still increases and flood peaks will increase if rainfall is more rapidly transferred to the stream via reduced interception or more rapid routing (Harr et al. 1975, Zeimer 1981, Jones and Grant 1996). In rain dominated hydroregions, increased flows appear to be proportional to increased acreage harvested (i.e., more timber harvest = more water) (Bosch and Hewlett 1982, Keppler and Zeimer 1990). A compilation of many studies of small basins with conifer vegetation indicates that annual water yield increases about 40mm for every 10% of the basin harvested (Bosch and Hewlett 1982). Another study focused on the Pacific Coast range noted a 50mm increase for every 10% harvested (Stednick 1996). Stednick (1996) suggests that flow changes are not measurable when <25% of the watershed is clearcut.

Grant et al. (2008) found that peak flow increases generally approach the 10% limit (minimum detectable change in flow) at storm events with recurrence intervals less than 6 years. The data also supports that peak flow effects on channels is confined to a relatively discrete portion of the stream network, particularly where channel gradients are less than 0.02 and streambed and banks are gravel and finer material. These are primarily the domain of gravel-bed rivers and streams in forested landscapes in western Oregon and Washington. Furthermore, Grant *et al*. (2008) states that peak flow effects on stream channels are likely to be minor in most step-pool systems and can be confidently excluded in high-gradient slopes (>10%). Grant et al. (2008) also found that the percentage change in peak flow generally decreases with time after harvest (Jones 2000, Jones and Grant 1996, Thomas and Megahan 1998. Peak flow effects seem to diminish over the first 10-20 years (as the stand grows) (NMFS 2005)

There are 1,203 sixth field watersheds within the planning area. When separated by hydroregion, 679 watersheds are predominately rain-dominated, 96 watersheds are predominately ROS dominated, 163 watersheds are predominately snow-dominated and 265 watersheds have mixed proportions of each hydroregion.

In ROS watersheds there is little evidence to indicate that forest harvest can elevate peak flows in the rain or snow-dominated hydroregions. Of the 96 ROS watersheds, 38 watersheds include BLM land, totaling 197,709 acres. Table 82 shows the ROS watersheds susceptible to increases in peak flow by ESU/DPS. The BLM analyzed these watersheds for the potential sediment transport and channel scour by channel gradient and stream type for the 1-6 year recurrence interval peak flows. In this analysis, the BLM addressed the ROS watersheds that meet the following three criteria: 1) BLM lands are more than 1% of the watershed; 2) the watershed has more than 100 acres of BLM lands in the ROS hydroregions; and 3) more than 60% of the watershed is in the ROS hydroregion. The BLM calculated the total open area from forest harvest and roads for all lands in the ROS watersheds as a percent of the total watershed area by decade, and compared this to the response curve from Grant et al. (2008). The mean response line crosses the 10% peak flow detection limit when 19% of the watershed is open from either roads or harvest. Although we recognize there are some uncertainties in modeling, we are not aware of any better methods to evaluate the potential for increases to peak flow.

Table 82. ROS watersheds susceptible to increases in peak flow by decade by ESU/DPS.

ESU/DPS	Number of ROS watersheds in ESU/DPS	Number of watersheds susceptible to increases in peak flow by decade	Number of watersheds susceptible to increases in peak flow by decade
OC coho salmon	262	22	3-4
SONCC coho salmon	146	2	1
LCR Chinook salmon	34	3	1
LCR coho salmon	34	3	1
LCR steelhead	28	3	1
UWR Chinook salmon	122	14	1-3
UWR steelhead	111	11	1-2
Eulachon*	146-262	2-22	1-4

* Outside of the Columbia River, the Umpqua River subpopulation of eulachon overlaps with the OC coho salmon and SONCC coho salmon ESUs. There is no distinct DPS boundary for eulachon in this subpopulation. Therefore, we assume the number of watersheds suspectible to increases in peak flow in the Umpqua River subpopulations range between the watersheds in the OC coho salmon and SONCC coho salmon ESUs.

Geomorphic changes in stream channels can be affected by the magnitude of flows. Geomorphically effective flows are defined as flows that affect bedload sediment transport. Flows that are large enough to alter channel morphology, bank erosion, or habitat structure have the highest likelihood of affecting fish (Grant et al. 2008). 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, 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, 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.

As summarized above, only a subset of watersheds are predicted to have increases in peak flow. LFH in these watersheds could be susceptible to these effects if flows are large enough to cause geomorphic effects; however, this will not occur during all rain events. In addition, the number of watersheds affected over a 50-year period range from 2 to 22, and number of watersheds affected in any given decade range from 1-4, and will be spatially separated. As the effects of peak flows attenuate (10-20 years after harvest), there will be temporal separation which will ameliorate some of the effects on LFH.

Withdrawing water for dust attenuation during hauling is likely to temporarily decrease the amount of available instream habitat. The amount of habitat decrease from water withdrawals would depend on the amount of stream flow, how much water is withdrawn, and the duration of water drafting. When large amounts of water are withdrawn (*e.g.*, greater than 10% of flow), slight water elevation drops may occur on larger rivers and streams. On smaller streams, shallower riffles and pools are likely to result from water withdrawal, leading to the temporary loss of margin habitat and instream cover. These adverse effects are most likely to occur in smaller streams (less than about 10 cubic feet per second of discharge), and to persist only during the periods of time that dust abatement vehicles are actively pumping water to refill their tanks.

Water trucks used for dust abatement, commonly hold 500 gal of water, with a withdrawal rate of up to approximately 7.5 gal sec^{-1}.[10] This means the maximum withdrawal would last at least approximately 67 sec, and the maximum withdrawal period commonly is less than 5 min at lower rates of withdrawal.[10] The BLM did not propose Management Direction that is specific to water withdrawals; however, it proposed the following relevant BMP:

> 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." R60

In addition, in the BA (USDI BLM BA 2016) indicated water withdrawal activities will follow the PDC identified in the 2011 WORP consultation for water withdrawals. That PDC is as follows: When pumping water from streams with ESA-listed fish, ensure that withdrawals do not reduce flows by more than 10%." Although the WORP consultation (NMFS WORP 2011c) has expired,[39] in areas where listed fish or critical habitat may be affected by this activity, in the context of this PRMP consultation, BLM has undertaken to implement rock quarry activities consistent with the requirements in the proposed action of the WORP replacement programmatic consultation as well as any terms and conditions for an incidental take statement that might accompany the opinion.[40] Based on the history of WORP programmatics and our knowledge of

[39] In the BA for the PRMP, BLM undertook to follow the WORP conservation measures and terms and conditions.
[40] July 8, 2016 email from R. Hardt (BLM) to K. Phippen (NMFS) clarifying BLM's consistency with the future WORP replacement programmatic design criteria and terms and conditions.

the ongoing replacement consultation, we assume the new programmatic will incorporate conservation measures for water withdrawals that are materially similar to those in the 2011 WORP. We therefore interpret the proposed action to include commitments to such conservation measures.

In other streams, the BLM will ensure at least 50% of the original stream flow remains below the pumping site. While discharge to LFH will likely be reduced (<10% change) for short periods of time (<5 min)[41], the magnitude of flow reductions is not expected to be large 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.

Road Work effects on peak/base flows. Roads can affect the rate that water is discharged and routed to a stream. Compaction of soils from construction of new access roads or skid trails results in less infiltration and greater overland flow (Grant et al. 2008). When this increased flow is intercepted by road networks that cross subsurface flowpaths and change flow routing, both the peak magnitude and time of peak concentration can change in a watershed (Grant et al. 2008). This effect should roughly scale with percentage of area compacted or length of road network that is directly connected to streams or both (Wemple et al. 1996) but is highly dependent on the location of roads in the landscape (Wemple and Jones 2003). Routing is predominantly affected by road and ditch networks (Harr et al. 1975, Jones and Grant 1996).

The BLM proposes the following Management Direction that would minimize the amount of runoff to streams:

- Allow road construction, and stream crossings where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives. In addition to the Management Direction that limits road construction in the RR, the BA says “It is extremely unlikely that any new road or landing construction would occur within the inner zone of a RR. BLM’s recent experience is that most road construction or renovation to provide access for RR thinning projects occurs in what would be the outer zone (at least 50 feet from intermittent streams and 120 feet from perennial streams), or entirely outside of the RR.”
- 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[42].

The following are a subset of the BMPs that are applicable for road work:

- Locate roads and landings on stable locations, ridge tops, stable benches, or flats, and gentle-moderate slopes.

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[41] December 10, 2010, telephone discussion between Chuti Fiedler, USFS, and Scott Lightcap, BLM concerning pump chances and several other categories of activity.

[42] Although this Management Direction is specific to minimizing sediment inputs to streams, it also minimizes runoff from reaching streams.

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.

Luce and Black (1999) found that incorporating design features such as cross-drains and ditch-relief culverts into roads reduced the hydrological connection of these structures. Forest vegetation buffers flow and prevents sediment from reaching streams (Copstead and Johansen 1998).

The Management Direction and the application of BMPs proposed by the BLM, in particular, the construction and spacing of cross drains and ditches (Luce and Black 1999) will minimize the amount of runoff to streams. This is because adding and spacing cross drains appropriately ensures that only a small portion of the road (less than 200 feet) is capable of routing water to streams. In addition, the PRMP includes a BMP that would direct runoff from cross drains to vegetated slopes. This would minimize the likelihood of the last 200 feet of runoff from the ditchline from reaching the stream. This is because the vegetated slope would buffer the flow and prevent runoff from reaching the stream (Copstead and Johansen 1998).

Road decommissioning can ameliorate the effect of increases in peak flows to the streams caused by new road construction by disconnecting runoff from previous roads to streams. Road decommissioning will include blocking the road, out-sloping and adding waterbars for drainage control, ripping and sub-soiling the road bed, culvert removal, and replanting the roadbed. Roads that receive full decommissioning (ripping and sub-soiling) will have the most beneficial effect of reducing runoff to streams. The fully decommissioned roads will be provide a long-term benefit of decreasing peak flows to streams by disconnecting these roads from the stream.

Timber and Rock Hauling effects on peak/base flows. The complex process of water routing can be modified by compaction of soil, and hauling may increase compacted soil at landings, and on temporary and permanent roads. The BLM did not identify the total number of miles of roads that could be used for hauling, but indicated that any of the roads (BLM roads and all other non-BLM roads) in the decision area could be used for hauling. The effects of timber hauling are connected with the effects of roads, and the effects of road work on peak flows are discussed fully in the section above. The application of BMPs described in the road work section, including the installation of additional cross-drains and ditch-relief culverts will minimize the hydrologic connectivity of roads to the stream network, and will partially ameliorate the effects of peak flow on streams. The Management Direction applies to all roads, including the non-BLM roads that could be used for hauling, as would the BMPs when applied.

Forest Management effects on Drainage Network Increase. Timber felling and timber hauling have no causal mechanism to affect an increase in the drainage network.

Timber yarding can affect the rate that water is discharged and routed to a stream, thus causing an increase in drainage network.

The BLM proposes Management Direction that maintains no-cut buffers of either 50 and 120 feet for streams in the action area, depending on stream type and subwatershed class; limits ground-based yarding to slopes less than 35%, and will exclude ground-based machinery for timber harvest from at least 50 feet from streams. In addition, the BLM proposes the following BMPs to minimize the likelihood of runoff reaching streams:

- Maintain the minimum percent of effective ground cover needed (20-75% depending on Natural Resources Conservation Services Erosion Hazard Rating[43] to control surface erosion, following forest management operations. Ground cover may be provided by vegetation, slash, duff, medium to large gravels, cobbles, or biological crusts.
- Apply erosion control measures to skid trails and other disturbed areas with potential for erosion and subsequent sediment delivery to waterbodies, floodplains, or wetlands. These practices may include seeding, mulching, water barring, tillage, and woody debris placement.
- Design yarding corridors crossing streams to limit the number of such corridors, using narrow widths (12-15 feet), and using the most perpendicular orientation to the stream feasible. Set yarding corridor spacing where they cross the streams to no less than 100 feet apart when physical, topography, or operational constrains demand, with an overall desire to keep an average spacing of 200 feet apart.

Wear et al. 2012 showed that adding slash, mulch, and grass seed prevented runoff to streams.

The Management Direction and BMPs proposed by the BLM, in particular adding erosion control measures to skid trails (seeding, mulching, water barring, tillage, and woody debris placement) will ensure that most runoff from yarding will not reach streams. This is because the erosion control techniques will help intercept water and prevent erosion (Burroughs and King

[43] Rating obtained from Natural Resources Conservation Services County Soil Survey information by map unit.

1989, Corbett and Lynch 1985, Gomi et al. 2005, and Lakel et al. 2010) of any runoff, thus minimizing any increase in drainage network.

Roads can affect the rate that water is discharged and routed to a stream, thus causing an increase in drainage network. This effect should roughly scale with percentage of area compacted or length of road network that is directly connected to streams or both (Wemple et al. 1996) but is highly dependent on the location of roads in the landscape (Wemple and Jones 2003). Routing is predominantly affected by road and ditch networks (Harr et al. 1975, Jones and Grant 1996).

The BLM proposes the following Management Direction that would minimize the amount of runoff to streams:

- Allow road construction, and stream crossings where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives In addition to the Management Direction that limits road construction in the RR, the BA says "It is extremely unlikely that any new road or landing construction would occur within the inner zone of a RR. BLM's recent experience is that most road construction or renovation to provide access for RR thinning projects occurs in what would be the outer zone (at least 50 feet from intermittent streams and 120 feet from perennial streams), or entirely outside of the RR."
- 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[44].

The following are a subset of the BMPs that could be implemented for road work:

- Locate roads and landings on stable locations, ridge tops, stable benches, or flats, and gentle-moderate slopes.
- 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.
- 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.
- 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.
- 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

[44] Although this Management Direction is specific to minimizing sediment inputs to streams, it also minimizes runoff from reaching streams.

filters, sediment fences, and check dams to prevent or minimize sediment conveyance. Locate cross drains to route ditch flow onto vegetated and undisturbed slopes.

- 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.
- 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.

Luce and Black (1999) found that incorporating design features such as cross-drains and ditch-relief culverts into roads reduced the hydrological connection of these structures. Forest vegetation buffers flow and prevents sediment from reaching streams (Copstead and Johansen 1998).

In addition to the Management Direction that limits road construction in the RR, the BA says "It is extremely unlikely that any new road or landing construction would occur within the inner zone of a RR. BLM's recent experience is that most road construction or renovation to provide access for RR thinning projects occurs in what would be the outer zone (at least 50 feet from intermittent streams and 120 feet from perennial streams), or entirely outside of the RR." Other Management Direction and BMPs proposed by the BLM, in particular, the construction and spacing of cross drains and ditches (Luce and Black 1999) will minimize the amount of runoff to streams, thus minimizing an increase in drainage network. This is because adding and spacing cross drains appropriately ensures that only a small portion of the road (less than 200 feet) is capable of routing water to streams. In addition, the BLM proposes the BMP that would direct runoff from cross drains to vegetated slopes. This would minimize the likelihood of the last 200 feet of runoff from the ditchline from reaching the stream. This is because the vegetated slope would buffer the flow and prevent runoff from reaching the stream (Copstead and Johansen 1998).

Road decommissioning can ameliorate the effect of increases in drainage network caused by new road construction by disconnecting runoff from previous roads to streams. Road decommissioning will include blocking the road, out-sloping and adding waterbars for drainage control, ripping and sub-soiling the road bed, culvert removal, and replanting the roadbed. Roads that receive full decommissioning (ripping and sub-soiling) will have the most beneficial effect of reducing runoff to streams, and decreasing the drainage network. The fully decommissioned roads will be provide a long-term benefit of decreasing the drainage network by disconnecting these roads from the stream.

<u>Forest Management effects on Road Density</u>. Although road density is identified as an individual indicator, it is the effects from roads that are subject to our analysis. These effects include increased temperature, decreased in-stream wood recruitment, increased suspended sediment, increased peak flow, and increased drainage network, and are discussed fully above.

<u>Forest Management effects on Disturbance History and Regime</u>. Extensive forest management has created large areas of mid-seral classes of trees mixed among some remnant mature stands. The proposed thinning of plantations could accelerate the development of late successional stand characteristics and create larger blocks of mature forest, creating conditions that are more like those that occurred under the natural disturbance regime than current conditions. However, regeneration and salvage harvest will involve replacing entire stands of trees, totaling 33,373 acres per decade. The 232 miles of new, permanent roads, and 202 miles of temporary road per decade that will be constructed will represent a long-term disturbance. This is particularly true for the permanent roads because of their inherent permanence. The 372 miles of roads that will be decommissioned per decade will have some off-set from the construction of roads. The effects from timber harvest, road construction and decommissioning will be partially ameliorated due to the spatial and temporal separation of these activities.

<u>Forest Management effects on Riparian Reserves</u>. The Forest Management program activities intersect the riparian reserve LUA in various ways. Forest Management activities include the harvest of trees and this will occur adjacent to RR as well as within RRs. Tree harvest is constrained by the RR LUA and varies by the three Class subwatershed strategies. Under the PRMP, the RRs will be one site-potential tree (140-240 feet) for all stream types, except they are 50 feet for intermittent, non-fish-bearing streams. No-cut buffers will be applied on all streams. The BLM proposes different harvest prescriptions based on the three different sub-watershed classes. These sub-watershed classes are distributed across the planning area and previously described by ESU/DPS in Table 6 and Table 11. Class I, II, and III sub-watersheds have a 1 SPTH RR on fish-bearing and perennial streams. The fish-bearing and perennial streams in these classes will maintain a minimum 120-foot no-cut buffer. Thinning can occur between 120 feet and 1 SPTH, with a minimum of 30% canopy cover and 60 TPA. Thinning, selection harvest, regeneration harvest, and salvage can occur outside of 1 SPTH in the Harvest Land Base. Class I and II sub-watersheds have a 1 SPTH RR on intermittent, non-fish-bearing streams. The intermittent, non-fish-bearing streams will maintain a minimum 50-foot no-cut buffer. In Class I sub-watersheds, non-commercial thinning can occur between the 50-feet and 120-feet. Commercial thinning can occur between 120 feet and 1 SPTH, with a minimum of 30% canopy cover and 60 TPA. In Class II sub-watersheds, commercial thinning can occur between 50 feet and 1 SPTH, with a minimum of 30% canopy cover and 60 TPA. Class III sub-watersheds have a 50-foot RR on intermittent, non-fish-bearing streams. Thinning, selection harvest, regeneration harvest, and salvage can occur outside of the 50-foot no-cut buffer. Table 83 summarizes the no-cut buffers and RR based on watershed type.

Table 83. No-harvest buffers and riparian reserves for the three classes of watersheds.

Stream Type	Sub-watershed Class	Riparian Reserve (ft)	No-cut Buffer (ft)
Fish-bearing and perennial	I	1 SPTH	120
Intermittent, non-fish-bearing	I	1 SPTH	50
Fish-bearing and perennial	II	1 SPTH	120
Intermittent, non-fish-bearing	II	1 SPTH	50
Fish-bearing and perennial	III	1 SPTH	120
Intermittent, non-fish-bearing	III	50	50

The following habitat indicators affected by the proposed action are relevant to the RR indicator: temperature, woody material, pool frequency and quality, large pools, off-channel habitat, refugia, width to depth ratio, streambank condition and, floodplain connectivity. The effects of Forest Management on these indicators are described fully above.

2.4.2 Fire and Fuels

Under the proposed action, BLM may use prescribed fire and management of the vegetation as a surrogate to natural fire disturbance to promote and maintain desired forest stand structure, composition, and fire resistance. Fire and fuel reduction may occur throughout BLM lands, but is emphasized in the dry forest of southern Oregon. Fuel reduction in the Inner Zone is limited to removal of brush and trees less than 12 inches in diameter.

Programmatic direction for fire and fuels activities is analyzed below. The design criteria for fire and fuels activities are located in the ARBO II consultation (NMFS ARBO 2013). Fire and Fuel activities included within the proposed action do not cover wildfire suppression. Wildfire suppression activities are usually covered under an emergency consultation or the fire retardant opinion.

Controlled Burns

Controlled burns are a tool used by the BLM to control vegetation fuel loading within the planning area. BLM is proposing to authorize controlled burns with timber sales conducted in the spring and fall when fuel moisture and relatively humidity are high. Under these conditions, burns in riparian areas tend to occur in a mosaic pattern, leaving considerable unburned area and resulting in low tree mortality. Areas with the highest moisture levels, immediately adjacent to streams, tend to receive the least damage from fire. Effects from low to moderate intensity prescribed fire in riparian areas include minor reductions in stream shade, minor reductions in LW recruitment and inputs of fine sediment and nutrients to streams. In some cases, LW levels will increase due to prescribed fire (Chan 1998).

Although there is considerable research available on the effects of wildfire on streams and riparian areas, there is less information available on the effects of controlled burn, and considerably less on controlled burns within riparian areas. In an Atlantic coastal pine forest, Richter *et al.* (1982) concluded that prescribed fire had limited effects on nutrient cycling, soils, and hydrologic systems.

In the Payette National Forest in Idaho, the Joint Fire Science Program (2009) found that a prescribed fire conducted in the spring when fuels were moist had negligible effects on stream communities. However, they concluded that even the lowest severity wildfires produced changes in stream communities. Streamside buffers are often difficult to exclude from a prescribed burn, but the soil and vegetation are usually moist and do not burn. Prescribed fire effects in these forests on stream communities are negligible, at least when the riparian forest is not burned. They reached the following key findings:

- Habitat changes varied based on interactions of annual stream flow patterns and burn severity of the streamside forest.
- Changes in habitat were correlated with instabilities in macroinvertebrate communities.
- Macroinvertebrate communities in burned areas did not become similar to communities in unburned areas within 4 years after fire.
- Springtime prescribed fire effects on stream ecosystems were negligible and even lower than the effects observed after low severity wildfire.
- Riparian forest burn severity and extent were lower after prescribed fire than after wildfire, which may explain observed patterns.

In a recent 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. The fire was most severe in those areas with large accumulations of conifer litter and debris and usually self-extinguished when it came into contact with moist soil and characteristic riparian vegetation. The prescribed fire did result in a tenfold increase in bare ground and a significant decrease in understory vegetation, but did not result in a measurable decrease in riparian canopy cover. Mortality of trees in the riparian areas was low (4.4%). Fine sediment in pools did not increase as a result of the fire, but the authors note that relatively little precipitation occurred post-fire. Little to no response was observed in the macroinvertebrate community.

Fuels Reductions

Fuel reduction will occur primarily in the dry forest of Southern Oregon. Moist forests generally do not create crown disturbing fires, and do not need as much active management to prevent fires. Fuels reduction in terms of thinning is not allowed in the inner riparian reserves of moist forest for the purpose of fuels reduction.

Fuel reduction includes thinning from below small brush and trees less than 12 inches in diameter in the no-harvest inner zone. We reviewed the possibility that BLM may harvest larger diameter trees for the purpose of fuels reduction, especially around roads as a potential fuel break, but these projects do not stand alone and the effects are considered in the Forest Management Section listed above in Section 2.4.1 as part of commercial harvest.

Mechanical mastication and other forms of fuel reduction that physically remove small diameter trees would reduce potential for wood debris delivery to streams. Management direction does not allow fuels reduction treatments within 60 feet of any perennial or fish-bearing stream and also requires a minimum 50 percent canopy cover within the inner zone of a fish bearing or perennial stream during fuels reduction. Intermittent streams may have thinning and fuel reduction treatments occur throughout the 50 foot inner zone. Fuels reductions in the inner zone of the riparian reserves are limited to dry forest in southern Oregon. Again, dry forest are only located in Southern Oregon in the South River Field Office of the Roseburg District, the Medford District, and the Klamath Falls Field Office of the Lakeview District.

Fire and Fuels effects on Temperature and Large Wood

As discussed in the temperature effects analysis of the Forest Management Section 2.4.1, we do not expect a shade loss unless forest canopy is reduced below 40%. Removing brush and small trees while maintaining a canopy of 50% is not likely to create a shade loss of 3% (Table). Similarly, we do not expect a loss of large wood in the inner zone with limitations of the 60' buffer on perennial and fish-bearing streams and thinning limited to small trees and brush thinned from below on all streams. The overall increase in large wood and resilience to fires over the long term will outweigh the short-term effects of fuels thinning.

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. Sediment is greatly filtered by duff and vegetation remaining in the inner buffer of the riparian reserve. This reduces the potential for fine sediment delivery to stream channels.

We expect some fine sediment will enter stream channels as a result of Fire and Fuels program. Increased deposits of sediment are expected to be higher in the first fall rains, but may also disperse each winter storm throughout the winter. Sediment may pulse throughout the stream with the highest concentration near the controlled burn, and slowly move downstream with each storm event. Many of the effects of sediment increases will be masked by back ground sediment inputted by the storm event. Management direction with subwatershed classification buffers, restrictions on mechanical use in riparian reserves, and vegetation growth in the early fall will limit the potential impacts to the stream. Again, the only areas that allow burning in the inner zone of the subwatershed classifications occur in the dry forest, which is limited to the South River Field Office of the Roseburg District, the Medford District, and the Klamath Falls Field Office of the Lakeview District in Southern Oregon.

2.4.3 Fisheries (Watershed Restoration)

The BLM's PRMP in some circumstance may require tree tipping and tree falling in the riparian reserves in conjunction with commercial timber sales. Additionally, BLM will implement large wood placement restoration projects throughout the action area. BLM will follow their Western

Oregon Aquatic Restoration Strategy (USDI BLM 2015b) to determine sites for large wood restoration projects. The strategy uses the concept "intrinsic potential" to define a set of habitat features that most influence whether habitat is selected or used by an individual species. BLM will also follow the project design criteria identified in ARBO II opinion (NMFS ARBO 2013) during large wood restoration projects. The effects of large wood restoration is analyzed below.

Under the proposed action, BLM will require up to 15 square feet of basal area tree tipped or tree falling into stream channels when these channels are determined by the fish biologist to benefit from wood introduction. Fifteen square feet of basal area equivalency in trees is estimated to be about 6 or 7 twenty-inch diameter breast height trees. Logs may also be obtained from upland sites from road construction, wind fall or danger trees. Wood placement will occur in streams in Class I, II and III subwatersheds.

Under the proposed action, the BLM will require contractors to tree tip or tree fall up to 15 square feet of basal area of trees per acre. The inner zone of all Class I, II, and III subwatersheds is 120 feet in width, where one acre correlates to 363 linear feet of stream (363 feet *120 feet =1 acre). So within an acre of inner zone, BLM contractors will tree tip or fall no more than one tree on average every 52 feet of stream distance. Some tree clumping may also occur in heavily stocked stands. Stocking density in most riparian stands vary from 140 to 400 trees per acre, such that removal of few trees per acre is minimal to the overall riparian stand stocking density.

The design criteria in ARBO II opinion (NMFS ARBO 2013) requires that large wood placement occur during the ODFW 2008 or most recent guidelines for in-water work. Generally, this period occurs during the summer from beginning of July through September. This limits work when ESA listed fish are not spawning and minimized the effects to the species.

Land management actions such as logging, road building, stream clearing, and splash damming carried out over the last 150 years have greatly reduced the amount of LW and boulders in streams in Oregon and Washington (McIntosh *et al.* 1994). BLM PRMP proposes tree tipping or falling as an activity to return these important elements to stream ecosystems. Addition of large wood is a common and effective restoration technique used throughout the Pacific Northwest (Roni *et al.* 2002). Roni and Quinn (2001a) found that large wood placement can lead to higher densities of juvenile coho salmon during summer and winter and higher densities of steelhead and cutthroat trout in the winter. These authors also found that addition of LW to streams with low levels of wood can lead to greater fish growth and less frequent and shorter fish movements (Roni and Quinn 2001b).

Live conifers and other trees can be felled or pulled/pushed over in the riparian reserves and upland areas for in-channel large wood placement. This action would result in increased large wood in streams.

Large wood structures will increase stream habitat complexity, increase overhead cover, increase terrestrial insect drop, and help reestablish natural hydraulic processes in streams. Large wood, in a stream can accomplish multiple purposes by trapping gravel above the structure, creating pools and increasing the connection with the floodplain vegetation.

Some sediment may enter the stream during tree tipping, especially when trees are in close proximity to the stream. Erosion may occur around the tree trunk, and potential at banks when current is deflected. The sediment input will most likely occur in the first few storms of the fall, and is limited to a small area near the fallen tree. This input of sediment will continue to pulse throughout the downstream reaches with each new storm event. Some fine sediment may fill interspatial areas closest to the trees, but will become immeasurable as the sediment pulses downstream with each storm event settling within eddies and pools.

The small amount of trees per acre that BLM is proposing for wood restoration is unlikely to reduce canopy cover because stand density in riparian reserve range from 140 to 400 trees per acre and only a few trees per acre are proposed for tree tipping/falling. We do not expect a measurable change in temperature from tree tipping without a significant reduction in stand density (overall less than 40% canopy cover (see temperature analysis in Forest Management above).

The proposed design criteria and conservation measures ensure that the BLM will place large wood in a natural manner to avoid unintended negative consequences. This activity category will result in numerous long-term beneficial effects including increased cover and pool habitat areas.

2.4.4 Invasive Species

The PRMP invasive species program anticipates activities that will comply with the ARBO II Opinion, together with some applicable management directives. The specific invasive species activities that will occur under the PRMP have already been consulted on (and resultant incidental take exempted) and thus, as noted in the baseline section, we incorporated by reference relevant portions of the ARBO II Opinion. The PRMP also provides some programmatic direction with respect to the invasive species program. The management directives are as follows:

- 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.
- Apply state-of-the art, integrated pest management prescriptions for the treatment of all identified sudden oak death (*Phytophthora ramorum*) infection sites.

These management directives are consistent with the goals and import of the ARBO II invasive plant program and therefore we also rely here on the analysis of that program as set out in the ARBO II Opinion. We also incorporate by reference applicable portions of the Noxious Weed Control Program and the Vegetation Treatments Using Herbicides EISs. We expect that the management directives will achieve the objectives of preventing the introduction and spread of invasive species and SOD. Although there may be some localized, short-term adverse effects associated with the implementation of the program, as described in the documents incorporated by reference, we expect that, on balance, the program will have a beneficial effect.

2.4.5 Livestock Grazing

Under the proposed action, livestock grazing will occur in the Medford District, Klamath Falls District and the Coos Bay District. Although no grazing allotments would be available for grazing leases in the Coos Bay District under the PRMP, there is grazing in the Coos Bay District authorized under a Cooperative Management Agreement. The BLM has completed consultation on a Cooperative Management Agreement Area located in New River (NMFS: NWR-2002-1058). The Klamath Falls grazing allotments are located in southern Oregon well upstream of anadromous distribution. All NMFS trust resources related to ESA-listed fish species inhabit the Klamath River downstream of Irongate Dam within the Klamath River. Any effects on the environment do not transfer downstream of Irongate Reservoir. Therefore, the effects and our analysis are limited to the allotments in the Medford District.

Livestock Grazing effects on Riparian Vegetation

Numerous symposia and publications have documented the detrimental effects livestock grazing can have on stream and riparian habitats (Johnson *et al*. 1985; Menke 1977; Meehan and Platts 1978; Cope 1979; American Fisheries Society 1980; Peek and Dalke 1982; Ohmart and Anderson 1982; Kauffman and Krueger 1984; Clary and Webster 1989; Gresswell *et al.* 1989; Kinch 1989; Chaney *et al*. 1990, Belsky *et al*. 1999). These publications describe a series of additive effects that can result when cattle over-graze or impact riparian areas. Over time, woody and hydric herbaceous vegetation along a stream can be reduced or eliminated and livestock trampling causes streambanks to collapse. Without vegetation to slow water velocities, hold the soil, and retain moisture, flooding causes more erosion of streambanks; the stream becomes wider and shallower and in some cases downcut; the water table drops; and hydric, deeply rooted herbaceous vegetation dies out and is replaced by upland species with shallower roots and less ability to bind the soil. The resulting is instability in water volume, increased summer water temperature, loss of pools and habitat adjacent and connected to streambanks, and increased substrate fine sediment and cobble-embeddedness.

In areas of historic season-long grazing, major vegetation changes can take place. Routinely grazing an area too late in the growing season can cause adverse changes in the plant community. Individual plants are eliminated by re-grazing them during the growing season and not allowing adequate recovery after grazing. Herbaceous vegetation consumed by livestock in July, August, and early September will generally not begin re-growing until Fall (September 15 or later). Some habitat functions of this vegetation such as providing shade and cover will be lost during the summer, however 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) provide the management direction for BLM that will allow for the long-term vigor of the plants through cattle grazing restrictions in the riparian reserve.

Stream cover and shade in hardwood-dominated riparian systems can also be damaged by unmanaged livestock grazing. Shrubby vegetation, such as willows, may be an important source of shade along smaller streams and in mountainous areas (Henjum *et al*. 1994). Cattle often begin to browse woody species when herbaceous stubble heights fall below about 4 inches (Hall and Bryant 1995). Others suggest that 4 to 8 inches of herbaceous residual stubble height may be needed to protect hardwoods, especially during late season grazing (Clary and Leininger 2000). In a study of late season grazing in the Blue Mountains of eastern Oregon, Kauffmann *et al.* (1983) found that shrub use was generally light except on willow-dominated gravel bars. They conclude that on gravel bars, succession was retarded by livestock grazing. In a later study in the same area, Green and Kauffman (1995) found that livestock disturbance and the ecosystem response to grazing were highly variable among plant communities. In areas rested from grazing, abundance of undesirable non-native species decreased. They also found that in grazed areas, height, establishment, and reproduction of woody species on gravel bars was less than in ungrazed areas. These studies suggest that although livestock grazing may not have adverse effects on mature individuals of woody species such as willows, recolonization of disturbed areas such as gravel bars may be impeded by livestock grazing. Another study with similar results found that regeneration of willow, cottonwood, and aspen was inhibited by browsing on seedlings (Fleischner 1994).

It is also important to note that cattle generally prefer herbaceous vegetation over woody vegetation, so the setting and meeting of appropriate stubble height endpoint indicators is an important tool to reduce shrub browsing by livestock. BLM will use management direction indicators such as stubble height to determine cattle herd rotation, the need for fencing, mineral supplements in the upland such that cattle are moved away from the riparian reserves such to minimize the grazing conversion to woody material.

Livestock Grazing effects on Shade and Stream Temperature

Water temperature is an important factor affecting distribution and abundance of salmonids within the action area. Stream temperature is influenced by a number of factors including site conditions, weather, riparian vegetation, and input of solar radiation. Solar radiation is the most important source of radiant energy affecting stream temperature. Removal of riparian vegetation can decrease shade which increases the amount of solar radiation reaching streams. Stream temperature is also affected by stream width-to-depth ratio, condition of riparian soil, and hydrograph. All of these factors are potentially affected by livestock grazing. Our analysis of the combined effect of these factors on stream temperature is presented below.

When riparian vegetation is removed by grazing, sunlight reaching streams can increase, leading to cumulative increases in downstream temperatures (Barton *et al*. 1985). Li *et al*. (1994) found that trout abundance decreased as solar input and water temperature increased. Warming of streams from loss of riparian vegetation is likely widespread in eastern Oregon and may be particularly acute because of low summer flows and many cloud-free days. These conditions are very similar to the dry forest of Medford.

Alteration of stream temperature processes may also result from changes in stream channel morphology. Streams in areas that are improperly grazed are wider and shallower than in ungrazed systems, exposing a larger surface area to incoming solar radiation (Bottom *et al.* 1985; Platts 1991). Wide, shallow streams heat more rapidly than narrow, deep streams (Brown 1972). Reducing stream depth may expose the stream bottom to direct sunlight, allowing greater heating of the substrate and subsequent conductive transfer to the water. Properly managed grazing allows for the establishment of healthy riparian vegetation which in turn allows streambanks to stabilize. Overtime, vegetation traps sediments, streambanks rebuild and channels begin to narrow. As streams channels regain a more natural morphology, stream temperatures will decrease.

Changes in a stream's hydrograph can also affect stream temperature. For instance, a shift in peak stream flow earlier in the season can reduce stream flow in summer, with a coincident increase in temperature due to reduced stream volume. Compaction of riparian soils by livestock can reduce water infiltration and decrease the amount of water released back into the stream from riparian areas during base flows. Proper management of grazing can help minimize these effects. In particular, using a combination of techniques, such as herding, can manage or restrict the amount of time cattle remain in riparian areas. This can lead to less soil compaction and greater water-holding capacity of riparian soils. If grazing intensity on riparian areas is properly controlled, the natural action of plant roots will alleviate soil compaction.

Management direction such as herding, fencing, minerals placed in the uplands for attractants to the cattle, etc. will provide measures to keep cattle in the upland areas, but will not completely remove the cattle out of the riparian reserves, Therefore, it is probable that livestock grazing will occur, mostly likely affected high mountain meadows where cattle can eat grasses that are shading small streams. This can result in small, measurable increases in water temperature in streams with narrow channels (less than 10 feet) where grass and grass-like vegetation are providing the primary stream shade. The loss of shade will occur as a result of reducing the height of shade-producing vegetation by grazing. The use of endpoint indicators such as *stubble height* and *shrub browse* helps to minimize this effect, but does not eliminate it (USDI BLM 1997). Additionally, the new subwatershed classifications from the PRMP require 120' no-harvest buffers on all perennial and fish-bearing streams that will provide forest vegetation buffers to provide shade cover, thus reducing the potential for increase shade from loss of grasses from cattle. We expect the increase in temperature to be limited to the streams high in the watershed where streams are small, and this temperature effect only effects this stream reach until the water travel downstream to reach a confluences of another cold water stream. The riparian buffers of 120' on all perennial and fish bearing streams in the subwatershed classification provided in the riparian reserves management direction in the BLM PRMP will also continue to provide forested shade to streams in the watershed providing cool water such to reduce the effect of any minor increases in upstream stream temperature from cattle grazing, especially where critical habitat occurs.

Livestock Grazing effects on Sediment and Suspended Fine Sediment

Grazing by large herbivores can result in hoof shear to streambanks (McIver and McInnis 2007) and trampling and consumption of streamside vegetation. Cattle trampling on streambanks or exposing bare soil and subsequent erosion adds fine sediments to stream substrates. Mass wasting of sediment may occur along streambanks where livestock walk on overhanging banks (Behnke and Zarn 1976; Platts and Raleigh 1984; Fleischner 1994). Concentrated use of an area by livestock can create trails and expose bare soil which is later washed into streams during precipitation events.

The amount of fine sediment introduced into streams by livestock grazing at any one time will be small. This is because the BLM's proposed grazing strategy under the PRMP will allow for ground cover to be maintained or increase over time. Pulses of sediment are likely to be small and last for a short time. Fine sediment is usually introduced to streams during high flows when background levels are also high from fall and winter storms. Although the creation of fine sediment during low flow may occasionally interrupt juvenile behaviors such as feeding, these interruptions will not be significant enough to reduce juvenile coho salmon survival.

The primary method to reduce the introduction of fine sediments from livestock grazing is to limit streambank trampling. BLM will use management direction such as fencing, rotation grazing with multiple pastures, herding, upland water sources, and other measures to minimize the amount the amount of time cattle enter the riparian reserve.

The cattle grazing will result in a small amount of fine sediment entering streams. This fine sediment will be primarily generated by streambank trampling and exposure of bare soil by livestock. Trampling will occur at locations where streambanks are composed of soils or soil and rock mixtures. Establishing proper streambank alteration indicators in combination with the other management measures, such as the fence construction and herding, intended to manage or restrict the amount of time livestock spend in riparian areas will substantially reduce the amount of fine sediment introduced into streams.

Livestock Grazing effects on Prey Base

The cold-water communities (aquatic invertebrates and other cold-water fish) which rearing juvenile coho salmon rely on for food require minimum dissolved oxygen levels of between 6 and 8 mg/L (ODEQ 1995). In streams without adequate riparian vegetation, temperatures increase and dissolved oxygen levels drop. Cold water communities shift from salmonids and less tolerant aquatic invertebrates such as mayflies and stoneflies to warmer water species dominated by sculpins and more tolerant aquatic invertebrates such as chironomids. A study by Li *et al*. (1994), in the John Day River basin, found that colder streams supported the highest standing crops of trout and had the most favorable trout-to-invertebrate standing crop ratios. This suggests that colder streams in this basin have a greater trophic efficiency leading to increased salmonid production.

As discussed above, a reduction in riparian canopy increases solar radiation and stream temperature. This stimulates production of periphyton (Lyford and Gregory 1974). In a study of high desert streams, Tait *et al*. (1994) found that prey less palatable for trout dominated the food base in warm water stream reaches exposed to sunlight. In this study, Tait *et al*. (1994) reported that thick growths of filamentous algae encrusted with epiphytic diatoms were found in reaches with high incident solar radiation, whereas low amounts of epilithic diatoms and blue-green algae occurred in shaded reaches. Periphyton biomass was significantly correlated with incident solar radiation. While densities of macroinvertebrates in forested streams typically increase in response to increased periphyton production, the effect of stimulated algal growth in rangeland streams is less clear. Tait *et al.* (1994) found that biomass, not density, of macroinvertebrates was greater in reaches with greater periphyton biomass. The higher biomass was a consequence of many *Dicosmoecus* larvae, a large-cased caddisfly, which can exploit filamentous algae. Consequently, any potential benefits of increased invertebrate biomass to organisms at higher trophic levels, including salmonids, may be small, because these larvae are well protected from fish predation by their cases. Tait *et al.* (1994) suggest that these organisms may act as a trophic shunt that prevents energy from being transferred to higher trophic levels.

Reducing riparian vegetation can reduce habitat for terrestrial insects, an important food for juvenile salmonids (Platts 1991). Riparian vegetation also directly provides organic material to the stream, which makes up about 50% of the stream's nutrient energy supply for the food chain (Cummins 1974). This allochthonous material provides an important food source for aquatic insects which, in turn, become prey for salmonids. Consequently, removal of riparian vegetation can affect the diet of fish by reducing production of both terrestrial and aquatic insects (Chapman and Demory 1963).

These studies underscore the need to manage grazing in a manner that allows for the establishment of healthy riparian vegetation. The studies discussed above demonstrate that streams with functioning riparian plant communities produce more suitable food for rearing juvenile coho salmon. Increased survival of coho salmon at the juvenile stage is needed to improve population abundance and productivity for populations that are not meeting the recovery criteria. Removal of streamside vegetation through livestock grazing will usually result in small decrease in the amount of food available to coho salmon.

The BLM proposes management direction that requires allotments be managed in accordance with Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997), which requires that allotments, including riparian areas, not be allowed to be overgrazed. The PRMP would make some grazing allotments unavailable for livestock grazing. As outlined in the previous discussions on riparian vegetation, these indicators were developed to maintain plant vigor and allow proper riparian function. Additionally, the BLM proposes a number of management practices to manage or restrict the amount of time livestock spend in riparian areas, including the proposed fencing. The BLM also proposes implementation and effectiveness monitoring to ensure that these practices are carried out and are having the desired results. Implementation of these practices will allow for the development of a healthy riparian plant community in streams that are recovering and maintenance of a healthy plant community in streams with properly functioning riparian areas. Over time, as riparian plant communities recover, the amount of food available to juvenile coho salmon should increase.

As discussed above, fine sediment resulting from livestock trampling banks can reduce benthic invertebrate abundance (McIver and McInnis 2007). Studies have shown that sediment inputs resulting in substrate embeddedness of greater than one-third can result in a decrease in benthic invertebrate abundance and thus a decrease in food available for juvenile salmonids (Waters 1995). As noted earlier, establishment of streambank alteration indicators in combination with other management practices, such as fencing and herding, that manage or restrict the amount of time livestock spend in riparian areas should significantly limit the amount of fine sediment introduced into streams.

Livestock Grazing effects on Large Woody Debris

Large woody debris is a key component of coho salmon freshwater habitat (Spence *et al.* 1996). In streams within the action area, large wood is usually provided by fallen conifers. The proposed action will have no effect on conifer recruitment. However, in some areas where hardwoods can play an important role in riparian species composition, ungulate grazing can prevent future large wood recruitment by limiting sapling regeneration and large tree recruitment. Large wood pieces provide essential habitat functions. LWD dissipates stream flow energy, and causes deep scour pools.

Cattle grazing will likely result in negative effects to future large woody debris recruitment. The effects will likely be observed in areas where cattle graze along low-gradient stream sections that have an open canopy and potential to develop a hardwood community. As older trees die and decay, they cannot be replaced if seedlings and root sprouts are removed. In addition to woody debris, broadleaved trees provide shade and forage input to streams. Negative impacts to the large woody debris indicator will be kept to a minimal by use of management direction provided in BLM's rangeland guidance (USDI BLM 1997), such as fencing and herding, designed to reduce the time livestock spend in riparian areas. However, where grazing allotments allow cattle to exceed the amount of grasses in a riparian reserve, cattle then graze on small herbaceous wood. The PRMP will off-set this loss by providing the newly proposed subwatershed classification that protect forested no-harvest buffers of 120' on perennial and fish bearing streams, and 50' on intermittent streams. The loss of hardwood recruitment to cattle is limited to the grazing allotments in the BLM Medford District (Table 28). These allotments are located on 64.7 miles of SONCC coho salmon critical habitat (Table 29).

Livestock Grazing effects on Nutrients

Nutrients consumed by cattle elsewhere on the range are often deposited in riparian zones (Heady and Child 1994). The deposition of nutrients in riparian areas increases the likelihood that elements such as nitrogen and phosphorous will enter the stream. Increased nutrients from livestock waste will likely increase stream productivity for a short distance downstream from the source. The BLM developed rangeland standard and guidelines to manage or restrict the amount of time livestock spend in riparian areas such as fencing, herding, salt blocks away from riparian reserves, etc. (USDI BLM 1997). When considered collectively, these rangeland standards and guidelines will minimize the amount of waste livestock deposit in streams and riparian areas.

Livestock Grazing effects on Water Quantity

Riparian vegetation has been linked to the water-holding capacity of streamside aquifers (Platts 1991). As riparian vegetation is removed by livestock grazing and streamside soils are compacted by livestock hooves, the ability of areas to retain water can decrease. Evapotranspiration and infiltration decrease and hasten surface runoff, resulting in a more rapid hydrologic response of streams to rainfall. When this occurs, high flows in the spring tend to increase in volume, leading to bank damage and erosion. Summer and fall base flows are decreased, often resulting in flows that are insufficient to provide suitable rearing habitat for juvenile salmonids. If aquifers lose their capacity to hold and slowly deliver water to the stream, differences between peak and base discharge rates increase dramatically (EPA 1993). Some streams that typically flowed perennially may experience periods of no flow in the summer or fall. Li *et al*. (1994) found that streamflow in a heavily grazed eastern Oregon stream became intermittent during the summer, while a nearby, well-vegetated reference stream in a similarly sized watershed had permanent flows. They suggested that the difference in flow regimes was due to diminished interaction between the stream and floodplain, with resultant lowering of the water table.

As stated earlier, proper management of grazing can help minimize soil compaction and potential changes in peak/base flow (USDI BLM 1997). In particular, using a combination of techniques, such as fencing and herding can manage or restrict the amount of time cattle remain in riparian areas. This can lead to less soil compaction and greater water-holding capacity of riparian soils. If grazing intensity on riparian areas is properly controlled, the natural action of plant roots will alleviate soil compaction. The stream buffers if 120'foot on perennial and fish bearing streams and 50 foot buffers on intermittent streams will also provide adequate vegetation to add root strength and additional soil filtration such to aid in water holding capacity. Additionally, the PRMP requires allotments be managed in accordance with Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (USDI BLM 1997), which generally limit grazing when soil moistures are high and could result in compaction. Although there may be some minor effects to water quantity in the short term, riparian function and water holding capacity is expected to maintain under the proposed grazing management.

2.4.6 Minerals

The proposed action addresses management of three types of minerals. They are as follows:

1. *Salable Minerals* - include common variety quarry rock used in construction and road surfacing, sand and gravel, clay, and volcanic pumice and cinders.
2. *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, provides for prospecting, exploring, and developing locatable minerals on lands open to mineral entry.
3. *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. Most often referred to as energy minerals.

Salable Minerals

The majority of salable resources used in Oregon are common rock for aggregate used for on construction and road surfacing; although a few sites are for pumice, sand, gravel, or dimension stone. Before any new rock quarry can proceed it will require a specific authorization from BLM, which will trigger its own consultation with NMFS for coverage under the ESA. However, we analyze the programmatic effects of the PRMP regarding new quarries below.

Rock quarries provide rock and gravel for use in road construction and maintenance across Federal and Tribal lands and for the sale of rock material. Activities within existing quarry boundaries include restoration, rehabilitation, drilling, blasting, crushing, sorting, loading, hauling on new or existing roads, and stockpiling material from road maintenance, slides, decommissioned roads, as well as aggregate for road surfacing.

Rock quarry activities can generate sediment when pits are excavated, and the material is crushed, piled, and hauled. Sediment is most likely to enter streams from quarries within a distance of 150 feet. Quarries outside of riparian areas may transport sediment via road ditches if the ditches are connected to streams. Although the WORP consultation (NMFS WORP 2011c) has expired,[45] in areas where listed fish or critical habitat may be affected by this activity, in the context of this PRMP consultation, BLM has undertaken to implement rock quarry activities consistent with the requirements in the proposed action of the WORP replacement programmatic consultation as well as any terms and conditions for an incidental take statement that might accompany the opinion. [46] Although implementing these measures may reduce erosion risk (except under unusual circumstances, such as when gravel is needed for emergency road repair), some sediment is likely to reach streams that include or are tributary to LFH.

Quarries placed on riparian reserves can knock down trees reducing the shade potential and wood recruitment of the reserve. Large wood can increase complexity and structure in the stream aiding the juvenile salmonid chances for over winter survival. Loss of shade increases temperature causing additional stress on summer rearing juvenile salmonids. The effects of increased temperature and wood reduction are discussed in detail above in the forest management section listed above.

The use and refueling of heavy machinery that is working within 150 feet of a streambanks during quarry operations present risks that fuel, lubricants, hydraulic fluids, or coolants may spill or leak into streams, or into streamside areas where they may be transported into waterways. The Proposed RMP includes BMPs to refuel heavy equipment at least 150 feet from streams and small equipment at least 100 feet from streams where practicable, develop spill response plans, and maintain spill response kits on-site. These measures reduce, but do not eliminate, the risk of contaminants being released into streams during fueling or from spills.

The PRMP will close 15 rock quarries to mineral development, of which 3 of these are located in the riparian reserves. The management direction in the riparian reserves will require 120’ buffers in perennial and fish bearing streams such that no new rock quarries are allowed in riparian reserves. Table 33 presents the future development of rock quarries in the next decade. We assume a similar amount of quarries in future decades. We assume in this consultation that if the BLM implements specific actions that include blasting which may affect listed fish or critical

[45] In the BA for the PRMP, BLM undertook to follow the WOPR conservation measures and terms and conditions.
[46] July 8, 2016 email from R. Hardt (BLM) to K. Phippen (NMFS) clarifying the intent to implement future WORP replacement programmatic.

habitat, that such actions will include measures that follow the blasting requirements in the proposed action for the new programmatic consultation. We assume the new programmatic will incorporate materially similar conservation measures and because the BLM has incorporated these undertakings in the PRMP context, we have interpreted them as part of the proposed action. Best management practices (BMPs) included in the new programmatic include practices associated with quarry work to only work in the dry. Also, management direction (Hydrology section 1.3.9.5) provide practices for vegetated ditch lines and relief culverts intended to filter sediment through vegetation. However, sediment derived from quarry road use and quarry operation is not completely filtered through vegetation and will reach streams. This sediment will cause minor adverse effects to streams especially for spawning habitats.

Locatable Minerals

The USDI BLM BA (2016) incorporated by reference the analysis of effects of a similar action with the USDA Forest Service (2015); in particular, the BLM BA provides (USDI BLM BA 2016) "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" (USDA FS 2015). The effects analysis for the USDA FS (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)." BLM's incorporation of the USFS BA and their assessment that the effects of the PRMP will be similar implies an assumption that materially similar conservation measures and sideboards will be imposed on or built into future suction dredging activities on BLM lands, to the extent consistent with the BLM's discretion, when future programmatic and/or individual consultations are completed. We therefore analyzed the effects of the PRMP's locatable mineral program on the basis that specific suction dredging actions implemented under BLM's PRMP will, consistent with BLM's discretion, include conservation measures that are materially similar and effectively comparable to those described in the Forest Service proposed action (USDA FS 2015) or will otherwise be designed to limit effects to the same or greater extent.

Suction dredge mining will occur below the OHW in streams with suction dredges operating in the wetted stream perimeter. Presently the State of Oregon has a temporary moratorium restricted suction dredging to waters without state designated essential salmonid habitat beginning January 2016. This ban is presently for five years, but may end with legislation approval at any time. We conducted our analysis on the assumption that the moratorium will be lifted and suction dredging will continue to occur on BLM lands. The details of this moratorium are also discussed below.

Operation of suction dredges alters stream ecosystems and results in excavation and scour of in-stream habitat, changes substrate composition, fills interstitial spaces, increases turbidity and suspended sediment, increases sedimentation, and destabilizes spawning gravels (Thomas 1985, Hassler *et al.* 1986, Harvey and Lisle 1998, Harvey and Lisle 1999, Somer and Hassler 1992). Some effects, including decreased riparian vegetation, destabilized stream banks, channel widening, and site damage and soil disturbance leading to erosion in riparian areas, can also result from dispersed camping and equipment deployment in riparian areas (Stern 1988, Kattelmann and Embury 1996, Prussian *et al.* 1999, Royer *et al.* 1999, Bernell *et al.* 2003, HWE

2011, USEPA 2012). Small streams are more vulnerable than large rivers (Harvey and Lisle 1998). Relatively intense declines in water clarity do occur temporarily during operation of the suction dredge, but these effects are often localized in proximity to the dredge, for some cases only evident for several feet downstream (Griffith and Andrews 1981, Prussian *et al.* 1999, Royer *et al.* 1999). Mining can also disturb mercury buried beneath the substrate, either from natural sources or a legacy from historical mining activity, allowing for re-suspension and transport to downstream areas where it has the potential to settle out in areas conducive to methylmercury production, with bioaccumulation and adverse effects to food webs and fish (Humphreys 2005, Fleck *et al.* 2011, Marvin-DiPasquale *et al.* 2011). Additional effects include stream bank undercutting, bank sluicing, stream channelization, and riparian vegetation damage (Hassler *et al.* 1986, Stern 1988). On the other hand, Bayley (2003) determined that cumulative effects from suction dredging on width-to-depth stream ratio or salmon densities could not be detected in the Illinois River subbasin. By comparing samples above and below mining, Huber and Blanchet (1992) concluded that several suction dredges (≤ 4-inch), operating simultaneously in the same drainage in Alaska, did not affect water quality.

As noted above, scientific and technical literature report variable levels of effects from suction dredge mining. Some variability occurs due to differences in dredge size, stream substrate, or stream gradient. Other variability occurs due to greater or lower mining intensity. For example, for Somer and Hassler (1992) in California, suction dredge activity was low during their study because of high stream flow – 180% of the average water year. Studies also differ in position of dredging within the stream; some studied bank-to-bank dredging while others studied dredging that only occurred in one location. However, this wide range of reported stream characteristics, mining effort, and variable effects are appropriate for our analysis because under this opinion we expect that the BLM will authorize a wide range of suction dredging activity, in multiple streams of differing size and topography and experiencing a variety of hydrological conditions over multiple years. Adverse effects are related to: (1) Mining-related substrate disturbance; (2) suspended sediment, sedimentation, and substrate embeddedness; (3) methylmercury; (4) unintentional chemical contamination; (5) suction dredge or operator interactions with individual fish.

(1) Mining-related substrate disturbance

Suction dredging typically disrupts the armored bed surface of the stream because miners prefer to target depositional layers at the bedrock interface where gold is likely to be present (Thomas 1985, Weber 1986, Somer and Hassler 1992). Riffles and gravel bars play important roles in the development and maintenance of geomorphic form and function, as well as stream ecology. In alluvial channels, riffles control channel profile and establish bed characteristics, sediment sorting, and pool formation; gravel bars are important for formation of scour pools, creation and destruction of floodplain surfaces, and variation in flow fields that create velocity refugia (HWE 2011).

The armored layer is a layer of interlocking coarse substrate materials that protects underlying finer sediments from scour and erosion during flow events; its disruption has the potential to destabilize the channel through further erosion (HWE 2011). A stream that is free to develop its own geometry evolves through time to develop a channel shape, dimensions, and planform pattern (i.e., morphology) that reflect a balance between the sediment and water inputs, the stream's relative energy and the dominant characteristics of the sediments forming the bed and banks. Undisturbed channel bottoms are frequently armored with a layer of larger gravels and cobbles that overlies mixtures of finer-grained substrate; nearly all gravel channels are mantled by an armored layer containing particles larger than the underlying sediment (Sullivan *et al.* 1987, NOAA Fisheries 2004). The armored layer stabilizes the stream bed and protects it from scour, erosion, and movement; it is more difficult to entrain because the particles are larger and are interlocked with other particles. When the armor layer is disrupted, the exposed, finer sediments underneath are much more easily transported at lower flows, and sediment load is increased (Lagasse et al. 1980). As more material begins to move, the bed becomes less resistant and even the larger, coarser materials are transported. Diminished sediment sorting processes and armor layer disruption result in a less stable channel (NOAA Fisheries 2004). Instability means that substrate and the stream bed is more susceptible to scour and erosion at lower flows and moves more frequently. Suction dredging can lead to development of breaks in channel slopes, or knickpoints in the channel profile that can then migrate upstream and cause further channel incision. Disturbed gravel bed streams will continue to rearrange bedload deposits until the channel morphology is harmonious with flow patterns (Brown et al. 1998).

Additionally, hand piling of substrate that is too large to fit through the intake nozzle creates areas of disproportionately greater-sized substrate materials (i.e., tailings). Deposited tailings are highly unstable, have a high potential for scour, and can mobilize under slight increases in stream discharge and velocity because they are unconsolidated and frequently deposited above the armor layer (Hassler *et al.* 1986, Stern 1988, Harvey and Lisle 1998, Harvey and Lisle 1999). In-stream substrate disturbance also negatively affects aquatic macroinvertebrates.

In some areas, substrate disturbance can be short-term with recovery, while in other areas the impacts can persist. Geomorphic recovery is the concept that, following disturbance, a landform will return to its general form or trend through moderating physical and biological processes (HWE 2011). Recovery is dependent on winter flow and bankfull flow events. Dredging (i.e., holes and tailing piles, disruption of the armored layer) that are not reset by a winter or bankfull flow event have increased potential for long-term impacts to stream geomorphic form and function (Harvey and Lisle 1999, HWE 2011). These long-term geomorphic effects are likely to be most evident in small channels and watersheds, along the margins of channels, downstream of dams, and in areas with a high concentration of dredging activity (HWE 2011).

However, in gravel- and cobble-bed channels, the bankfull stage establishes channel morphology and accomplishes the most sediment transport (Wolman and Miller 1960, Montgomery and Buffington 1998); the magnitude of the channel-forming discharge commonly lies between the mean annual discharge and the discharge that occurs once or twice every one to two years (Parker and Peterson 1980, Andrews 1980). Years in which the bankfull (dominant) discharge is met or exceeded will have a greater likelihood of transporting a larger sediment load, and thus potential for aggregate recharge, than years in which the flow is less than the bankfull discharge. Flow measurements from gauged rivers around the world show that the bankfull discharge has a recurrence interval on 1.5 years on average. This means in any given year there is a 67% chance that a bankfull discharge will occur (Vermont 2009). Therefore, suction dredging increases the rate of disturbance as well as the duration of channel instability, because suction dredging increase the frequency of disturbance to 100% annually. On average, the probability of a bankfull discharge event not occurring in a given year is 33%. For ease of discussion, we will evaluate the probability of a bankfull discharge event occurring over 2 years, rather than 1.5 years. There is an 89% chance that the bankfull discharge will occur during the time frame of 2 winters, or an 11% chance that it will not occur.

(2) Mining-related effects on Suspended sediment, sedimentation, and substrate embeddedness

Measurable, increased suspended sediment and sediment deposition rates downstream of suction dredges have been reported at multiple distances (Table 84) and decreasing rates are typically associated with increased downstream distance. Suspended substrate emerges from the rear of the dredge and sediment deposition/sedimentation occurs downstream of the dredge location (Thomas 1985). Heavier substrates will settle out on the stream bed closer to the dredge while lighter particles and fines will remain suspended for some distance downstream until they also settle out (Harvey and Lisle 1998, Fleck *et al.* 2011). Measurable, increased suspended sediment occurs only when suction dredging is occurring and for an ephemeral time immediately after. Measurable, increased sedimentation and substrate embeddedness are related to suspended sediment; they occur during suction dredging and persist afterward. Future flow events will mobilize settled fines and sediment such that they will be continually redistributed and transported downstream; these events will occur during late fall, winter, and early spring.

Table 84. Downstream extent of suction dredge caused turbidity, suspended sediment, sediment deposition, or substrate embeddedness as reported from multiple sources.

Dredge size	Reported Downstream extent (Parameter measured)	Citation
2.5-inch	36 feet (sediment deposition) 97 feet (suspended sediment)	Thomas 1985
	3.3 feet (turbidity) None (turbidity)	Griffith and Andrews 1981
4-inch	400 feet (turbidity) >370 feet (suspended sediment)	Somer and Hassler 1992
	>160 feet (suspended sediment and turbidity)	Hassler *et al.* 1986
	>328 feet (total suspended solids and turbidity) 164 feet (substrate embeddedness)	Stern 1988
	>200 feet (total suspended solids and turbidity)	Johnson and Peterschmidt 2005
5-inch	>160 feet (suspended sediment and turbidity)	Hassler *et al.* 1986
5.9-inch	263 feet (turbidity)	Harvey 1986
6-inch	98 feet (turbidity and settleable solids) 197 - 394 feet (sedimentation rate)	Harvey *et al.* 1982
8-inch	525 feet (turbidity and total filterable solids)	Prussian *et al.* 1999, Royer *et al.* 1999
10-inch	492 feet (turbidity)	Wanty *et al.* 1997

While the literature has reported a large range in downstream suspended sediment and sedimentation magnitude, it does demonstrate the variability of effects which are dependent on stream hydrology and substrate composition in addition to dredge size. Turbidity and total suspended solid concentrations within suction dredging plumes are unlikely to exceed 50 nephelometric turbidity units (NTUs) and 340 milligrams per liter (mg/L), respectively (Table 85). Background concentrations of turbidity and total suspended sediment during suction dredging are typically very low value NTUs or mg/L due to normal water clarity in summer. Throughout Oregon, background turbidity during the summer is 1 NTU in most regions (Borok 2014).

Table 85. Maximum magnitude of suction dredge caused turbidity, suspended solids, or sediment deposition as reported from multiple sources. T= turbidity, measured in NTUs; SS = suspended solids, measured in mg/L; SD = sediment deposition, measured in grams per square meter per day or grams per trap.

Maximum Turbidity (NTU); Location	Maximum Suspended solids (mg/L); Location	Maximum Sediment Deposition; Location	Background or Control values			Citation (dredge size – inches)
			T (NTU)	SS (mg/L)	SD (see caption)	
2.2; 3.3 feet downstream	N/A	N/A	1.6	N/A	N/A	Griffith & Andrews 1981 (2.5)
0.7; 3.3 feet downstream			0.8			
22; 10 feet downstream	1.6; 10 feet downstream	2,075 grams per square meter per day; 39 feet downstream	<2	0	50	Harvey *et al.* 1982 (6)
N/A; N/A	340; dredge outflow	40 grams per trap; dredge outflow	N/A	4.56	5	Thomas 1985 (2.5)
50; 33 feet downstream	N/A	N/A	4-5	N/A	N/A	Harvey 1986 (5.9)
20.5; 13 feet downstream	244; 13 feet downstream	42,366 grams per square meter per day; 29.5 feet	0.47	0	22	Hassler *et al.* 1986 (5)
5.6; 13 feet downstream	47.5; 13 feet downstream	12,080 grams per square meter per day; 13 feet downstream	0.88	0.5	105	(4)
2.22; 33 feet downstream	62.5; 33 feet downstream	1,859 grams per square meter per day; 33 feet downstream	0.24	0	7	Stern 1988 (6)*
1.81; 33 feet downstream	274; 72 feet downstream		0.23	0	46	(4)
		3,858 grams per square meter per day; 72 feet downstream			22	(5)*
		42,366 grams per square meter per day; 30 feet downstream			105	(4)

Maximum Turbidity (NTU); Location	Maximum Suspended solids (mg/L); Location	Maximum Sediment Deposition; Location	Background or Control values			Citation (dredge size – inches)
			T (NTU)	SS (mg/L)	SD (see caption)	
		12,080 grams per square meter per day; 13 feet downstream				
15; dredge outflow	N/A	1,711 grams per square meter; 131 feet downstream	---	N/A	23	Somer and Hassler 1992 (4)
19; 100 feet downstream	N/A	N/A	1.7	N/A	N/A	Wanty *et al.* 1997 (10)
25; dredge outflow	46; dredge outflow	N/A	1	3	N/A	Prussian *et al.* 1999; Royer *et al.* 1999 (8)
12; 10 feet downstream	86; 10 feet downstream	N/A	0.8	10	N/A	Johnson and Peterschmidt 2005 (4)
* 2 dredges operating						

Fine sedimentation and substrate embeddedness will be reset in between mining season during winter flows. However, because stream flows typically do not increase substantially until November or December, we expect that sedimentation and substrate embeddedness will persist until November or December, with some reasonable annual and spatial variation. Larger, coarser sediment and substrate embeddedness may take additional year to reset, thus resulting in unstable gravel bars for spawning to occur.

Temporary downstream decreases in macroinvertebrates are most likely associated with sediment deposition and substrate embeddedness below the suction dredge (Harvey *et al.* 1982, Stern 1988). Royer *et al.* (1999) reported that macroinvertebrate abundance and diversity was substantially reduced for approximately 30 feet downstream of an 8-inch suction dredge, with values returning to reference site levels by approximately 260 feet downstream of the dredge. Similarly, Harvey (1986) saw decreased abundance approximately 32 feet downstream with recovery occurring by 197 feet downstream. In other studies, there were no downstream decreases in mean macroinvertebrate abundance or diversity indices due to suction dredging even with deeper dredge holes; however, some functional feeding groups did decrease below dredging sites or were more abundant above dredging sites, while other groups had the reverse pattern (Thomas 1985, Hassler *et al.* 1986, Somer and Hassler 1992). The benthic invertebrate populations within each NOI project area will be reduced until disturbed substrates are recolonized. Furthermore, frequent and multiple NOI activities will likely slow the development of a healthy benthic community. As a result, we expect that negative effects to benthic productivity and availability of prey items will last at least a few months.

(3) Mining-related effects on availability of methylmercury

Stream bed sediments in the action area are likely to contain mercury either as a legacy of historical gold mining or from naturally occurring deposits and mercury mining. When buried in sediment the mercury is relatively harmless. Conversely, disturbance of those areas containing legacy mercury remobilizes it into the aquatic environment where it can methylate and enter the food web, especially in downstream reservoirs and estuaries (Alpers et al. 2005, Lambertsson and Nilsson 2006, Evers et al. 2008, Merritt and Amirbahman 2008, Chen et al. 2009, Singer et al. 2013). However, some estuarine habitats are more conducive to methylmercury production than others (Eagles-Smith and Ackerman 2014) and demethylation also occurs; both production and degradation of methylmercury occur simultaneously (Lambertsson and Nilsson 2006, Hsu-Kim et al. 2013). The rate of methylation relative to demethylation determines the amount of methylmercury present in aquatic systems. Estuarine and reservoir methylmercury can be found in the water column, in sediment, and in sediment pore waters.

Mercury and methylmercury are contaminants; methylmercury is a highly toxic and organic form of mercury that passes more easily into the brain. Methylmercury is efficiently transferred through the aquatic food web and concentrations increase with each additional step in the food chain in a process known as biomagnification. In this process, consumers retain and further concentrate much of the methylmercury of their prey; when this organism gets eaten it passes this greater concentration on to that consumer. This means that higher-level predators build up greater and more dangerous amounts of toxic materials than organisms lower on the food chain. Nearly all mercury accumulated in fish tissue (95–99%) is in the form of methylmercury, although the percentage of methylmercury to total mercury in the muscle tissue increases as the fish ages (Bache *et al.* 1971, Bloom 1992).

From existing literature and largely based on sublethal endpoints, Beckvar *et al.* (2005) identified 0.2 ppm as a whole-body mercury tissue threshold, below which adverse effects in most juvenile and adult fish are unlikely. However, Alpers *et al*. (2008) noted that subtle behavioral effects may occur at lower concentrations. Sandhenreich and Weiner (2011) concluded that changes in biochemical processes, damage to cells and tissues, and reduced reproduction in fish occur at methylmercury concentrations of about 0.3-0.7 ppm wet weight in the whole body and about 0.5-1.2 ppm wet weight in axial muscle; correlations indicative of adverse effects in wild fishes have been reported for multiple field studies in which maximal tissue concentrations were less than 1.0 ppm wet weight (Webb *et al.* 2006, Moran *et al*. 2007, LaRose *et al.* 2008). Additionally, 0.1 ppm is the level deemed protective for fish-eating mammals (Peterson *et al.* 2002).

Peterson *et al.* (2002) sampled fish in Oregon to assess freshwater mercury contamination in fish tissue using whole-fish samples. Anadromous salmon were not sampled. Cutthroat trout only exceeded 0.1 parts per million (ppm) wet weight in an inferred 15% of the stream lengths where they occurred. The overall mean concentration for large invertivores was 0.055 ppm (SD 0.047). Mercury was also present in other fish species and piscivores (pikeminnow, largemouth bass, and smallmouth bass) had significantly higher mercury levels, up to five times higher than western Oregon invertivores.

Peterson et al. (2002) was a probability study of all of Oregon streams and rivers; therefore fish in the action area, including coho salmon, will also contain mercury as part of their baseline condition. Because most mercury in fish is assimilated through the food web, mercury and methylmercury are also present in macroinvertebrates as a baseline condition. Methylmercury concentrations have been documented in mayfly, stonefly, caddisfly, and dragonfly larvae (Slotton et al. 1997, Hall et al. 1998, Mason et al. 2000, Naimo et al. 2000, Murphy 2004, Chasar et al. 2009, Fleck et al. 2011). Bioaccumulation through the food chain is not linear; larger and older piscivorous fish have greater accumulations than non-piscivorous fish. Oregon pikeminnow and bass of a size where they actively feed on fish had mean mercury concentrations of 0.284 ppm (SD 0.175; Peterson et al. 2002). The ODEQ sampled pikeminnow from the Rogue River, although only 5 valid individual tissue samples at each location, and these fish contained mercury concentrations with geometric means of 0.433 and 0.516 ppm wet weight (ODEQ 2012). The ODEQ did not include anadromous salmon in their mercury studies “because they spend limited time feeding in Oregon rivers or lakes and generally contain lower levels of mercury” (Matzke 2014). Although there are no records of mercury concentrations in anadromous salmon juveniles, we anticipate that baseline concentrations will be similar to those of cutthroat trout rather than the larger, resident, piscivorous fish like pikeminnow, because juvenile salmon in freshwater do not consume fish. Using information from peer-reviewed articles and limited existing data for non-coho salmon in the Rogue River, RRSNF hypothesized that baseline conditions for mercury concentrations in fish tissue of juvenile coho salmon in the Rogue River may be in the range of 0.12 to 0.21 ppm wet weight whole body (USFS 2015).

Existing mercury in the stream sediments will be disturbed and remobilized by mining operations, especially those that mine the sediments below the armored bed surface. Fleck *et al.* (2011) demonstrated an increase of mercury in the water column caused by using a 3-inch suction dredge in the South Yuba River and Humbug Creek, California, even though mercury was present only in low concentrations at the dredge sites. Although mercury, like gold, can remain captured in the sluice of the dredge, some proportion will be returned to the stream. A dredge efficiency test using a 4-inch dredge was performed on the South Fork of the American River, California, with results indicating that approximately 98% of dredged mercury was removed by the dredge (Humphreys 2005). Mercury not captured or released by the dredge was associated with fine-grained sediments, which typically have the highest mercury concentrations. The mercury concentration in the suspended sediment returned to the river by the dredge was 240 ppm. For context, California classifies mercury concentrations of 20 ppm as hazardous waste (Humphreys 2005). Therefore, even with the majority of mercury captured by the dredge, the amount of mercury mobilized in-stream by suction dredging can be environmentally relevant.

Concentrations of methylmercury, a toxic, organic form of mercury, appeared to be unaffected at the dredge location (Fleck *et al.* 2011). However, Fleck *et al.* (2011) concluded that disturbance of sediments by suction dredging would likely lead to enhanced mobilization of mercury to downstream environments. Elevated concentrations of mercury are associated with sediment particles, especially fine-grained sediments (i.e., silt-clay, < 0.063 mm; Hunerlach *et al.* 2004, Fleck *et al*. 2011, Marvin-DiPasquale *et al*. 2011). As discussed previously in the section describing suspended sediment, sedimentation, and substrate embeddedness, future flow events will mobilize settled fines and sediment from suction dredging and high banking such that they will be continually redistributed, transported downstream, and, over time, will reach the estuaries and/or reservoirs (Alpers *et al*. 2005, Gehrke *et al.* 2011). Marvin-DiPasquale *et al.* (2011), with laboratory experiments using sediments collected from the South Yuba River and Humbug Creek, demonstrated the potential for downstream sediments receiving the transported mercury to exhibit methylmercury production. Effects are dependent on the physical and chemical nature of the mobilized materials as well as that of the environmental conditions in the downstream depositional areas.

Methylation of inorganic "reactive" mercury (i.e., fraction of total mercury that is most readily converted to methylmercury by microbes) into methylmercury is a concern because of the toxic qualities of methylmercury. Methylmercury levels in aquatic systems are not always correlated with total mercury concentrations because methylation rates generally depend on the productivity of anaerobic microorganisms and the bioavailability of reactive inorganic mercury. Some studies suggest that the primary producers of methylmercury in freshwater and coastal aquatic environments are bacteria in anoxic zones, including benthic sediments, saturated soils, stratified water columns, and periphyton biofilms (Compeau and Bartha 1985, Davis *et al.* 2003, Hammerschmidt and Fitzgerald 2004, Heim *et al.* 2007, Evers et al. 2008, Chen *et al.* 2009, Hsu-Kim *et al.* 2013), while others consider photochemical reactions and redox potential to the be most important source in estuaries (Bratkic *et al.* 2013). Methylation typically occurs in environments with high organic content, low pH, low dissolved oxygen content, presence of sulfate or iron-reducing bacteria, and higher temperatures (Alpers *et al.* 2008, Ward *et al.* 2010), and the presence of wetlands (USEPA 1997). Many studies report a seasonal variation in estuarine methylmercury concentrations and methylation rates, with the highest values observed during times of highest water temperatures (Hammerschmidt and Fitzgerald 2004, Heyes *et al.* 2006, Lambertsson and Nilsson 2006, Canario *et al.* 2007, Heim *et al.* 2007, Bratkic *et al.* 2013). Therefore, summer is likely the time of highest methylmercury concentrations.

The Yuba River experiments suggests that main channel depositional zones are not very conducive for methylmercury production (Marvin-DiPasquale *et al*. 2011) and Peterson *et al.* (2002) estimated that low pH/high dissolved organic carbon streams are very rare in Oregon. Other studies have also determined that in-stream benthic methylmercury production is minimal (Brigham *et al*. 2009, Chasar *et al*. 2009, Marvin-DiPasquale *et al.* 2009). Therefore, we do not expect measurable amounts of methylation to occur in the freshwater streams and mainstem rivers within the action area because conditions favorable to methylation are typically associated with reservoirs, lakes, and wetlands

However, although there are no reservoirs located downstream of suction dredging locations, mobilized fines and sediments transporting the mercury that are continually redistributed and transported downstream will eventually settle out when reaching the estuaries and their tidally-influenced areas. Currently, there is no information available to estimate how much mercury must be remobilized and transported to cause measurable increases in estuary methylmercury concentrations, although Fleck *et al.* (2011) estimated that the amount of dredging needed to equal long-term downstream accumulation rates was unlikely to occur. Demethylation, which often occurs simultaneously with methylation and often by the same microorganisms and other pathways, also plays a role in the amount of estuary methylmercury concentrations.

Analysis of methylation in estuaries and/or reservoirs downstream from suction dredging will be dependent on the overall amount of mining in the drainage and environmental conditions of the estuary in terms of depositional areas favorable for methylmercury. We expect the highest concentration of methylmercury to occur in Southern Oregon in the Chectco and Rogue estuaries due to high number of claims in the upper watersheds (Figure 7). The lowest concentration will occur in the Willamette Basin and downstream Columbia River Estuary as suction dredging is very limiting in the basin (Figure 7).

(4) Mining-related effects contributing to unintentional chemical contamination

Suction dredges and high banking equipment require the use of fuel, oil, and other lubricants, which are petroleum-based contaminants containing polycyclic aromatic hydrocarbons (PAHs). These contaminants may also be used while camping and in vehicles using existing fords. Fuel is also stored on-site. Equipment is operated within the wetted perimeter of the stream for suction dredging (and also for vehicles fording streams) and in the dry area below the OHW elevation, but above the wetted perimeter, for high banking. Thus, there is a potential for introduction of toxic contaminants into the stream or adjacent riparian areas from accidental spills, improper storage, or mechanical failure.

In addition to negatively affecting water quality, these contaminants can also negatively affect aquatic macroinvertebrates; petroleum-based contaminants (such as fuel and oil) contain PAHs, which are acutely toxic to aquatic organisms, including aquatic macroinvertebrates at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz *et al.* 1999, Heintz *et al*. 2000, Incardona *et al*. 2004, Incardona *et al*. 2005, Incardona *et al.* 2006). Sublethal effects are those that are not directly or immediately lethal, but are detrimental and have some probability of leading to eventual death via behavioral or physiological disruption. Resident benthic macroinvertebrates will be exposed to PAHs through their diet and direct contact with the sediment (Neff 1985). PAHs may bioaccumulate in aquatic invertebrates within these benthic communities (Varanasi *et al.* 1985, Meador *et al.* 1995). When death occurs, most foraging reductions will likely be short-term because adjacent macroinvertebrate populations will quickly recolonize the disturbed substrate as the summer-fall in-stream mining coincides with high levels of invertebrate activity. Therefore, unintentional chemical contamination will temporarily decrease macroinvertebrate abundance, likely for a few months, until recolonization occurs. Bioaccumulated PAHs will reduce the quality and value of surviving macroinvertebrates as forage items. Again, we expect the highest concentration of PAHs from suction dredging to occur in the upper Rogue Basin due to the amount of suction dredging occurring in the basin (Figure 7).

(5) Mining-related effects on fish entrainment

Entrainment of fish by the dredge nozzle is dependent on the strength of the suction at the nozzle and the size and burst swimming speed of the juvenile is a factor in its ability to avoid entrainment. Suction dredging occurs in the water and, as the name implies, pulls water and sediment from the stream to run through sluice, and returns water and tailings to the stream. Fish can also be pulled from the stream and passed through the dredge via the nozzle or be impinged on the pump screen. Operators are also working in the water to operate their suction dredge and fish may be accidentally stepped on or trampled by an operator, leading to injury or death; similar effects will also occur for vehicles crossing streams at fords. These activities may also disturb fish and disrupt their essential behaviors of feeding, rearing, sheltering, and migrating. Again, we expect the entrainment from suction dredging to mostly occur in the upper Rogue Basin due to the amount of suction dredging occurring in the basin (Figure 7), although some site specific entrainment will occur at suction dredging sites throughout the action area.

Leasable Minerals

The PRMP identifies 211,638 acres of land that would be subject to the following leasable minerals restrictions: no surface occupancy, conditional surface use and timing limitations. BLM expects that any such projects are several decades out and speculative in nature based on Federal permitting requirements, market factors, and data collection needs for the project. Management direction for leasable minerals as follows:

- 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.

In addition, management direction applicable to the Riparian Reserves LUA will restrict locatable mineral activity in ways that will limit impacts to areas important to listed species, as set out in Section 1.3.8. The management direction for riparian reserves and hydrology limits locations for leasable mineral extraction actions to areas outside of the first site potential tree height such to protect ESA listed species and their critical habitat.

Although the management directives addressing resource protection and ESA species and habitats is framed with respect to site-specific stipulations, because it appears in the PRMP as plan-level guidance, we assume that BLM intends to apply it with a broad, plan-level perspective, taking into account synergistic and aggregate effects of leasable mineral proposals. Taking this approach, we expect that site-specific stipulations will ensure temporal and geographic separation and placement that will ensure minimal potential impacts. If we are wrong in these assumptions and there would be effects from the programmatic decisions in the PRMP on leasable mineral development that are not considered in this Opinion, reinitiation would be warranted.

2.4.7 Recreation and Visitors Services

Under the proposed action, Recreational and Visitor Services includes several project categories:

- Motorized Off-Highway Vehicle Travel
- Driving for Pleasure (along designated BLM roadways)
- Non-motorized Travel (hiking, biking, and horseback riding)
- Camping and Picnicking
- Wildlife Viewing, Interpretation, and Nature Study
- Hunting (big game, upland game, and migratory game birds)
- 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

Some of these activities have and are anticipated to be analyzed in other (i.e. WORP) programmatic opinions;[47] however, to the extent that the proposed action provides programmatic direction applicable to these activities they are analyzed at a plan-level in this Opinion. Management direction generally applicable to the recreation and visitor services category include a requirement to "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." This is expected to operate as a limit on numbers of recreationists and their associated effects at particular sites. In addition, with respect to the subset of activities referenced in the first sentence, the BLM's BA provides: "BLM activities occurring under the three categories [i.e. non-motorized travel; camping and picnicking; wildlife viewing, interpretation and nature study; and fishing)] would utilize the PDCs of the … 2010 [WORP] BA, and follow the terms and conditions of the 2011 [WORP] BOs, to minimize adverse effects to ESA-listed fish species and designated CH." Although the WORP consultation (NMFS WORP 2011c) has expired,[48] in areas where listed fish or critical habitat may be affected by these activities, in the context of this PRMP consultation, BLM has undertaken to implement these recreation related activities consistent with the requirements in the proposed action of the WORP replacement programmatic consultation as well as any terms and conditions for an incidental take statement that might accompany the opinion. [49] The relevant management directive is also expected to operate as a limit on numbers of recreationists at particular sites, in other words, BLM will "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

[47] Our understanding is that the general recreational activities that do not require a special use permit or some other BLM authorization or decision will occur without additional section 7 consultation and these are analyzed within this document.
[48] In the BA for the PRMP, BLM undertook to follow the WORP conservation measures and terms and conditions.
[49] Email from R. Hardt to K. Phippen dated 7.8.2016.

setting characteristics are not being protected, resource damage is occurring, or user conflicts need to be addressed."

Swimming and Other Water-Based Activities. Recreationists using streams may interact with rearing or spawning fish when they are in the water, for example, wading, swimming, or boating. Under the proposed action, BLM provides the opportunity for recreationists to access the land and use the streams, and by maintaining recreational facilities the proposed action does concentrate public access at these locations. These locations include campgrounds and boat ramps, as well as other recreation sites. Disturbance by recreationists may cause rearing fish to leave cover and become more susceptible to predation. Disturbance of adults at the spawning sites may delay some spawning. BLM identified recreation facilities within 216 feet of occupied habitat or critical habitat for ESA-listed species (Table 38). Although BLM's analysis described this as one potential tree height (216 feet), the one potential tree height definition is a site specific analysis and varies considerably across the planning area. To avoid confusion we will use the 216 feet distance because that is the best available information BLM provided for the proximity of these sites to occupied habitat or critical habitat and will not refer to the one site potential tree height term. These facilities concentrate recreationists and represent the likely and most predictable areas where disturbance may occur. Although these sites may concentrate the disturbance, this may limit the disturbance area to the immediate site. This occurs mostly in the OC coho salmon ESU where 40 of these facilities occur within 216 feet of occupied habitat. All other ESUs have fewer than 8 of these designated areas. Although the potential for increased predation and spawning delay may occasionally occur, disturbance by recreationists is expected to be of a minor nature due to the limited number of sites within most ESUs. Within the OC coho salmon ESU, the larger number of sites are dispersed across the many populations.

Under the proposed action, the Motorized Boating project category includes the construction or replacement of boat docks and boat ramps. The effects of these activities, including the effects of over-water structures, pile driving, and boating activity have been analyzed extensively in many previous biological opinions, including the SLOPES IV In-water Structures (NMFS 2011f), including increased shading, reduction in prey, increased predation, hydroacoustic effects, and disturbance and displacement.

Due to their location, timing, and activity focus, the other recreational activities, for example: non-motorized winter activities; snowmobile and other motorized winter activities; hunting; and wildlife viewing are not expected to interact with the ESA-listed species or their habitats considered in this document with the exception of visitors using the road and trail system (see Section 2.4.9).

All of these recreational activities include use of the BLM road system to access BLM recreational and visitor opportunities. The use of the road system is analyzed under the Trails and Travel Management section in Section 2.4.9.

2.4.8 Sustainable Energy (Fuel Biomass)

Fuel biomass is slash produced as a by-product of commercial and non-commercial harvest. As such, the effects of piling and removing slash was analyzed under the Forest Management section.

2.4.9 Trails and Travel Management

This program includes three components: The road system (construction, maintenance and decommissioning); public motorized access designations (use of roads); and the trail system (use, construction, and maintenance). The construction of new roads, the maintenance of existing roads, and the decommissioning of roads under the PRMP are largely connected to the Forest Management program. Because of the nexus to Forest Management, projected new road construction, road decommissioning, and any timber sale road maintenance activity that would occur under the PRMP are analyzed in the Forest Management program section (Section 2.4.1). The analysis in this section is focused on the other two components of the proposed Trails and Travel Management program: public motorized travel designations and the trail system.

The BLM has not included implementation-level travel management planning as part of the proposed action. 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. In the proposed action, the BLM states that it will make final route designations in comprehensive, interdisciplinary Travel Management Plans (TMP). For areas with listed fish or designated critical habitat in the action area plans will be initiated within five years of the effective date of the Records of Decision (ROD) for the Resource Management Plans and completed within ten years of the effective date of the ROD. Our observations of Federal agencies accomplishing travel management plans suggest it will take at least the five years after initiating this task; we have therefore made an assumption that all of these will be completed no sooner than 10 years and analyzed the effects accordingly. This assumption is more realistic taking into account past practice. The BLM will develop proposed future route designations through public scoping and NEPA analysis, using the draft route inventories to evaluate amendments to the existing travel network during an implementation-level travel management plan. The PRMP states that route-specific decisions in the travel management plan will support RMP goals, objectives, and management actions, and the designation criteria in 43 CFR 8342. Until the 10-year timeframe for TMPs is reached, we anticipate the use of the road and trail system will be managed by the general designations. Consistent with the PRMP directives, we expect the TMPs will fully consider opportunities to reduce resource conflicts and address these conflicts by decommissioning roads, seasonally closing roads, implementing measures to manage erosion and water flows.

Although route-specific travel planning is not currently proposed, the proposed RMP does include general direction as to road use, e.g., disallowing off-road use, and limiting public motorized use to existing roads. This analysis considers the effects of that general direction in addition to other applicable plan-level actions. Until the 10 year period for proposed implementation-level management plans is complete, the effects of the proposed action then is based on the use of existing road system and management direction intended to protect water quality by maintaining the road and trail system to reduce sedimentation (see Section 1.3.9.4). These management directions, such as cross drains and vegetated ditch lines, are effective at reducing, but not eliminating sedimentation (GLEC 2008).

Public motorized use of existing roads

The BLM manages a large and complex road system within the planning area, which includes approximately 15,000 miles of roads (USDI BLM FEIS 2016). The BLM proposes to manage public motorized access to these roads using three categories of use: open, limited, and closed, as described in the proposed action. The PRMP designates no areas as "open" to public motorized access. The PRMP designates 156,036 acres as "closed," which means that, on these acres, public motorized travel activities are prohibited; therefore roads and off-road areas within the designated area will not be used by the public and no associated adverse effects result. Under the PRMP the "limited" designation means that public motorized use is only allowed on existing roads – and this use will occur upon adoption of the RMP without further BLM decision-making processes and ESA compliance. Thus, this section of the document assesses the public, non-commercial, motorized use of existing BLM roads in the "limited" designation. BLM administrative use is also included.

Use of the existing road system by vehicles falls within two broad categories, commercial and non-commercial, as well as subcategories of BLM or non-BLM related activities. Commercial use includes both BLM related and non-BLM related actions and these are analyzed in several different sections of this document. Examples of the BLM actions include timber hauling from private timberland or some other commodity associated with non-BLM activities. Additionally, BLM commercial use include road use associated with timber haul from a BLM timber sale (see Section 2.4.1). This section analyzes non-commercial public use and administrative use since they are not already addressed in other parts of the document.

Road use results in a variety of environmental consequences, such as, degradation of water quality, stream substrate, and pool quality (GLEC 2008). 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). The FEIS (USDI BLM FEIS 2016) described the road network functional classification as collector roads, local roads, and resource roads that serve different functions within a transportation system. These classification categories provide a sense of traffic volumes where collector roads carry the highest traffic volume of the three, local roads next, and resource roads the lowest traffic volume. In addition to traffic volume, road surface type influences the variables deemed most significant to the consequence of using these roads, that is, sedimentation and contaminants.

Water quality: Water quality is adversely affected by fine sediment and stormwater contaminants generated by vehicular travel on the roads. Fine sediment generating from surface erosion caused by vehicular traffic may transport to streams through ditchlines or directly into streams. Fine sediments transport in the stream as suspended particles reducing water clarity and potentially altering invertebrate communities. Pollution from vehicles also results in degradation of water quality from petroleum products and heavy metals, such as copper and zinc. In extreme situations, even water temperature may be affected by the increase of fine and coarse sediments to the stream when hyporheic flows are reduced.

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-foot 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.

Fine sediment transport potential depends on variables such as road parent material, location, surface type, use, density, and design. Not all road use results in, nor contributes to, water quality issues. The BLM made a reasonable assumption that roads within 200 feet of a stream are likely the greatest contributors of fine sediment due to road use. We concur with this assumption and use this 200-foot delivery zone to assess road use impacts from sediments and contaminants.

The BLM's sediment delivery estimates reflect all road use and sediment delivery causes (USDI BLM 2008); therefore, sediment delivery specifically caused by public motorized use and administrative use is less. We do not have the information to quantitatively separate out these various causal mechanisms, but we can describe the road use in terms of public and administrative use of the roads and the existence of the road by surface type within 200 feet of the stream (Table 86). We consider this information is database driven and these values could vary by 5% from the values presented in Table 86 due to database errors.

Table 86. Total miles of BLM roads within 200 feet of a stream presented by surface type and located within sub-watersheds of the various species within the planning area.

Road Surface	Road miles							
	CR chum	LCR coho	LCR Chinook	LCR steelhead	UW Chinook	UW steelhead	OC coho	SONCC coho
Aggregate	28.8	36.0	36.0	29.5	436.4	364.9	1711.1	1073.4
Natural	5.7	5.8	5.8	1.7	25.2	27.3	439.5	455.0
Paved	2.9	6.7	6.7	6.7	42.3	21.3	302.7	143.3
Unknown	7.2	8.0	8.0	6.7	23.3	36.7	148.7	172.2

The BLM (USDI BLM BA 2016) described and predicted future numbers within recreational user groups, such as those involved in wildlife viewing, pleasure driving, camping, hunting, and fishing are road users (Table 87). As the number of participants in each of these categories rises, the potential for sediment generation will rise due to increased traffic volume. BLM also predicted use of the roads varies across the landscape based on the proximity of the road to major communities (Figure 11). Roads closer to major communities likely will experience the largest traffic volumes and therefore produce the greater sediment compared to similar roads (for example construction design, geology, and age) further from the cities. Administrative use of the road system is assumed to be significantly less than the public motorized use and also assumed to remain constant over the same time-frame presented in Table 87. Administrative traffic is associated with BLM personnel carrying out their varied duties on the land and dependent on required travel to accomplish those duties. These duties are not likely to increase over this time-frame, nor are the number of staff likely to increase during this time-frame.

Table 87. Current and projected levels of participation by recreation activity within the planning area from 2012 to 2060.

BLM Recreation Categories	Current Number of Participants (2012)	Projected Number of Participants (By End of Decade)				
		2020	2030	2040	2050	2060
Wildlife Viewing, Interpretation, and Nature Study	2,564,574	2,810,926	3,149,289	3,456,865	3,751,811	4,056,276
Driving for Pleasure (Along Designated BLM Roadways)	1,959,729	2,140,696	2,388,704	2,610,605	2,819,454	3,033,896
Camping and Picnicking	1,273,349	1,389,106	1,548,035	1,689,978	1,822,216	1,956,881
Non-motorized Travel (Hiking, Biking, and Horseback Riding)	1,211,201	1,334,041	1,499,867	1,666,874	1,841,117	2,031,541
Hunting (Big Game, Upland Game, and Migratory Game Birds)	1,063,709	1,111,142	1,159,767	1,197,012	1,232,188	1,270,468
Motorized Off-highway Vehicle Travel	826,256	887,031	955,996	1,035,266	1,128,804	1,238,989
Fishing	598,420	645,558	706,223	760,591	814,388	872,763
Specialized Non-motorized Activities and Events	458,870	501,333	559,264	612,440	663,431	716,455
Swimming and Other Water-based Activities	424,376	467,997	526,296	583,388	640,883	701,192
Non-motorized Boating	224,876	242,296	262,362	286,958	315,870	349,744
Motorized Boating	97,622	107,563	119,936	133,508	149,019	167,485
Non-motorized Winter Activities	50,444	56,687	64,711	73,679	84,205	97,138
Snowmobile and other Motorized Winter Activities	6,903	7,428	7,998	8,734	9,629	10,697
Total All Activities	**10,760,329**	**11,701,804**	**12,948,448**	**14,115,898**	**15,273,015**	**16,503,525**

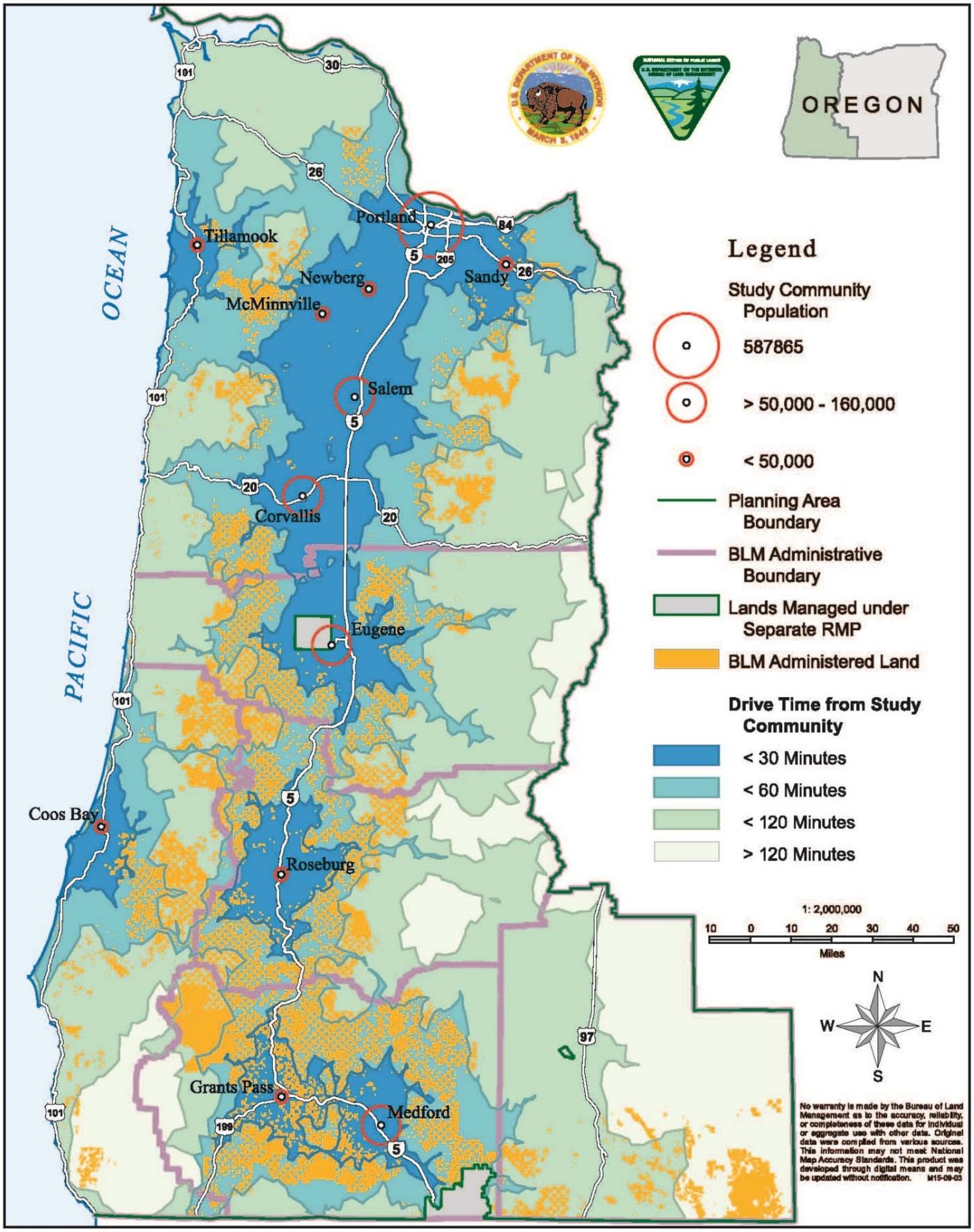

Figure 11. Drive times from major population centers and associated BLM administered lands.

Within each of the major river basins associated with the species considered in this consultation, road density varies considerably. Road surface type also varies regionally due to climate characteristics, where the proportion of paved roads is higher in the wetter coast range compared to the drier southwest and Klamath portions of the planning area. We assessed the number of road miles within 200-feet of a stream per sub-watershed (HUC6). The sub-watersheds within OC coho salmon and SONCC coho salmon distribution have the highest road miles within 200 feet; therefore, the highest predicted risk for road derived sediment to enter the streams of these sub-watersheds (Table 81). Some sub-watersheds contain over 20 miles of road within the sediment delivery zone. A few sub-watersheds have over 50 miles of roads within the delivery zone. We also make the assumption, for this discussion, roads with unknown surface types are natural surface roads; therefore representing the highest risk for sedimentation of the surface types.

Aggregate surfacing dominates the road miles within most sub-watersheds (Table 86). Reviewing the sub-watersheds with the most road miles provides an opportunity to identify the highest risk sub-watersheds. When these sub-watersheds are considered in juxtaposition with the travel zones (Figure 11) and surface erosion classes within the planning area (Figure 12), we conclude sedimentation risk from road use will be highest in those areas closest to the population centers with the higher erosion risk potential. Based on this information, it appears public motorized use of BLM roads within SONCC coho salmon, OC coho salmon, UW steelhead, and UW Chinook salmon are most at risk from high road-derived sediments.

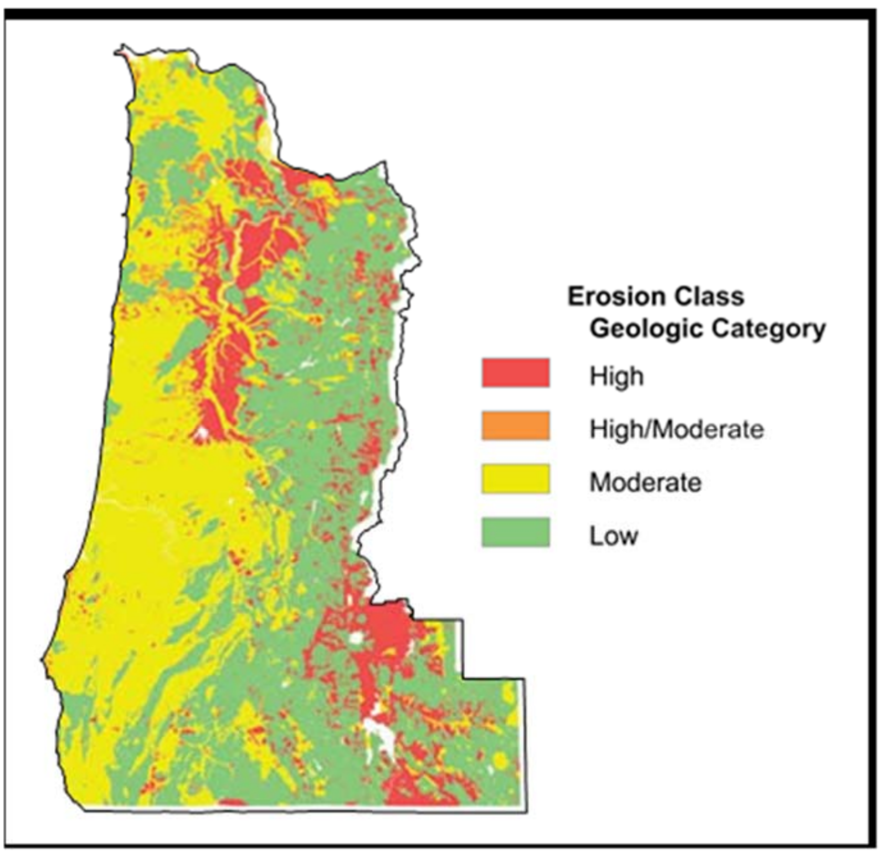

Figure 12. Erosion class geologic categories overlapping the BLM planning area (from the FEIS, Figure 3-82, page 344).

In addition to increased sedimentation due to road use, chemical contaminants from vehicles degrade water quality. Stormwater runoff from impervious surfaces delivers a wide variety of pollutants to aquatic ecosystems, such as metals (*e.g.* copper and zinc), petroleum-related compounds (polynuclear aromatic hydrocarbons), along with the sediment washed off the road surface (Driscoll *et al.* 1990; Buckler and Granato 1999; Colman *et al.* 2001; Kayhanian *et al.* 2003). Aquatic contaminants often travel long distances in solution or attached to suspended sediments, or gather in sediments until they are mobilized and transported by the next high flow (Anderson *et al*. 1996; Alpers *et al.* 2000a, 2000b).

BLM roads most likely to contribute contaminants to streams are the same segments of paved roads and aggregate roads described in the previous sediment discussion. Natural surface roads are less likely to function as impervious surface. Although aggregate roads may have a pervious top surface, depending on the depth of gravel, aggregate roads are considered impervious due to no, or at least reduced, water percolation to the soil (NRC 2009). The road database includes a large number of road miles with an unknown surface type. Consistent with the assumption made in the context of sedimentation effects, we assume these roads are natural surface and therefore not likely to contribute significantly to stormwater contaminates because we assume these natural surface roads function, to some degree as pervious surface; are more connected to the vegetated forest floor; and have very low traffic volume.

We consider the fate and transport of stormwater contaminates from BLM roads different from roads within the urban environment, but nonetheless, ditch lines, culvert and bridge crossings, road side conditions, such as riprapped streambanks, provide efficient stormwater transport to streams. Vegetated ditch lines and cross drains assist in stormwater treatment by filtering the stormwater, but we make an assumption here that roads within that 200-foot sediment delivery zone may also transport stormwater contaminants. Where cross drains carry the water onto the forest floor, given sufficient distance to a stream and ground cover, filtration is likely to occur. Even designed stormwater treatment facilities have a threshold for treatment capacity; therefore we anticipate stormwater will exceed the filtering capabilities of roadside ditches and vegetation in some situations. Traffic volume for BLM roads is much lower than the urban environment where most of the stormwater studies have occurred. Kayhanian et al. (2003) described the relative differences in pollutant concentrations between urban and nonurban highways. Based on their research findings they discussed urban highways had higher concentrations for some pollutants, yet nonurban highways were found to have higher concentrations of totals suspended sediments, total dissolved solids, turbidity, NH_3, and diazinon. Kayhanian et al. (2003) concluded some of these pollutants were likely from non-transportation sources.

Roads contribute both sediment and stormwater contaminants to streams. As discussed, there are a variety of variables that determine the potential for road-derived sediment and stormwater contaminants. The primary factors we considered were proximity to streams (200 feet), surface type, erosion risk, and proximity to population centers (traffic volume). Few miles of BLM roads occur within watersheds inhabited by the LCR coho salmon, LCR steelhead, LCR Chinook salmon, and CR chum; although these roads are the closest to a large population center and likely have some of the highest traffic volumes (Table 87, Figure 12). Despite the likely higher traffic volume for a forest road, the combined low road miles and management direction to reduce sedimentation (see Section 1.3.9.5 Hydrology) limit the magnitude of the effect on the environment. Within the OC coho salmon, SONCC coho salmon, UWR steelhead, and UWR Chinook salmon ESUs, road mileage within 200 feet of a stream is very high (Table 86). For many areas of OC coho salmon and SONCC coho salmon, the distance from population centers limits traffic volume (Figure 12). Low traffic volume combined with management direction to minimize sedimentation (Section 1.3.9.4) limits the amount of road generated sediment caused by public motorized use. Management direction that identifies providing cross drains, maintaining vegetated ditchlines, reducing chronic sources of sediment will also reduce stormwater runoff to the streams. Road use within watersheds of the UWR steelhead and UWR Chinook salmon are closer to population centers and have higher traffic volumes for forest roads; therefore, likely contributing stormwater contaminants such as PAHs and heavy metals. For all watersheds, in the short-term, BLM is relying on their management direction and best management practices to minimize sedimentation due to road use. These management directions and practices will also assist with stormwater contaminant reduction because cross-drains that divert stormwater to the forest floor and vegetated ditchlines function as stormwater treatment. BLM also proposes to complete access and travel management plans within ten years of the effective signing date of the Records of Decision for the Resource Management Plan. As previously mentioned, we expect it will take as much as 10 years to complete and implement these plans in areas where listed fish and critical habitat occur within the BLM Districts, and have assumed a year period. Beyond 10 years, we expect these travel management plans will identify roads causing resource conflicts, such as high sediment and stormwater sources, and propose options to reduce those conflicts using management direction described in Section1.3.9.4 where road closures, vegetated ditchlines, cross drains, and other methods may be used to disconnect stormwater from streams. We also expect BLM to implement these management directions to reduce contaminants in the highest priority watersheds described in their restoration strategy (USDI BLM 2015a).

Use of Trails

The BLM manages 63 individual trails and trail systems that total over 395 miles in the Western Oregon decision area. In contrast to roads, trails are managed for human-powered, stock, or off-highway vehicle forms of transportation and trails are not generally managed for use by four-wheel drive or high-clearance vehicles (BLM 2006; BLM 2012). 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. Each of these uses involve unique interaction with the trail tread surface and therefore the range of the potential impacts due to the use varies greatly. Motorized vehicles have the most capability of causing erosion while hikers the least. Potential impact to the aquatic ecosystem from the use of trails includes sedimentation from the surface erosion of the existing trail. Proximity to streams, just as in the previously described road use, provides the greatest chance for sediments reaching the streams.

The BLM completed 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 (USDI BLM BA 2016). The BLM reported one public motorized travel crossing on a stream occupied by ESA-listed

Upper Willamette River steelhead (USDI BLM BA 2016). The motorized use trail ends just beyond the crossing. The stream is Mohawk Creek, a tributary to Shotgun Creek in the McKenzie River basin.

The proposed action includes best management practices associated with public motorized travel trails intended to minimize effects on the aquatic environment. These are primarily intended to manage location, erosion risk, and seasonal use. Trail use may generate surface erosion and result in fine sediments entering the stream system. The magnitude of this sedimentation is related to the direct connectivity of the trail to a stream, the intensity of the use, the erodibility of the trail surface, and the type of use. We expect use of trails will generate some sedimentation of streams, but use of the trail systems likely represents a localized sediment source.

2.4.10 Wildlife

Wildlife does not cause significant effects to listed fish or their habitats and native species have existed together in balance for many centuries. However, indirect effects may occur when the BLM management prescriptions for wildlife species require thinning of LSR and Riparian Allocations. The effects of thinning of trees are covered in Section 2.4.4 Forest Management listed above. The BLMs protection of wildlife through the LSR allocation provides additional benefits to listed ESA stocks. The LSR management objectives and direction limits road construction, regeneration harvest, and as the example for Marbled Murrelet, limits thinning in riparian reserves.

2.4.11 Wild Horses

The Pokegama Herd Management Area (HMA) is the only HMA within the planning area. The HMA is located on the eastside of the planning area above Irongate Dam. There are no anadromous fish above Irongate Dam and thus there is no mechanism for any affects to reach any listed fish or their critical habitats.

2.4.12 BLM Designations and Designations Established by Law

The items listed below are BLM designations (a-b) or designations established by law (c-d), rather than programs with management activities. Designations generally prohibit certain activities from occurring to protect resource values. These designations protect values in the forested area surrounding the area identified (river, trail, wilderness area, area of environmental concern), but the designation does not involve the planning or constructing the action such as the trail. 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, the effects are attributed to the Invasive Species program. Therefore there are no actions associated with the designation that trigger any effects.

a. Areas of Critical Environmental Concern
b. District-Designated Reserve-Lands Managed for their Wilderness Characteristics
c. National Trails System
d. Wild and Scenic Rivers.

2.4.13 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 listed fish or their habitats.

2.4.14 National Trails Systems

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 in this document.

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 critical habitat and known distribution. Thus, the designation of the PCT NTMC would not affect any ESA-listed fish species or designated critical habitat 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 SONCC coho salmon, approximately 0.23 miles of stream with designated critical habitat and 0.11 miles of stream with known distribution 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 designation of the 100 foot wide buffer on BLM portions of the Applegate Trail Route would not have any additional effects on any ESA-listed fish species or designated critical habitat.

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 reduction of any habitat features to effect the ESA-listed fish species and designated critical habitat.

2.4.15 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 listed fish or their habitats.

2.4.16 Tribal Interests

The BLM excluded any related aspects of the PRMP from its ESA consultation request on the basis that it has no discretion regarding Native American uses.

2.4.17 Visual Resources

The visual resources management program does not result in ground-disturbing activities. There are no causal mechanisms to affect any listed fish or their habitats.

2.4.18 Special Forest Products

Actions under this resource program typically involve bough, plant, mushroom, and firewood collection with little ground disturbance. There are no causal mechanisms to affect any listed fish or their habitats.

2.4.19 Lands and Realty

The Lands and Realty program includes the purchase, exchange, and dispossession of BLM land. This program could have effects to LFH if the BLM disposed or exchanged land that provided habitat for ESA-listed fish. Lands in Zone 1 are retained under BLM administration (219,953 acres). Lands in Zone 2 are available for exchange to enhance public resource values, improve management capabilities, or reduce the potential for land use conflict (2,255,243 acres). Lands in Zone 3 are available for disposal using appropriate disposal mechanisms (18,469 acres). Under the 1995 RMPs Federal legislation, rather than discretionary agency action, directed most land exchanges and transfer activities within the planning area.

Management Direction directs BLM to retain lands in Zone 1.

- 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

The BLM uses the following criteria to identify parcels for acquisition (USDI BLM FEIS 2016):

- Facilitates access to public land and resources retained for long-term public use
- Secures Threatened or Endangered or Bureau Sensitive plant and animal species habitat
- Protects riparian areas and wetlands
- Contributes to biodiversity
- Protects high quality scenery
- Enhances the opportunity for new or emerging public land uses or public resource values
- Facilitate management practices, uses, scales, of operation, or degrees of management intensity that are viable under economic program efficiency standards
- Protects significant cultural resources and sites eligible for inclusion on the National Register of Historic Places where non-Federal sites exist for the proposed use

The BLM uses the following criteria to identify the disposal of parcels in Zone 2 as part of an exchange, or the disposal of parcels in Zone 3:

- Suitability for purposes including but not limited to community expansion or economic development, such as industrial, residential, or agricultural development
- Lands of limited public resource value
- Lands that are difficult for the BLM to manage and unsuitable for transfer to other Federal agencies or State and local governments
- Lands that would aid in aggregating or repositioning other public lands or public land resource values where the public values to be acquired outweigh the values to be exchanged

In addition, the proposed action includes a management directive stating that 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."

LFH would fall under zones 2 and 3, and is the majority under the PRMP. Since 1995, the BLM has acquired 22,390 acres of land and disposed of 7,367. We assume that the BLM would continue to make similar use of land exchanges in the future. Based on the criteria for acquisition and disposal, specifically directing the BLM to acquire land that provides habitat for Threatened and Endangered species, and acquiring land that protects riparian areas, we assume that a portion of land acquisitions would benefit ESA-listed fish. If the BLM proposes to exchange or dispose of land, it would be guided by the requirement that the land should be of limited public resource value and – if it did provide habitat for listed species -- by the related directive that the action must maximize public resource values – and only occur after ESA consultation. These are expected to make it highly unlikely that BLM would dispose of land that is important to listed fish or their critical habitat unless there was some specific factual circumstance which translated into an overall benefit to those species and CH.

2.4.20 Sustainable Energy: Wind and Geothermal Energy

The Wind Energy category includes the siting and development of wind energy and energy transmission ROWs. The proposed action provides that 419,784 acres would be avoided and excluded from any wind energy and transmission line siting and development. There is no current wind energy production, nor any proposals in the last decade, nor new proposals for wind energy production, nor known sites with potential utility-scale wind development on BLM lands.

The Geothermal Energy category includes the development of geothermal energy resources. The proposed action provides that 211,638 acres would have leasable stipulations with major constraints that would discourage the potential for geothermal energy development. There is no current geothermal development occurring on BLM land.

The BLM proposes the following 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 resources uses. Appropriate practices will be applied based on site-specific conditions and include, but are not limited to the following:
  - Establish non-disturbance buffer zones to protect sensitive habitats or areas of high risk for species of concern.
  - 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.
  - Consolidate necessary infrastructure requirements wherever possible, including electric power transmission lines, pipelines and market access corridors, and support utility infrastructure.

Because there have not been any wind energy or geothermal energy projects in the past [and because the proposed action provides additional disincentives, we assume that there is a low likelihood that these types of projects would occur in the future. However, if any wind energy or geothermal energy project are proposed, Management Direction will operate to limit effects to ESA-listed fish and critical habitat by excluding energy development in areas to protect sensitive habitats or areas of high risk for species of concern (which would include ESA-listed species and designated critical habitat). In addition, site specific conditions would be imposed to reduce or avoid impacts to other resource uses including non-disturbance buffer zones to protect sensitive habitats or areas of high risk for species of concern. Although this is framed with respect to site-specific conditions, because it appears in the PRMP as plan-level guidance, we assume that BLM intends to apply it with a broad, plan-level perspective, taking into account synergistic and aggregate effects of any sustainable energy proposals. Project-specific effects would also be addressed in the individual section 7 consultation that would occur for any wind energy or geothermal energy projects that may affect ESA-listed species and designated critical habitat.

2.4.21 Effects of the Action on ESA-listed salmonids, eulachon, and green sturgeon

2.4.21.1 Effects Related to Water Temperature

ESA-listed species are likely to face a combination of: (1) Minor, localized increases in water temperature from limited activity categories (*i.e*., New road construction and livestock grazing). We will explain below.

Removal of riparian vegetation through cattle grazing can reduce habitat quality and result in negative impacts on fish production (Platts and Nelson 1989). Reductions in streambank cover related to overhanging vegetation, root vegetation, and undercut banks have been correlated with reduce fish production (EPA 1993). This is particularly evident in meadow systems, where herbaceous vegetation may provide the only shade to stream channels. Removal of herbaceous vegetation can result in a reduction of shade; this is typically minimal and limited to streams with narrow channels. BLM will use guidelines in the *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Land Administered by the Bureau of Land Management in the States of Oregon and Washington* (USDI BLM 1997) to minimize the potential for increase in stream temperature. Stream temperature will most likely affect stream meadows where grasses are the primary shade for small streams. This effect is localized to the stream reach until it meet a confluence of another stream channel for cooling.

Road construction will remove shade associated trees within the road right-of-way clearing limits. Roads may cross perpendicular to a stream removing a width of 14 to 18 feet, but sometime roads can parallel streams removing the same width for up to ¼ to ½ mile. Management direction will limit new road construction such to make it unlikely to occur in riparian reserves and thereby keeping the impacts to a low level for streams, however, some circumstances only allow for harvest management to occur with new road construction in the riparian reserve.

Water temperatures influence water chemistry, as well as every phase of salmonid life history. Research indicates that most salmonid species are at risk when temperatures exceed 73 to 77° F

(Spence *et al.* 1996). In addition to the lethal effects of high temperatures, salmonids rearing at temperatures near the upper lethal limit have decreased growth rates because nearly all consumed food is used for metabolic maintenance (Bjornn and Reiser 1991). Temperatures exceeding the upper lethal limits may be tolerated for brief periods or fish may seek thermal refugia. Li *et al*. (1991) reported that resident rainbow trout in an eastern Oregon stream selected natural and artificially created cold water areas when temperature in the main stream channel exceeded 75.2°F and showed no preference for these areas when temperature in the main stream channel was less than 68°F. Coldwater refugia, such as springs and groundwater seeps, allow coho salmon to persist in areas where temperatures in mainstream channels exceed their upper lethal limit.

Adverse physiological and behavioral effects to salmon and steelhead accrue not only from persistent high temperatures in summer, but from intermittent exposure to high temperatures, increased diurnal variation in water temperature, and altered cumulative exposure history of the organism (McCullough 1999). Adverse effects to salmon and steelhead from warm water temperature are likely to include: (1) Increased adult mortality and reduced gamete survival during pre-spawn holding; (2) reduced growth of alevins or juveniles; (3) reduced competitive success relative to non-salmonid fishes; (4) out-migration from unsuitable areas and truncation of spatial distribution; (5) increased disease virulence, and reduced disease resistance; (6) delay, prevention, or reversal of smoltification; and (7) harmful interactions with other habitat stressors such as pH and certain toxic chemicals, the toxicity of which is affected by temperature (Reeves et. al. 1987; Berman 1990; Marine 1992, Marine and Cech 2004; McCullough 1999; Dunham *et al*. 2001; Materna 2001; McCullough *et al*. 2001; Sauter *et al*. 2001). These adverse effects are likely to affect all life stages of UWR Chinook salmon, OC coho salmon, SONCC coho salmon, and UWR steelhead. LCR Chinook salmon, LCR coho salmon, LCR steelhead, and CR chum salmon will also be affected by increased stream temperature, but on a much smaller scale because there is minimal BLM land that overlaps with the distribution of these species. Eulachon in the Columbia River; green sturgeon; and the MCR, Snake River, and UCR species are unlikely to be adversely affected because the increased stream temperature will not affect the Columbia River mainstem where these species are present. It is difficult to determine the effects of temperature increase at the planning process without site specific data, but we determined that the increase in temperature will adversely affect the eulachon along the Oregon coast. Therefore, eulachon in the SONCC and OC recovery domains will expect similar adverse effects as listed coho salmon in these recovery domains.

We expect that the management direction for the subwatershed classifications will protect stream shade and keep stream shade reduction to limited occurrences. Forest management activity in riparian areas has the largest geographic scope and the possibility of the most influence on stream temperature. At the planning scale, the management direction providing the 120’ buffers on all perennial and fish bearing streams will limit shade reduction and subsequent potential temperature increases to a few situations involving East/West stream aspects and low (40% or less) pre-harvest canopy cover (see Section 2.4.1 and Table 78). Site specific planning efforts can identify these higher risk situations and avoid reducing stream shade and increasing stream temperatures. Therefore, although the potential for stream temperature increases due to the proposed action is likely, we expect it will be limited at the project planning phase consistent with the PRMP management directives.

2.4.21.2 Effects Related to Wood Recruitment

The proposed action is likely to reduce wood recruitment potential from the following programs: cattle grazing, fire and fuels, and forest management (new road construction). There are no other project elements that will affect in-stream wood or wood recruitment in the action area.

Large wood that falls into streams is essential to the maintenance of habitat because it forms pools, traps and sorts gravels, increases hyporheic exchange, modulates stream temperature, and provides cover and increased habitat complexity (Beechie and Sibley 1997, Moore et al. 2005). Large wood provide hydraulic complexity and pool habitats that serve as resting and feeding stations for salmonids as they rear or migrate upstream to spawn (Spence *et al.* 1996). Instream wood also retains salmon carcasses (Cederholm and Peterson 1985), a major source of nitrogen and carbon in stream ecosystems (Bilby *et al.* 1996).

The cattle grazing and fire and fuels programs are located in southern Oregon affecting the SONCC recovery domain. Both these programs have the potential to remove small diameter trees (less than 8 inches) that will lead to decreased potential wood recruitment into the future. Cattle grazing is limited to existing allotments located in the upper watershed, whereas fire and fuels programs are generally targeted with timber sales. The effect of these small tree removals from the fire and fuels and cattle grazing programs is minimal, as described in effects to the environment (Sections 2.4.2 & 2.4.5).Under the proposed action, BLM is requiring active instream wood placement as part of commercial sales that will continue to increase the overall wood volume instreams. Additionally, BLM's management direction for the Class I and Class II stream buffers will provide a 120' buffer of trees along perennial and fish bearing streams, along with a 50' buffer along intermittent streams. The overall increase in large wood and resilience to fires over the long term will outweigh the short-term effects of fuels thinning. BLM management directives within the cattle grazing program will utilize actions such as herding, salt blocks, fencing, rotation, etc. such that grazing will only result in a minimal reduction of herbaceous hardwood that eventually contributes to the large wood indicator. Additionally, this reduction of large wood is offset by tree tipping and falling during commercial timber sales.

Road construction will remove trees within the road right-of-way clearing limits. Roads may cross perpendicular to a stream removing a width of 14 to 18 feet, but sometime roads can parallel streams removing the same width for up to ¼ to ½ mile. Management direction will ensure there is only a minimal amount of new road construction in the riparian reserve, however, some circumstances only allow for harvest management to occur with new road construction in the riparian reserve. This is usually limited from ¼ mile to 1 ½ miles within a timber sale.

The reduction of wood mainly from roads constructed parallel to streams will reduce the wood recruitment potential to the streams. This adverse effect will continue until the road is decommissioned and trees are allowed to grow again, thus road construction can affect the large wood recruitment into the stream for centuries. However, this reduction in wood recruitment compared to the overall 6th field watershed is small, due the BLM's management direction to allow new road construction in the riparian reserve where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives. When new road construction does occur, the area immediate adjacent to the road, often ¼ to 1½ miles with a roadway width of 12' to 14', will see a minimal amount of reduction to the large wood recruitment process from the riparian reserve. The reduction spread across the 6th field HUC is relatively small, but will continue throughout several decades until the road is decommission and new growth is allowed to survive.

The minor adverse effects from reduction of wood to the stream are likely to affect all life stages UWR Chinook salmon, OC coho salmon, SONCC coho salmon, and UWR steelhead. LCR Chinook salmon, LCR coho salmon, and LCR steelhead will also be affected by decreased wood production, but on a much smaller scale because there is minimal BLM land that overlaps with the distribution of these species. Eulachon in the Columbia River; green sturgeon; and the MCR, Snake River, and UCR species are unlikely to be adversely affected because the reduction of wood and will not affect the Columbia River mainstem where these species are present.

For the reasons outlined above, loss of wood will have a minor adverse effect on eulachon along the Oregon coast. Therefore, eulachon will experience similar adverse effects as listed coho salmon along coastal Oregon.

2.4.21.3 Effects Related to Changes in Peak and Base Flow

Geomorphic changes in stream channels can be affected by the magnitude of flows. Geomorphically effective flows are defined as flows that affect bedload sediment transport. Flows that are large enough to alter channel morphology, bank erosion, or habitat structure have the highest likelihood of affecting fish (Grant et al. 2008). 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, 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, 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.

The highest likelihood of increased peak flows from timber harvest and road construction will be in the ROS watersheds. Based on modeling conducted by the BLM as described above in the Forest Management (Section 2.4.1), the BLM predicted the number of watersheds within each DPS and ESU per decade that would be susceptible to increases in peak flows. Although we recognize there are some uncertainties in modeling, we are not aware of any better methods to evaluate the potential for increases to peak flow.

The results of the modeling are as follows:

There are 34 watersheds with BLM ownership in the LCR Chinook salmon and LCR coho salmon ESUs, and 28 watersheds in the LCR steelhead DPS. Of these watersheds, only one is predicted to have increases in peak flow; however, there is no LCR Chinook salmon distribution in this watershed.

There are 262 watersheds that overlap with land governed by the PRMP in the OC coho salmon ESU. Of these watersheds, four are predicted to have increases in peak flow; however, there is no OC coho salmon distribution in three of the watersheds. The increases in peak flow for the affected watershed with OC coho salmon distribution is predicted to occur over a 50 year period. The effects could occur beyond 50 years; however the BLM only modeled the effects through year 2063.

There are 146 watersheds with land governed by the PRMP in the SONCC coho salmon ESU. Of these watersheds, only one is predicted to have increases in peak flow. The increases in peak flow are predicted to occur over a 20 year period.

There are 122 watersheds with land governed by the PRMP in the UWR Chinook salmon ESU. Of these watersheds, three are predicted to have increases in peak flow. The increases in peak flow are predicted to occur over a 20-50 year period, depending on which watershed is affected.

There are 111 watersheds with land governed by the PRMP in the UWR steelhead DPS. Of these watersheds, two are predicted to have increases in peak flow. The increases in peak flow are predicted to occur over a 40-50 year period, depending on which watershed is affected.

Since eulachon in the Umpqua subpopulation overlap with OC coho salmon and SONCC coho salmon, we assume the watersheds susceptible to increases in peak flow range between the watersheds in the OC coho salmon and SONCC coho salmon ESUs (146-262). However there are no watersheds predicted to have increases in peak flow where eulachon are present.

As summarized above, only a subset of watersheds impacted by the proposed action are predicted to have increases in peak flow, and some of the affected watersheds do not have ESA-listed fish distribution. Green sturgeon, eulachon in the Columbia River population, and the MCR, Snake River, and UCR species are unlikely to be adversely affected because increases in peak flow will not affect the Columbia River mainstem where these species are present. LCR Chinook salmon and eulachon in the Umpqua subpopulation are also unlikely to be adversely affected because there are no watersheds with peak flow increase that overlap with LCR Chinook salmon and eulachon distribution. These adverse effects are likely to affect all life stages of UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, LCR coho salmon, and LCR steelhead because these species and life stages would be present during potential increases in peak flow. Effects to these species would occur if flows are large enough to cause geomorphic effects; however, this will not occur during all rain events.

Base flows are likely to be reduced from water withdrawals. During the periods of decreased flow due to water withdrawals at some pump chances, juvenile fish in small streams (*i.e.,* streams with less than about 10 cubic feet per second of discharge) are likely to become more vulnerable to predation from either crowding into remaining habitat available, or becoming stranded in pockets of water isolated from the main channel. A few juvenile salmon and/or steelhead are likely to be injured or die in each of these events. In Section 2.4.1 in the Forest Management effects on change in peak/base flow, we described the likely effects water withdrawal would influence base flows and concluded the effects would be limited by the capability of the water trucks in terms of capacity of the truck and the duration of the pumping. Adverse effects from decreases in base flow are likely to affect all life stages of UWR Chinook salmon, OC coho salmon, SONCC coho salmon, and UWR steelhead because these species and life stages would be present during potential decreases in base flow. The limited volume and duration of these water withdrawals, along with the PDCs for pumping water that are incorporated into the proposed action will result in very small changes to flow from dust abatement related water withdrawals. LCR Chinook salmon, LCR coho salmon, LCR steelhead, and eulachon will also be affected by decreases in base flow, but on a much smaller scale because there is minimal BLM land that overlaps with the distribution of these species. Green sturgeon, and the UCR and Snake River species are unlikely to be adversely affected because the decreases in base flow will not affect the Columbia River mainstem where these species are present.

2.4.21.4 Effects Related to Suspended Sediment

All species within the planning area will be exposed to increased sediments due to the implementation of the proposed RMP described in the proposed action (Section 1.3), and analyzed in Sections 2.4.1 through 2.4.20 of this document. The interior Columbia basin species that spawn and rear upstream of the action area will only be exposed to increased suspended sedimentation from the action area drainages delivering sediment within the Columbia basin. As these species migrate to the ocean (smolts) and back (adults) to their natal streams, individuals will be exposed to the sediment generated by the proposed action as it reaches the mainstem Columbia River. We do not expect the interior Columbia River species exposed to this sediment to respond appreciably different to this sediment than if this proposed RMP is not implemented. Because the transport rates and sediment routing processes will disperse the fine sediment, spatially and temporally, these fine sediments generated miles from the Columbia will not be concentrated in such a way as to cause physiological or behavioral responses by salmon or steelhead migrating in the mainstem Columbia River. This group of species include SR sockeye, SR fall-run Chinook salmon, SR spring/summer Chinook salmon, SRB steelhead, MCR steelhead, UCR steelhead, and UCR spring-run Chinook salmon. Green sturgeon inhabit the Columbia River and some estuaries and rivers of the Oregon coast. Because green sturgeon are less sensitive to fine sediment; their feeding is not affected by suspended sediment concentrations; and only feeding adult and subadult are present in the action area, we determined they are unlikely to have a response to this increased sedimentation.

In contrast, proposed action caused fine sediment increases will cause physical and behavioral responses for CR chum, LCR coho salmon, LCR steelhead, LCR Chinook salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, and eulachon. All of these species spawn or rear in the streams within the action area and therefore are proximal to the sediment sources generated by the proposed action. Individuals of these species are likely to be exposed to concentrations of suspended sediment directly generated by activities the PRMP proposes. Suction dredge mining is concentrated within streams of SONCC coho salmon, although this activity will also occur, to a much lesser degree, in some watersheds inhabited by OC coho salmon, UWR steelhead, UWR Chinook, and eulachon.

In the absence of data on the specific effects of suspended sediments on eulachon, potentially harmful effects associated with elevated suspended sediments can be assumed to be similar to salmonids, which are among the most sensitive species for which effects from suspended sediments have been evaluated in estuarine dependent species (Wilber and Clarke 2001). However, Hay and McCarter (2000) noted that some eulachon rivers are large or turbid, with high sediment loads, and that the majority are fed by extensive snowmelt or glacial runoff; and Hay et al. (2002) concluded the high sediment load and organic debris in the lower Fraser River may be good habitat for larval eulachon due to the protection from predation it provides. Thus, eulachon may be less sensitive to higher background suspended sediment concentrations than salmonids. Due to the lack of information regarding eulachon distribution we conservatively describe eulachon as inhabiting all basins where elevated sediment levels will occur, although in most basins well downstream of proposed action derived sediments.

We anticipate that individuals of each of the salmonid species and eulachon, as listed above, will be adversely affected by increases in sedimentation due to the implementation of the proposed action. Each species will be exposed to increased sedimentation in proportion to the management activities proposed within the watersheds inhabited by these species analyzed in Sections 2.4.1 through 2.4.20. We rely on BLM's management direction intended to identify and reduce erosion, such as those in the hydrology section (1.3.9.5), to reduce sedimentation generated by activities.

The relative level of increased sediment is likely proportional to the intensity of all the management activities (Sections 1.3 and 2.4), geological erosion risk, and precipitation levels. Across the planning area, the environmental and management activity variables influencing erosion and sediments reaching the streams are quite diverse with no accurate means to quantify sediment loading. We previously discussed these management activities and their relative intensity within the distribution of each of these species in Section 2.4. BLM modeled sediment loading generated by roads to provide a means of comparing alternatives within their FEIS (2016), but this modeling was not intended as a precise estimate of the sediment loading, but rather a means to compare relative differences between analyzed alternatives. In this section, we use the relative intensity of the management activities within the distribution of each species as a proxy for sediment loading resulting from the implementation of the proposed RMP.

Sediment derived from roads in the action area is the greatest source of fine sediment (USDI BLM BA 2016). We analyzed the number of road miles per sub-watershed (HUC6) within each ESU (Figures 14 through 17) and also presented in Table 86. The road miles represent the intensity of the amount of sediment that may be generated by the use of roads, which includes motorized public, administrative, and log haul use. The species exposed to the largest amount of road derived sediment are OC coho salmon, SONCC coho salmon, UWR steelhead, and UWR Chinook salmon due to the presence of these roads (Figures 14 through 17, Table 86). We also include eulachon in this group although our ability to refine the exposure level is more difficult due to the lack of distribution information. For eulachon, we considered all BLM road segments within 200 feet of a stream (sediment delivery zone) in the action area contributed sediment to areas inhabited by eulachon. Timber harvest (both riparian and from the harvest land base) also provides a proxy for sedimentation intensity because these two activities are proportional to the generation of sediment and road use resulting from the timber harvest (Figures 18 and 19).

Timber harvest and associated activities such as landing development, yarding corridors, and log haul, will be greatest in SONCC coho salmon and OC coho salmon watersheds over the next 45 years (Figure 18). Log haul occurring within the UWR steelhead and UWR Chinook salmon ESUs will rise over the next few decades and then gradually decrease, therefore sediment derived from this activity will reduce over time. Sediment from road use, due to few roads, and minimal timber harvest is lowest in the watersheds with LCR Chinook salmon, LCR coho salmon, LCR steelhead, and CR chum (Figures 14, 18, and 19). Projected road use is not available for each species, but where roads are concentrated near populations centers, sedimentation is anticipated to be highest (Figure 12). Management direction (Section 1.3.9.4) that requires road maintenance and minimizing sediment delivery due to these activities will contribute to reducing sedimentation. Consistent with PMRP direction, we expect that travel management plans will identify resource conflicts and assess options to reduce conflicts, such as chronic sedimentation sources. We anticipate prior to completing travel plans, which we expect to take up to ten years, BLM will implement road management and maintenance per management direction identified in Section 1.3.9.4. After travel management plans, we anticipate part of BLM's decision process will consider identifying roads contributing sediments and taking action to reduce the road derived sediments.

Increased sedimentation from implementing the proposed RMP will occur and the causes of increased sediments and suspended sediments were described within each program assessment presented in the effects on the environment (Sections 2.4.1 through 2.4.20). Sources of increased fine sediments include, but are not limited to: all motorized use of roads (2.4.1 and 2.4.9); livestock grazing (2.4.5); mining (2.4.6); and forest management activities (2.4.1), such as timber harvest, skid trails, landing developments, log haul and road construction. An estimated 90% of the sediments derived from forestry activities will be caused by the existence and use of the road system (USDI BLM BA 2016). Suction dredge mining has a unique effect, in that this activity directly manipulates instream sediment by suctioning up streambed material and then discharging it back into the stream. Because of this more direct manipulation of sediments and the resulting suspended sediment plumes, we discuss suction dredge mining effects in greater detail than the other activities.

Proposed action caused fine sediment increases described in the previous effects on the environment section will likely directly and indirectly affect the listed species through physical impairments, behavioral responses, availability of preferred forage, and changes in habitat quality. These sediments entering the stream can contribute to total suspended sediment concentrations, as well as the bedload. Although suction dredge mining does not introduce new sediments, as previously described in Section 2.4.6, this activity re-distributes sediments in the stream causing sediment plumes. These proposed action generated suspended sediments are likely to have detrimental physical effects on fish, including salmon and steelhead (Bilotta and Brazier 2008, Scheurer *et al.* 2009, Kemp *et al.* 2011). The effect of mineral particles on free swimming salmon and steelhead decreases with particle size and increases with particle concentration and exposure duration (Newcombe and Jensen 1996). The fine suspended sediments generated as part of the proposed action may affect salmon and steelhead and cause direct physical damage (Newcombe and Jensen 1996, Newcombe 2003). Studies show that salmon and steelhead regularly experience physiological stress when exposed to suspended sediment particles, a response often paralleled by decreased leucocrit values (Servizi and

Martens 1987). Likewise, gill abrasion and particle uptake in gills and spleen have been reported (Servizi and Martens 1987, Goldes *et al.* 1988). Behavioral responses include avoidance of sediment plumes and alarm reactions (Bisson and Bilby 1982, Berg and Northcote 1985). Reduced growth and mass of salmon and steelhead exposed to suspended sediment beyond 4 days has been attributed to increased energy demands (Shrimpton *et al.* 2007) but also reduced feeding in turbid waters (Shaw and Richardson 2001). We expect the fine suspended sediment generated by the proposed action will have these identified categories of adverse effects on the species inhabiting the streams within the action area.

Response of the listed species to project generated suspended sediment is related to concentration levels and exposure duration. Research investigating relationships between suspended sediment concentrations and exposure duration provide general predictors for salmon and steelhead response. Of key importance in considering the detrimental effects of suspended sediment on juvenile steelhead are the frequency and duration of the exposure, as well as the concentration. Sublethal effects of short-term exposure (i.e., hours to weeks) of juvenile coho salmon to suspended sediment occur at approximately 20 Nephelometric Turbidity Units (NTU) in laboratory settings (Robertson *et al.* 2006). Suspended sediment may be estimated by turbidity measurements in NTUs, which is a measure of light scattered by particles suspended in liquid. Increases in suspended sediment concentrations as low as 30 NTU can result in reduced prey capture success or gill flaring for juvenile coho salmon exposed to turbidity pulses for periods as short as four hours (Berg and Northcote 1985). Other negative behavioral responses can include changes in territorial behavior, alarm reactions with downstream displacement and increased predation and competition, avoidance behavior, decreased feeding, and reduced growth (Noggle 1978, Berg 1983, Lloyd 1987, Newcombe and Jensen 1996, Bash *et al*. 2001, Robertson *et al.* 2006). High levels of suspended sediment can be lethal to salmonids; lower levels can cause chronic sublethal effects including loss or reduction of foraging capability, reduced growth, reduced resistance to disease, reduced respiratory ability, increased stress, and interference with cues necessary for homing and migration (Bash et al. 2001). Sublethal effects (such as olfactory effects) are those that are not directly or immediately lethal, but are detrimental and have some probability of leading to eventual death via behavioral or physiological disruption. Some juveniles use suspended sediment plumes for cover to reduce risk of predation where other cover is lacking (Bisson and Bilby 1982). Where proposed action activities generate chronic fine sediment, salmon, steelhead, and eulachon may respond in similar manner as described by these research findings.

Turbidity levels as low as 20 NTUs can cause behavioral changes and we anticipate the proposed action will result in additional fine sediments to the stream that will raise background turbidity levels over 20 NTUs during precipitation events and potentially due to other circumstances. Given the potential for an exposure duration greater than 4 hours, suspended sediment levels above 20 NTUs could cause gill irritation and behavioral responses, which include alteration to feeding and social hierarchy (Berg and Northcote 1985). Berg and Northcote (1985) concluded the turbidity threshold was the important consideration; therefore, the proposed action generated fine sediment, when added to the baseline suspended sediment levels, could raise stream's turbidity levels above the 20 NTUs in the action area streams. As the turbidity levels approach 60 NTUs, feeding may cease (Berg and Northcote 1985). At high enough concentration levels, the addition of fine sediment to channels is likely to lead to displacement from or avoidance of preferred rearing areas, or abandonment of preferred spawning grounds, which increases losses to competition, disease, predation, or, for juvenile fish, reduce the ability to obtain food necessary for growth and maintenance (Newcombe and Jenson 1996, Sprague and Drury 1969, Moberg 2000).

Fine sediments contributed to the system during storm events contribute to elevated natural and anthropogenic caused sediments. These events happen most frequently in the fall and winter, where, depending on the species, spawning adults are exposed or rearing juveniles. Because suction dredging occurs in the stream during summer, rearing and outmigrating juvenile salmonids will be exposed to this increase of suspended sediment at a time of year when typically suspended fine sediments are at their lowest. Because of the unique nature of suction dredging we are more informed of the nature of the source, concentration, and duration of the sediment plumes. Maximum suspended solid concentrations in suction dredging plumes are expected to range from 1.6 mg/L to 340 mg/L, or up to 50 NTU; the duration of the plume is limited because measurable, increased suspended sediment occurs only when suction dredging is occurring and for an ephemeral time immediately after. These concentrations and daily exposure durations are less than what have been reported to cause direct mortality of coho salmon juveniles (Newcombe and Jensen 1996). However, the sublethal effects described above (i.e., increased predation, decreased feeding, reduced growth) are expected for rearing and migrating juvenile salmon.

We expect that CR chum, LCR coho salmon, LCR steelhead, LCR Chinook salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, and eulachon individuals will have the same response to suspended sediment concentrations and exposure duration as described in these research study findings. Quantifying the number of individuals from each of these species (CR chum, LCR coho salmon, LCR steelhead, LCR Chinook salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, and eulachon) considered in this opinion exposed annually to adverse concentrations of sediments is very difficult for several reasons. Fish population estimates within the planning area watersheds are not available and, for the most part, would be unreliable to predict affected numbers due to the difficulties of sampling and estimating fish population sizes. Naturally these numbers vary from year to year. Second, 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 (USDI BLM BA 2016). Cederholm *et al.* (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.

We conclude the proposed action's effect on increased suspended sediment is pervasive across the planning area from many different sources described in Section 2.4 (effects on the environment). We also consider BLM's management direction, for example, Section 1.3.9.5 (Hydrology section) where erosion sources are identified and actions taken, such as, disconnecting ditchlines from the stream system with cross drains, maintaining vegetated ditchlines, locating roads and trails outside of riparian areas, and managing log hauling in wet conditions will serve across the action area to reduce potential sedimentation within the watersheds inhabited by these species. In addition to these management directions that reduce sedimentation, BLM will use travel management plans and restoration activities to identify and reduce erosion sources. The proposed action, on balance, may cause a moderate increase in sedimentation within watersheds inhabited by these species (CR chum, LCR coho salmon, LCR steelhead, LCR Chinook salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, and eulachon), but current and future actions proposed by BLM will reduce that potential.

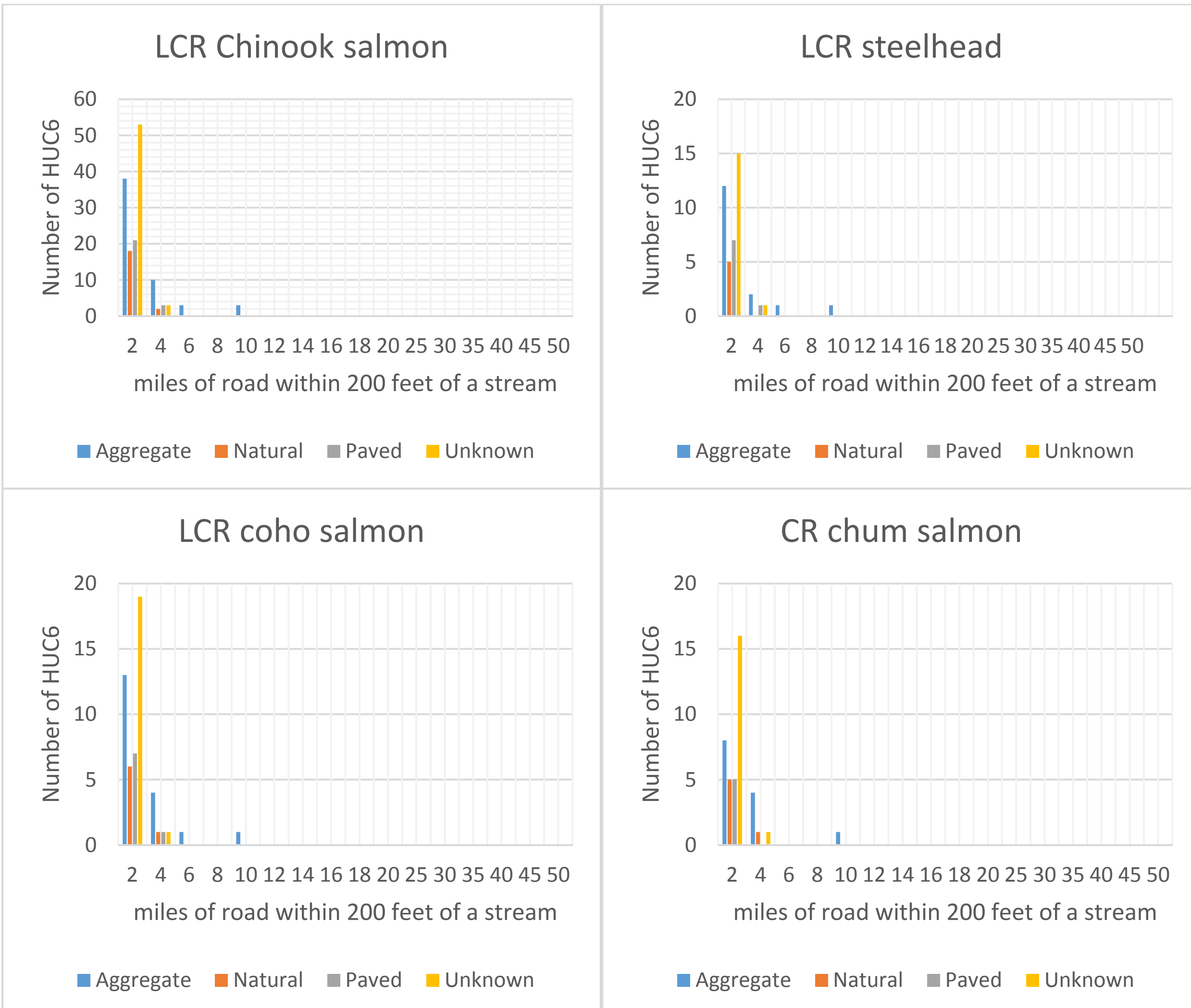

Figure 14. BLM roads within 200 feet of a stream in the Lower Columbia River area. The histograms display are the number of sub-watersheds (HUC 6) with the total length of BLM road miles per surface type.

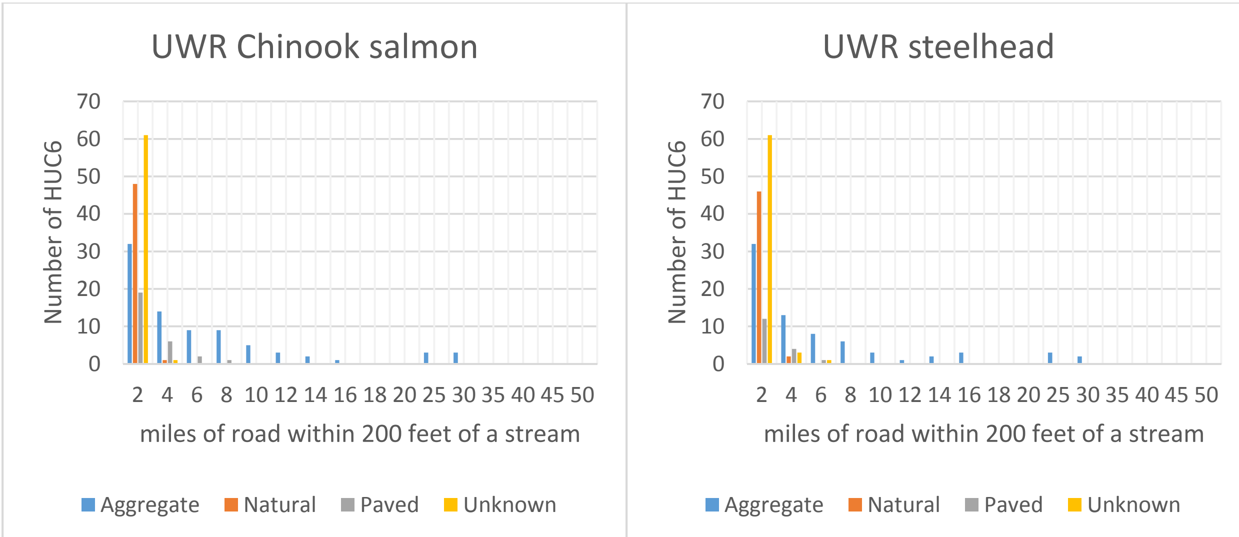

Figure 15. BLM roads within 200 feet of a stream in the Willamette River basin. The histograms display are the number of sub-watersheds (HUC 6) with the total length of BLM road miles per surface type.

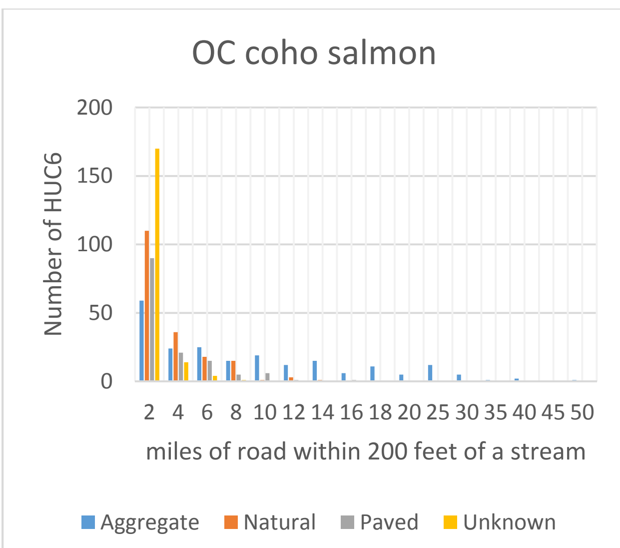

Figure 16. BLM roads within 200 feet of a stream in the Oregon Coast coho salmon distribution. The histograms display are the number of sub-watersheds (HUC 6) with the total length of BLM road miles per surface type.

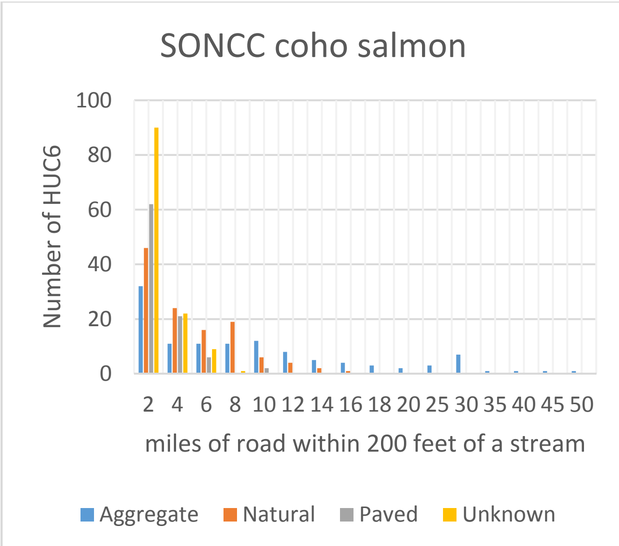

Figure 17. BLM roads within 200 feet of a stream in the Southern Oregon/Northern California Coast coho salmon distribution. The histograms display are the number of sub-watersheds (HUC 6) with the total length of BLM road miles per surface type.

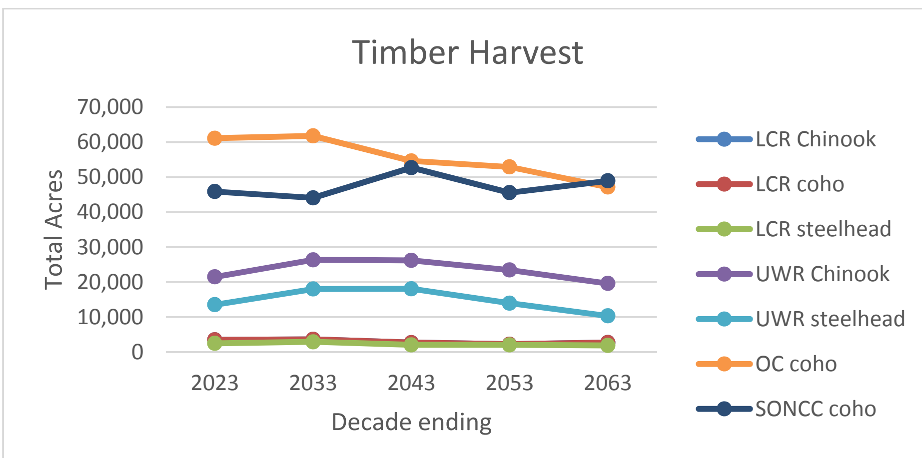

Figure 18. Proposed RMP total acres of projected harvest within the watersheds of each species in the planning area.

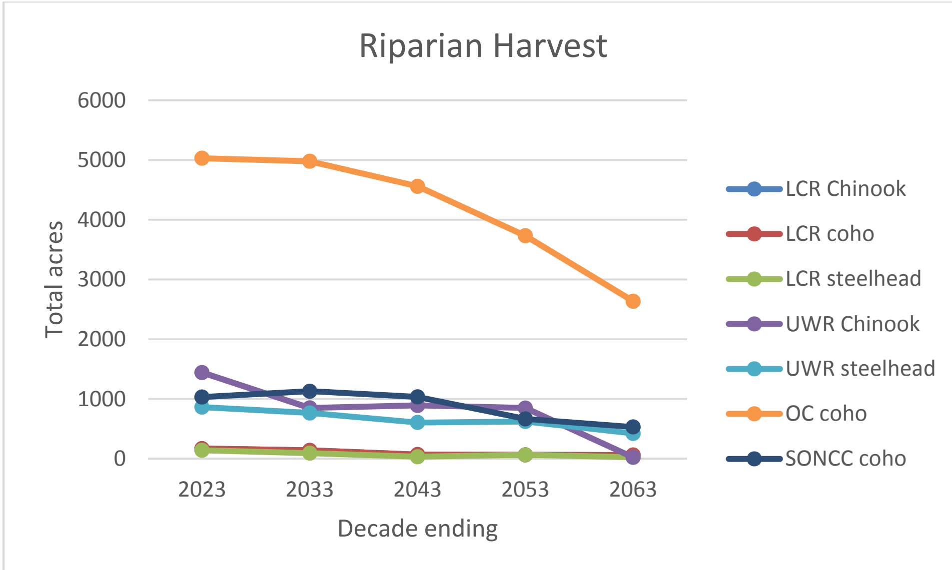

Figure 19. Proposed RMP total acres of projected harvest within the watersheds of each species in the planning area.

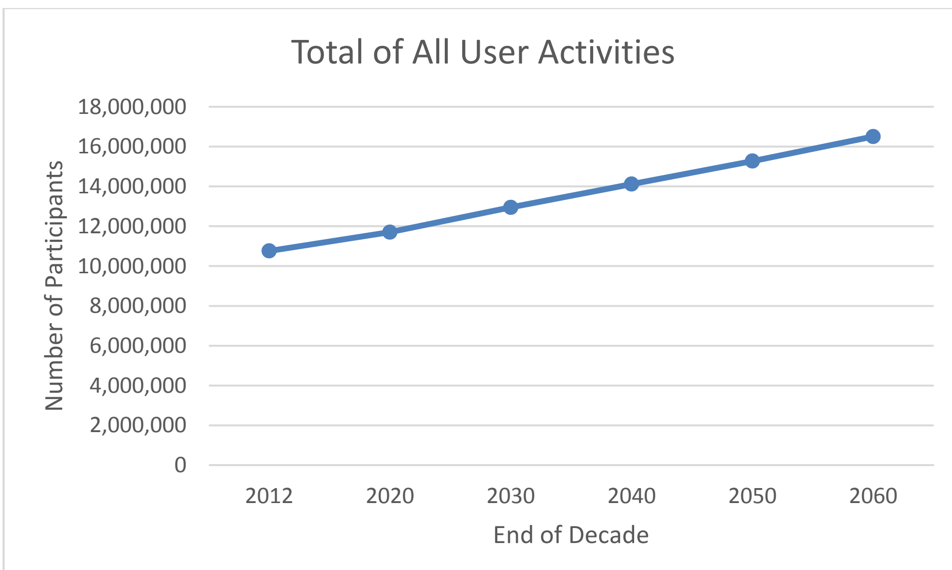

Figure 20. Projected number of recreational users involved in all activities on BLM administered land starting with estimated users in 2012 and projecting use by the end of each decade.

2.4.21.5 Effects Related to Methylmercury

Nearly all (95-99%) mercury accumulated in fish tissue is methylmercury (Grieb *et al.* 1990, Bloom 1992, Hammerschmidt *et al.* 1999, Peterson *et al.* 2007), a highly toxic compound that readily crosses biological membranes, accumulates in exposed organisms, and biomagnifies to high concentrations in fish atop aquatic food webs (Wiener *et al.* 2003, Scheuhammer *et al.* 2007). Methylmercury can enter estuarine food webs through either benthic or water column pathways via accumulation in primary producers or other base organisms (Chen *et al.* 2009). Wild fish obtain methylmercury mostly from food, with dietary routes accounting for approximately 90% of total uptake. Fish eliminate methylmercury very slowly (Trudel and Rasmussen 1997, Van Walleghem *et al.* 2007) and methylmercury accumulates in fish to concentrations that exceed surface water concentrations by as much as 106 to 107 fold (Wiener *et al.* 2003). Sandhenreich and Weiner (2011) concluded that the principal effects of methylmercury on North American freshwater fish populations at existing exposure levels are depressed reproduction and sublethal damage to tissues; these effects have been observed in multiple species of freshwater fish at tissue concentrations well below 1.0 ppm wet weight. Because methylmercury effects are often manifested as neurological impairment, effects may not be readily detected in the wild.

Methylmercury primarily exerts its toxic effect on the central nervous system, resulting in reduced coordination, behavioral abnormalities, and cellular damage to the brain, including lesions and nerve demyelination (loss of protective coating around nerve synapsis). Methylmercury also accumulates in olfactory rosettes and in nerves, axons, and Schwann cells (Baatrup and Doving 1990). Mela et al. (2007) also suggested that methylmercury caused oxidative stress, which contributed to the development of necrotic tissues. Thus, effects of methylmercury on fish are not limited to neurotoxicity, but also include histological changes in the spleen, kidney, liver, and gonads. Oxidative stress-mediated damage has been associated with cancer, chronic inflammation, cardiovascular disease, and stroke in humans (Farina et al. 2011). Additional effects on fish related to mercury include altered sex hormone expression (Friedmann et al. 2002, Drevnick and Sandheinrich 2003), reduced spawning success and reproductive output (Hammerschmidt et al. 2002, Drevnick and Sandheinrich 2003), reduced gonadosomatic indices and testicular atrophy (Friedmann et al. 1996), liver necrosis (de Oliveira et al. 2002), altered predator avoidance behavior (Webber and Haines 2003), and altered gene expression (Moran et al. 2007). Chronic outcomes of toxicity are reproductive effects, developmental effects, hormonal effects, behavioral effects, and disease, resulting in population effects of reduced survival and reduced reproductive success. Many responses can be delayed and not appear until long after the initial exposure (Weis 2009).

As noted in above, 0.2 ppm has been identified as a whole-body threshold, below which adverse effects in most juvenile and adult fish are unlikely, although subtle behavioral effects may occur at lower concentrations. Adverse effects on biochemical processes, damage to cells and tissues, and reduced reproduction in fish occur at concentrations of about 0.3-0.7 ppm wet weight in the whole body and about 0.5-1.2 ppm wet weight in axial muscle.

The scope of effects of methylmercury in estuaries and/or reservoirs downstream from suction dredging will be dependent on the overall amount of mining in the drainage, environmental conditions of the estuary in terms of depositional areas favorable for methylmercury, and exposure of salmonids to dietary methylmercury. Estuaries are not used for spawning, therefore spawning adults, eggs, embryos will not be exposed to increased methylmercury in the estuary resulting from remobilization and transport of mercury by suction dredging. Some salmon, like coho, pass through the estuary without feeding (McMahon 1983, Cooke *et al.* 2011, Hughes *et al.* 2014) or greatly reduce their feeding (Garner *et al.* 2009 and 2010) and are unlikely to bioaccumulate large amounts of methylmercury or will likely be exposed to methylmercury only through the water, which is a minor pathway of uptake, and unlikely to result in adverse effects.

Greater duration of rearing juveniles and smolts in the estuaries will increase exposure to methylmercury as will their diet (i.e., juvenile fish and/or invertebrates). Some rearing individuals and outmigrants will bioaccumulate sufficient methylmercury to increase their overall concentrations to a level where they will experience adverse effects including neurological impairment; other additional negative effects on behavior, development, or reproduction; or a reduction in overall survival and fitness.

Suction dredging primarily occurs in the BLM Medford District (Figure 7).We expect the highest concentration of methylmercury to affect SONNC coho salmon in the Rogue and Chetco estuaries. SONCC coho salmon use these estuaries as migration corridors during smolt outmigration and therefore have very limited during exposure time (2 to 3 weeks). Furthermore, we assume that repeated exposure is necessary to result in adverse effects in exposed individuals, and that repeat exposures sufficient to adversely affect individuals is limited to only a small portion of the population. Bioaccumulation of forage species from methylmercury is expected to cause alterations to biochemical processes, damage to cells and tissues, and reduced reproduction in some individuals, but is not expected to notable adverse effect at the population structure of SONCC coho salmon because of the limited number of fish that will be subject to repeat exposures. Species within the OC Recovery Domain, the LCR/Willamette, or the Interior Columbia Domain will only be exposed to methylmercury from very few mining claims such that the accumulation in forage species is expected to be extremely minimal.

2.4.21.6 Effects Related to Chemical Contaminants

Stormwater pollutants are a well-known source of potent adverse effects to salmon and steelhead, even at ambient levels (Loge *et al*. 2006, Hecht *et al*. 2007; Johnson *et al*. 2007; Sandahl *et al*. 2007; Spromberg and Meador 2006). These pollutants also accumulate in the prey and tissues of juvenile salmon where, depending on the level of exposure, they cause a variety of lethal and sublethal effects including disrupted behavior, reduced olfactory function, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities (Fresh *et al*. 2005; Hecht *et al.* 2007; LCREP 2007).

Baldwin *et al.* (2003) exposed juvenile coho salmon to various concentrations of copper to evaluate sublethal effects on sensory physiology, specifically olfaction. Short pulses of dissolved copper at concentrations as low as 2 micrograms per liter (μg/L) over experimental background concentrations of 3 μg/L reduced olfactory sensory responsiveness within 20 minutes, and the response evoked by odorants was reduced by approximately 10%. At 10 μg/L over background, responsiveness was reduced by 67% within 30 minutes. They calculated neurotoxic thresholds sufficient to cause olfactory inhibition at 2.3 to 3.0 μg/L over background. They also referenced three studies that reported copper exposures over 4 hours cause cell death of olfactory receptor neurons within rainbow trout (*Oncorhynchus mykiss*), Atlantic salmon (*Salmo salar*), and

Chinook salmon. The concentrations tested are lower than common concentrations in stormwater outfalls, and thus indicate toxicity even after stormwater has been moderately diluted. The measured exposure times are likewise shorter than typical stormwater outfall discharge times. Inhibiting olfaction is detrimental to salmon because olfaction plays a significant role in the recognition and avoidance of predators and migration back to natal streams to spawn (Baldwin *et al*. 2003). More recent research indicates that the effect of 2 μg/L copper concentrations over experimental background concentrations of 3 μg/L reduces the survival of individuals (Hecht *et al.* 2007).

Adverse effects to salmon, steelhead, eulachon, and green sturgeon from exposure to stormwater are reasonably certain to include mortality, injury, and a variety of sublethal and behavioral effects that will reduce growth, fitness, and survival of a small number of individual fish. Although adverse effects from chemical contaminants are not limited to one time of year, these adverse effects will occur at their greatest intensity in the first few hours of a storm event (Wang et al. 2013). In western Oregon the first significant precipitation event of the fall likely carries a significant amount of contaminants into the streams due to the long dry deposition period. Contaminant introduction will continue at lower intensity throughout the remainder of the wet season. Any precipitation event large enough to transport contaminants from the road surface and overwhelm the filtering capacity of the ditch line or forest floor will cause exposure to the species considered in this opinion. Rearing juveniles, outmigrating smolts, and migrating adults would also be exposed directly to any accidental in-stream spills from suction dredges.

In addition to direct exposure from contaminants, salmon and steelhead may be indirectly exposed to contaminants from stormwater and accidental spills from equipment, such as suction dredges. Salmon, steelhead, and green sturgeon prey include benthic invertebrates; therefore, salmon are indirectly exposed to PAHs through the food web. While many PAHs do not significantly bioaccumulate in vertebrates, some of the heavier PAH compounds with toxic metabolites may persist and are known to cause sublethal effects to fish in laboratory studies (National Toxicology Program 2014) and field studies (Moore and Myers 1994, Myers *et al.* 1998a, 1998b). The greatest risk of accidental spills is from suction dredging and vehicles using existing fords. Additionally, BLM PRMP does not require miners to fuel outside the riparian reserves. Therefore, unintentional chemical contamination from accidental spills or equipment malfunction is likely to injure rearing juveniles or reduce their feeding and growth, increase their disease susceptibility, and decrease their survival and fitness. Migrating salmon, both adults and juvenile outmigrants in addition to having a shorter duration of potential exposure, are highly mobile and are likely to avoid localized and temporary contamination events with only a slight delay in migration and no resulting long term effect on health or survival. However, outmigrating juvenile salmon and steelhead will also accumulate PAHs through their diet, with similar effects as described above for rearing salmon and steelhead, although to a lesser extent due to their shorter exposure duration. Green sturgeon inhabiting the Columbia River and the coastal rivers and bays will feed upon invertebrates exposed to contaminants from many sources, including the BLM derived roads. Eulachon adults are not known to feed in freshwater; therefore they are not likely to be exposed to contaminants through this mechanism.

Aquatic contaminants often travel long distances in solution or attached to suspended sediments, or gather in sediments until they are mobilized and transported by the next high flow (Anderson *et al.* 1996; Alpers *et al.* 2000a, 2000b). Because these contaminants travel long distances from their source and can become available time and again through resuspension, bioaccumulation, and transport, in addition to the species within the planning area and occupying habitat adjacent to the BLM roads, species inhabiting the mainstem Columbia River will also be exposed to these contaminates. These species include green sturgeon, eulachon, SR sockeye, SR fall-run Chinook salmon, SR spring/summer Chinook salmon, SRB steelhead, MCR steelhead, UCR steelhead, UCR spring-run Chinook salmon. Green sturgeon and eulachon are also present within the estuaries and some river systems along the Oregon coast where exposure to stormwater contaminants is more proximal to BLM roads. For eulachon and green sturgeon, their distribution within the different watersheds of the action area are relatively unknown, although anticipated to primarily inhabit the estuarine portions of the action area. In the case of eulachon, this also includes migration up into freshwater tributaries low in the various river basins.

The specific nature of each road, traffic volume characteristics, and associated stormwater filtering potential is unknown. We are confident that even designed stormwater treatment systems do not provide 100% treatment effectiveness (Grant et al. 2003,); therefore stormwater contaminants from the use of BLM roads without a designed treatment system will reach streams and expose individuals of each of the species. The relative magnitude of these effects can be represented by road miles within 200 feet of a stream, which were presented for each salmon and steelhead species in Table and also represented by Figures 14 through Figure 17. In addition to road miles, traffic volume serves as another important determinant of the magnitude of contaminants entering project area streams. Similar to our sedimentation risk assessment, we anticipate the greatest risk to listed fish species to be near the urban population centers where the most road use will occur (Figure 11). Paved roads, designated as collector roads and near population centers are most likely the highest stormwater contaminant contributors due to the highest traffic volume. Local roads have a lower traffic volume and next highest contributors. Resource roads with the lowest traffic volume represent the lowest risk. Within each of these categories, roads further from the population centers will have a lower relative risk than those in proximity to the population centers. Resource roads far from population centers with low traffic volume likely present a low stormwater contaminant risk. Paved roads represented in table 82 provide some reference to the magnitude of stormwater sources for each species. OC coho salmon have the highest number of road miles segments within 200 feet of a stream (302.7) and are most likely to have the greatest exposure to stormwater contaminants from BLM roads. Because of the poor distribution information for eulachon and green sturgeon, our most conservative estimate for exposure for these two species is the combined paved road miles presented in Table 82 for all of the areas, meaning the combined miles of LCR, Willamette, OC, and SONCC domains represent the magnitude of stormwater contaminant sources.

Management direction and best management practices designed to reduce sedimentation are also expected to reduce stormwater contaminants by hydologically disconnecting the road surface and ditchlines from the stream. Vegetated ditchlines and crossdrains that divert flow to the forest floor likely provide some stormwater treatment. BLM's proposed sediment reduction practices will reduce stormwater contaminants, even if the stated intent is sediment reduction because these vegetated ditchlines and crossdrains can be effective stormwater treatment methods. Without focused and strategic treatment efforts, stormwater contaminates will be at low or moderate levels based on the traffic volume and surface type. At highest risk are paved roads with high traffic volumes located within watersheds inhabited by listed species. Proposed travel management plans are also expected to consider resource conflicts and provide another opportunity for BLM to identify road systems that pose the highest stormwater contaminants risks and apply management direction to minimize these stormwater contaminants from reaching the stream. We expect BLM will take the opportunity in the travel management planning process to reduce stormwater contaminants. Beyond seven years, we expect these travel management plans will identify roads causing resource conflicts, such as high stormwater sources, and propose options to reduce those conflicts using management direction described in Section 1.3.9.4 where road closures, vegetated ditchlines, cross drains, and other methods may be used to disconnect stormwater from streams. We also expect BLM to implement these management directions to reduce contaminants in the highest priority watersheds described in their restoration strategy (USDI BLM 2015a).

2.4.21.7 Effects Related to Substrate Changes

Stream substrates are altered by coarse and fine sediment deposition. Fine sediments transport downstream in the water column, but on the falling leg of a storm event, will deposit downstream until another event mobilizes them. Coarser material will add to the bedload and also deposit downstream of the initial source when storm event flows recede. When these sediments deposit on the streambed they fill interstitial spaces that result in reduced hyporheic water flow, changed invertebrate habitat, increased stream temperature, altered fish spawning substrate, and in extreme situations, altered channel morphology.

Adverse effects from sedimentation and substrate embeddedness include reduced reproductive success as well as reduced growth, reduced survival, and increased mortality of eggs, embryos, and emerging fry; reduced feeding of rearing and outmigrating juveniles as a result of sedimentation/substrate embeddedness and temporarily decreased macroinvertebrate abundances; increased predation, decreased feeding, and reduced growth of rearing and outmigrating juveniles from suspended sediment.

Sedimentation generated by the proposed action may occur throughout the year, although some actions have specific time-frames when sediment is generated. For example, suction dredging and cattle grazing occur during the summer, while road related sediment may occur throughout the year based on storm events. Although spawning adults, redds, eggs, embryos, and emerging fry will not be directly exposed to suction dredging and suspended sediment due to the timing of the activity, increased sedimentation and substrate embeddedness downstream of suction dredges could result in decreases in available spawning areas. In a similar manner, sediment derived from other activities may be generated at specific times, but the lasting effects of increased erosion rates and subsequent sediment transport through the stream system results in adverse effects to fish.

In redds, eggs undergo incubation and hatching with emergence of fry; survival to emergence is related to flow conditions and substrate. Embedded substrate clogs interstitial spaces, reduces intergravel velocities, and reduces dissolved oxygen concentrations in redds, which are all detrimental to successful egg survival, hatching, and fry emergence. Embedded substrate also makes it more difficult for fish to dig redds (Cederholm et al. 1997). Spawning females can remove deposited fine sediment when creating redds and burying eggs (Lisle and Lewis 1992) but we expect that in some situations, the extent of degradation will be more than a spawning female can sufficiently reverse. Eggs deposited in subpar or degraded incubation conditions have reduced growth and survival, increased mortality of embryos and emerging fry, and adverse effects on the timing and size of emerging fry (Chapman 1988, Lisle and Lewis 1992). Salmon that survive incubation in redds, but emerge later and smaller than other fry, appear to be weaker, less dominant, and less capable of maintaining their position in the environment (Mason and Chapman 1965).

Of all the proposed action activities, suction dredging is the one activity that is completely water dependent and specifically has the intended action of disturbing the stream substrate (see Section 2.4.6). Spawning salmon and steelhead are likely to avoid dredged areas when choosing redd sites, thus substrate embeddedness could result in a decrease in available spawning habitat. Substrate embeddedness will likely be dissipated by fall rains and stream discharge events, but we don't expect these events to occur until approximately November or December, with some expected annual and spatial variation. Therefore, in some years and in some streams, we expect there will be an overlap between residual sedimentation and substrate embeddedness from suction dredging and spawning coho salmon with adverse effects on reproductive success as well as reduced growth, reduced survival, and increased mortality of steelhead and salmon eggs, embryos, and emerging fry.

Adverse effects from mining-related substrate disturbance include redd construction on unstable tailings. Redds on tailings are likely to be damaged or destroyed because the period of maximum scour usually overlaps with the embryo incubation and development period for Chinook salmon and coho salmon (Lisle and Lewis 1992, Harvey and Lisle 1999). Harvey and Lisle (1999) examined scour of Chinook redds on dredge tailings compared to scour of redds on undisturbed substrates and measured greater net and maximum scour for redds on dredge tailings. However, others studies reported that Chinook salmon did not spawn on dredge tailing piles (Hassler *et al.* 1986, Stern 1988). Steelhead are potentially less affected, because they spawn later in the winter (Harvey and Lisle 1999), however, given the potential duration of destabilized channels over multiple years some steelhead will also be affected. Some spawning salmon will use unstable dredge tailings for redd construction and egg deposition with scour of some redds resulting in mortality of eggs and embryos and reduced reproductive success.

Management direction such as hydrologically disconnecting the streams from the ditchlines, dry haul only, and best management practices such as keeping vegetation in ditchlines, and adding addition rocking to road surfaces minimizing sedimentation from proposed action activities and will reduce sedimentation to streams. Road construction and maintenance related management direction that reduces the potential for sedimentation is important to the overall strategy of the PRMP to maintain water quality. As part of the travel management plan development, BLM will use an interdisciplinary approach that will include identifying resource conflicts, such as road segments that cause excessive erosion and then consider options, such as seasonal closures or permanent closures. Additionally, we expect BLM will use this travel management process and restoration strategy actions to identify these higher risk areas and implement measures to reduce the sedimentation risk, which leads to substrate embeddedness. The proposed action, on balance, may cause a moderate increase in sedimentation within watersheds inhabited by these species

(CR chum, LCR coho salmon, LCR steelhead, LCR Chinook salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, and eulachon), but current and future actions proposed by BLM will reduce the potential for substrate embeddedness.

2.4.21.8 Effects to Forage

Disturbance and removal of riparian vegetation is reasonably certain to cause a reduction in terrestrial macro-invertebrates and available forage for juvenile salmonids. Sedimentation and substrate embeddedness also contributes to temporary decreases of aquatic macroinvertebrates abundance and diversity by filling interstitial spaces.

Chemical contaminants can also negatively affect aquatic macroinvertebrates; petroleum-based contaminants (such as fuel and oil) contain PAHs, which are acutely toxic to aquatic organisms, including aquatic macroinvertebrates at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz *et al.* 1999, Heintz *et al*. 2000, Incardona *et al*. 2004, Incardona *et al*. 2005, Incardona *et al.* 2006). Sublethal effects are those that are not directly or immediately lethal, but are detrimental and have some probability of leading to eventual death via behavioral or physiological disruption. Resident benthic macroinvertebrates will be exposed to PAHs through their diet and direct contact with the sediment (Neff 1985). PAHs may bioaccumulate in aquatic invertebrates within these benthic communities (Varanasi *et al.* 1985, Meador *et al.* 1995). Bioaccumulated PAHs will reduce the quality and value of surviving macroinvertebrates as forage items.

Increases in methylmercury production also have the potential to negatively affect food webs. The quality of forage and food will also decrease due to the potential for methylmercury bioaccumulation.

Most foraging reductions will likely be short-term, adverse effect because adjacent macroinvertebrate populations will recolonize the disturbed substrate as the summer-fall program activities (mining, cattle grazing, road construction, etc.) occur with high levels of invertebrate activity. Because this is a coastal forest in a mild climate, vegetation along streams is expected to quickly regenerate in disturbed areas, including overstory species (*e.g.*, red alder, willow), understory rhizomatous shrub species (*e.g.*, salmonberry, thimbleberry), and rhizomatous herbaceous species (*e.g.*, slough sedge, bull rush, water parsley). Chemical contaminants will adversely affect the food chain within sites closest to the action, and may adversely affect the stream for several years after the action.

All species of salmonids within the SONCC recovery domain, OC recovery domain, and UW/LCR recovery domain will be affected. Chemical contaminants in both stormwater and methylmercury will also affect the food web in the estuaries adversely affecting green sturgeon. Eulachon adults are not known to feed in freshwater; therefore they are not likely to be exposed to contaminants through this mechanism. We assume that repeated exposure is necessary to result in adverse effects in exposed individuals, and that repeat exposures sufficient to adversely affect individuals is limited to only a small portion of the population. Quantifying the effects to forage reduction and related adverse effects to list fish is difficult, but we expect this forage reduction to be localized to areas of paved roads located within 200 feet of a stream, during potential spills during mining, and where ponding occurs and concentration of methylmercury occurs such as estuaries of the Rogue and Chetco rivers. These adverse effects are centralized around concentration of mining operations in the BLM Medford District and urban cities due to traffic volume creating stormwater.

2.4.21.9 Non-habitat Effects – Disturbance and Entrainment

In our assessment we identified mining, grazing, and recreational activities that are likely to result in some non-habitat related effects. These effects include disturbance and entrainment. All three activities are likely to cause disturbance, where suction dredging may additionally result in entrainment of juveniles[50].

Recreation - Recreationists using streams may interact with rearing or spawning fish when they are in the water, for example, wading, swimming, or boating. BLM's recreational facilities will concentrate the public at these locations. These locations include campgrounds and boat ramps, as well as other recreation sites. Disturbance by recreationists may cause rearing fish to leave cover and become more susceptible to predation. Disturbance of adults at the spawning sites may delay some spawning. BLM identified recreation facilities within 216 feet of occupied habitat or critical habitat for ESA-listed species (Table 38). The number of sites provided in Table 38 is the best available information representing the occurrence of these recreational facilities at the time of this analysis. These facilities concentrate recreationists and represent the likely and most predictable areas where disturbance may occur. Although these sites may concentrate the disturbance, this may limit the disturbance area to the immediate site. This occurs mostly in the OC coho salmon ESU where 40 of these facilities occur within 216 feet of occupied habitat. All other ESUs have fewer than 8 of these designated areas. Although the potential for increased predation and spawning delay may occasionally occur, disturbance by recreationists is expected to be of a minor nature due to the limited number of sites within most ESUs. Within the OC coho salmon ESU, the larger number of sites are dispersed across the many populations. The relevant management directive is also expected to operate as a limit on numbers of recreationists at particular sites, where BLM will "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."

Mining - There will be an overlap between suction dredging and some life histories of salmon, including rearing juveniles, outmigrating smolts, and migrating adults. Eggs will not be exposed to suction dredging under the proposed action. Suction dredging occurs in the water and, as the name implies, pulls water and sediment from the stream to run through sluice, and returns water and tailings to the stream. Fish can also be pulled from the stream and passed through the dredge via the nozzle or be impinged on the pump screen. Operators are also working in the water to operate their suction dredge and fish may be accidentally stepped on or trampled by an operator,

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[50] While incidental take discussed in this section as a result of recreational activities is expected to occur in the absence of any future authorizations and section 7 consultation, the incidental take discussed in relation to grazing and mining will not occur until future authorization of those activities and associated section 7 consultation. Thus, the Incidental Take Statement only addresses the former but not the latter.

leading to injury or death; similar effects will also occur for vehicles crossing streams at fords. These activities may also disturb fish and disrupt their essential behaviors of feeding, rearing, sheltering, and migrating. Displacement of individual fish may be caused if fish choose to move to another location to avoid these activities or if tailings are deposited on their preferred stream location forcing them to move to another location; displaced individuals are subject to increased predation, increased competition with other juveniles, and a reduction in feeding due to a less favorable feeding position. Small juveniles are also likely to be startled by the noise of the suction dredge (HWE 2011). These effects are caused by in-water activities as a result of the interaction between the fish and the suction dredge or operator.

Entrainment of fish by the dredge nozzle is dependent on the strength of the suction at the nozzle and the size and burst swimming speed of the juvenile is a factor in its ability to avoid entrainment. Burst swimming is important in predator avoidance and food capture; it is a fish's maximum velocity, can only be sustained for a short period (<20 seconds), and results in fatigue or greatly reduced performance (Beamish 1978). After using its burst swimming speed, an individual needs rest to recover (Lee *et al.* 2003) and is vulnerable during this recovery period. Therefore, if a juvenile salmon uses its burst speed to avoid entrainment or in an attempt to avoid entrainment, it is susceptible to additional entrainment or predation while it is recovering. Taylor and McPhail (1985) determined a maximum burst speed of 3.4 feet per second (fps) for wild coho salmon juveniles approximately 2.1 inches in length. We expect similar results for juvenile steelhead and chinook.

HWE (2011) estimated that flow velocities at the intake of a 4-inch suction dredge nozzle are approximately 3.8 fps. Their estimated velocities for nozzles ≤ four inches are listed in Table . The highest estimated velocity (4.5 fps) was for a 3-inch nozzle and the lowest estimated velocity (3.3 fps) was for the 2.5-inch nozzle. Flow velocity decreases with increased distance from the nozzle. Based on the burst speed information from Taylor and McPhail (1985), coho salmon, steelhead, and Chinook juveniles would likely be able to avoid accidental entrainment by the 2.5-inch nozzle but not by the other nozzle sizes.

Table 88. Intake flow velocities and length of fish vulnerable to those velocities, as reported by HWE (2011). Values for intake flow velocities were estimated by using estimated suction dredge production values for dredges with nozzle sizes ≤ 4 inches.

Dredge Nozzle size (inches)	Flow velocity (fps)	Length of fish vulnerable to entrainment (inches)
2	4.1	≤5.4
2.5	3.3	≤4.4
3	4.5	≤6.1
4	3.8	≤5.1

HWE (2011) also estimated burst swimming speed as a function of fish length to identify vulnerability to flow velocity at dredge nozzle intakes. Based on their results, juvenile salmon would need to be greater than 6.1 inches in length to avoid entrainment for nozzle sizes from 2 – 4 inches (Table 88). Steelhead and coho salmon rear over the summer when dredging is to occur.

The average size of juvenile coho salmon and steelhead range from 2 to 6 inches in length during the in-water work period. Therefore, coho salmon and steelhead juveniles would be susceptible to entrainment by the dredge.

Hassler *et al.* (1986) did not observe any incidents of entrainment in suction dredges. However, a small number of juvenile rainbow trout did pass through a dredge in California (Harvey 1982). Although not experimentally tested, Harvey (1982) did not observe any immediate negative effects for the small number of juvenile rainbow trout entrained. Griffith and Andrews (1981) used a 3-inch suction dredge in southeastern Idaho streams to assess the ability of early life stages of trout to survive entrainment. Hatchery rainbow trout sac fry, defined as 3 days post-hatch, experienced 83% mortality compared to 9% mortality in the control groups. Brook trout juveniles, ranging from 1.6-2.3 inches in length or 5.3 – 6 inches in length, were also passed through the dredge and then observed for 48 hours; none of these fish died. However, no long-term observations were conducted to assess for delayed mortalities. Also, fish exiting the dredge are likely to be disoriented and susceptible to increased predation.

Juvenile rearing salmon and salmon outmigrants in the action area will be susceptible to accidental entrainment, impingement, trampling, and disturbance. Impinged and trampled individuals are likely to be injured or die. Small juveniles entrained in the dredge will be injured and may even die if they still have their yolk sacs; older juveniles will likely survive their entrainment but are susceptible to injury or increased predation. Disturbed and displaced juveniles are subject to increased predation, increased competition with other juveniles, and a reduction in feeding due to a less favorable feeding position.

Entrainment will occur primarily to SONCC coho salmon as most of the dredging occurs in the BLM Medford District. Limited dredging does occur in the OC Recovery Domain and the UW Recovery Domain, therefore OC coho salmon, UW Steelhead, and UW spring Chinook are all affected through entrainment. Suction dredging may cause entrainment of fish where dredging occurs. We expect this is limited to a few juveniles per site. This is because 1) juveniles can move away from the dredging activity and 2) suction dredging usually occurs near the tail out of pools where fewer fish are located. Because of the limiting dredging, only a minimal amount of juvenile OC coho salmon, UW steelhead, or UW Chinook will be adversely affected. SONCC coho salmon has the potential for greater adverse effects due to the amount of dredging that occurs in the BLM Medford District. This non-habitat related effect is difficult to assess, but we anticipate that not many individuals may be entrained because the dredging occurs during summer when the juveniles are older and have a better ability to avoid the dredge. Activities are constrained to the summer by state Department of Environmental Quality regulations (ODEQ 2015b). We expect the number of individuals exposed, entrained, and killed by the suction dredge will be low enough to not produce effects at the population level. This is because the adult equivalence of juvenile fish requires hundreds of smolts to produce just one adult, and a couple adults adversely affected will not alter the population productivity or diversity. Eulachon are not affected by entrainment because of lack of presence.

In the short-term, there is a moratorium on suction dredge mining in the state of Oregon. This moratorium will prevent suction dredge mining in these streams occupied by these species. Since the moratorium can be lifted at any time through state legislative approval, we did not rely on its existence in our analysis.

Cattle grazing – Cattle grazing occurs all in the SONCC recovery Domain and only adversely affects SONCC coho salmon. Eulachon are not affected due to lack of presence around grazing activities.

Juveniles will experience minor and infrequent behavioral modifications associated with livestock grazing and watering on some stream reaches. It is likely that some disturbance of juvenile coho salmon will occur as cattle approach the streams to drink or cross, rearing juveniles are likely to be disturbed and may leave near shore cover in an attempt to escape and enter open water where they are likely to be more vulnerable to predation. Cattle entering streams may also cause juvenile coho salmon to abandon other critical behaviors such as feeding, but in most cases, juveniles are likely to simply move into adjacent cover.

As cattle approach streams to drink or cross they could interrupt spawning behavior by forcing adult coho salmon to retreat to nearby cover. Of more concern, livestock can trample redds which is reasonably certain to result in partial or total mortality of embryos or juveniles concentrated in the redd. Salmonid embryos are vulnerable to mechanical disturbance, and their sensitivity varies with developmental stage (Peterson *et al*. 2010). For instance, Roberts and White (1992) reported that a single wading incident on a simulated spawning redd killed 43% of pre-hatching embryos and twice-daily wading throughout embryo development killed at least 83% of eggs and pre-emergent fry.

BLM's proposed action will reduce the potential for redd trampling by implementing management direction that will 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.

Additionally, BLM's proposed action will minimize disturbance coho salmon by implementing BMPs such as: 1) Placement of mineral and salt supplement blocks a minimum of ¼ mile upslope from permanent waterbodies or Riparian Reserves, 2) Exclusion fences and 3) Development of upland water sources.

The occasional disruptions caused by livestock are not expected to result in any notable decrease in abundance or productivity of juvenile or adult coho salmon at the population scale. This is because 1) Adults will not be present during cattle grazing and 2) the disruptions to essential juvenile behaviors of feeding and sheltering are likely to be limited to stream reaches where cattle can easily approach or enter the water, and 3) BLM management direction such as herding, mineral deposits placed upland, fencing, etc. that minimize the cattle accessing the stream. Disruptions are not likely to occur in streams that are less accessible due to steep topography, the occurrence of woody vegetation around the streambanks or the presence of large amounts of down woody debris near streams.

VSP analysis

The proposed RMP program activities will affect the environment, fish habitat, and individuals of each species within the action area (Table 89 through Table 92). Each program's activities affect the environment differently and the resulting changes in environmental conditions directly or indirectly affect the species considered in this opinion. The significance of these direct or indirect effects on the survival of an individual and the species is based on the species exposure to the environmental change; the sensitivity of the species to the change; the life stage exposed; and the limiting factors affecting the survival and recovery of the species. Implementation of these programs will adversely affect CR chum, LCR coho salmon, LCR steelhead, LCR Chinook salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, SR sockeye, SR fall-run Chinook salmon, SR spring/summer Chinook salmon, SRB steelhead, MCR steelhead, UCR steelhead, UCR spring-run Chinook salmon, green sturgeon, and eulachon.

Table 89. PRMP programs and likely environmental and ecological pathways resulting in adverse effects to SONCC coho salmon, OC coho salmon, UW steelhead, UW Chinook salmon, LCR steelhead, LCR Chinook, LCR coho salmon, and CR chum salmon within the action area.

PRMP Programs	Water Temperature	Suspended Sediment	Substrate	Large Wood	Flow	Forage	Chemical Contaminants Stormwater	Non-Habitat (Harassment & Entrainment)
Forest Management (wood delivery, new road construction, timber felling and yarding)	X	X		X	X	X	X	
Fire & Fuels	X			X				
Fisheries								
Livestock Grazing	X	X	X	X		X		X
Minerals		X	X			X	X	X
Recreation & Visitor Services		X	X			X	X	X
Sustainable Energy								
Trails and Travel Management		X	X			X	X	
Wildlife								
Wild Horses								
BLM Designations								
Air Quality								
National Trails System								

PRMP Programs	Water Temperature	Suspended Sediment	Substrate	Large Wood	Flow	Forage	Chemical Contaminants Stormwater	Non-Habitat (Harassment & Entrainment)
Rare Plants and Fungi								
Tribal Interests								
Visual Resources								
Special Forest Products								
Land and Realty								
Sustainable Energy								

Table 90. PRMP programs and likely environmental and ecological pathways resulting in adverse effects to UCR Chinook, SR spring/summer run Chinook, SR fall/run Chinook, MCR steelhead, SRB steelhead, UCR steelhead, SR sockeye and within the action area.

PRMP Programs	Water Temperature	Suspended Sediment	Substrate	Large Wood	Flow	Forage	Chemical Contaminants Stormwater	Non-Habitat (Harassment & Entrainment)
Forest Management (wood delivery, new road construction, timber felling and yarding)						X	X	
Fire & Fuels								
Fisheries								
Livestock Grazing								
Minerals						X	X	
Recreation & Visitor Services								
Sustainable Energy								
Trails and Travel Management						X	X	
Wildlife								
Wild Horses								
BLM Designations								
Air Quality								
National Trails System								
Rare Plants and Fungi								
Tribal Interests								
Visual Resources								
Special Forest Products								
Land and Realty								
Sustainable Energy								

Table 91. PRMP programs and likely environmental and ecological pathways resulting in adverse effects to green sturgeon within the action area.

PRMP Programs	Water Temperature	Suspended Sediment	Substrate	Large Wood	Flow	Forage	Chemical Contaminants Stormwater	Non-Habitat (Harassment & Entrainment)
Forest Management (wood delivery, new road construction, timber felling and yarding)						X	X	
Fire & Fuels								
Fisheries								
Livestock Grazing								
Minerals						X	X	
Recreation & Visitor Services								
Sustainable Energy								
Trails and Travel Management						X	X	
Wildlife								
Wild Horses								
BLM Designations								
Air Quality								
National Trails System								
Rare Plants and Fungi								
Tribal Interests								
Visual Resources								
Special Forest Products								
Land and Realty								
Sustainable Energy								

Table 92. PRMP programs and likely environmental and ecological pathways resulting in adverse effects to eulachon within the action area.

PRMP Programs	Water Temperature	Suspended Sediment	Substrate	Large Wood	Flow	Forage	Chemical Contaminants Stormwater	Non-Habitat (Harassment & Entrainment)
Forest Management (wood delivery, new road construction, timber felling and yarding)	X	X		X	X	X	X	
Fire & Fuels								
Fisheries								
Livestock Grazing								
Minerals						X	X	
Recreation & Visitor Services								
Sustainable Energy								
Trails and Travel Management						X	X	
Wildlife								
Wild Horses								
BLM Designations								
Air Quality								
National Trails System								
Rare Plants and Fungi								
Tribal Interests								
Visual Resources								
Special Forest Products								
Land and Realty								
Sustainable Energy								

We previously analyzed implementation of the proposed RMP's program's effects on the environment. We then assessed how these environmental effects would expose individuals of each ESA-listed species and subsequent response by individual fish to changes in their habitat (Table 89 through Table 92). In our next step below, we evaluate how the effects of the proposed action in consideration of the relevant limiting factors, were likely to affect the species' viability by assessing the four VSP parameters; abundance, productivity, spatial structure, and diversity.

- "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). A viable population needs sufficient abundance to maintain genetic health and to respond to normal environmental variation.
- "Productivity," as applied to viability factors, refers to the entire life cycle (*i.e.*, the number of naturally-spawning adults produced per parent). The productivity of a population (the average number of surviving offspring per parent) is a measure of the population's ability to sustain itself. A viable population needs sufficient productivity to enable the population to quickly rebound from periods of poor ocean conditions or freshwater perturbations.
- "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. Populations with restricted distribution and few spawning areas are at a higher risk of extinction as a result of catastrophic environmental events, such as flooding or landslides, than are populations with more widespread and complex spatial structure.
- "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). Populations exhibiting greater diversity are generally more resilient to short-term and long-term environmental changes.

Where recovery plans have been completed, we used the identified recovery scenarios to frame our viability assessment. Where recovery plans are still in development, we took a precautionary approach. While recognizing that not all populations are likely required for species recovery, in the absence of a recovery plan we assumed that for a listed species to become viable, all populations are important to the species' survival and recovery. In particular, for this analysis we relied on the recovery plans for the Upper Willamette River (ODFW and NMFS 2011), Middle Columbia River (NMFS 2009), Lower Columbia River (NMFS 2013), Upper Columbia River species (UCSRB 2007) together with the Estuary Module for Columbia River Basin species (NMFS 2011d), Southern Oregon Northern California coho salmon (NMFS 2014a), and the draft plan for the Oregon Coast coho salmon (NMFS 2015b).

Effect of Habitat Change on Fish. Individual fish that spawn, rear, and migrate in the action area may be exposed to the effects of the proposed action throughout their freshwater residency (incubation, rearing, and out-migration). Individuals that spawn and rear (*i.e.*, originate) outside of the action area and occur in the action area during migration are exposed to the effects of the proposed action only during their periods of incubation and migration downriver as juveniles and upriver as adults. Therefore, while recognizing the proposed action is likely to contribute to environmental stressors of fish that migrate through the action area, individuals that originate in the action area would be more greatly affected than individuals that originate outside of the action area.

Also, juvenile rearing strategies of anadromous fish are important to consider when evaluating the effects of the proposed action. In the simplest of terms, salmon and steelhead exhibit two basic juvenile rearing strategies. One strategy is for juveniles to migrate to the ocean to mature the same year that they are born. This is termed an "ocean-type" life history. The other strategy is for juveniles to remain in freshwater for one or more years before migrating to the ocean. This is termed a "stream-type" life history.

Effect on Populations. Effects that occur among individuals must then be considered in terms of the multiplicity of individuals that make up cohorts, and populations, and in that context, over time how population viability parameters are likely to be altered.

Populations that originate in the action area are susceptible to the effects of the proposed action regardless of their juvenile rearing strategy. However, individuals that exhibit an ocean-type rearing strategy are exposed to the proposed action effects as juveniles for a matter of months, while individuals that exhibit a stream-type strategy remain in freshwater and may be exposed to effects considerably longer. Furthermore, ocean-type juveniles typically spend more time in the estuary in shallow water areas than stream-type juveniles, which migrate through the estuary more rapidly. For this reason, individuals exhibiting an ocean-type rearing strategy are generally more susceptible to habitat effects in the estuary, while individuals exhibiting a stream-type rearing strategy are more susceptible to habitat effects in freshwater reaches.

Accordingly, we assume that where the proposed action would affect habitat features and limiting factors in estuary reaches, populations that exhibit a predominately ocean-type rearing strategy would be more greatly affected in the estuary than populations that exhibit a predominately stream-type strategy. Conversely, we assume that where the proposed action would affect limiting factors in freshwater reaches, populations that exhibit a predominately stream-type rearing strategy would be more greatly affected in the freshwater portions (including freshwater reaches in the estuary) than populations that exhibit a predominately ocean-type strategy.

Limiting factors are defined as "physical, biological, or chemical features (*e.g.*, inadequate spawning habitat, high water temperature, insufficient prey resources) experienced by the fish at the population, intermediate (*e.g.*, stratum or major population grouping), or ESU [or DPS] species levels that result in reductions in viable salmonid population (VSP) parameters (abundance, productivity, spatial structure, and diversity)" (NMFS 1997a, as cited by Stout *et al*. 2012, p. 53).

Consequently, proposed actions that would adversely affect limiting factors for more than a limited duration could reduce the viability of the population, stratum, or ESU/DPS level, depending on the spatial scale of the effect.

The land management actions associated with the proposed action are: (1) predominately long-term in nature (e.g. forest stand management and road use); (2) include both direct and indirect effects on the ESA-listed species; (3) incorporate conservation measures through management direction and designed strategies to restore and protect important ecosystem functions and processes; and (4) for some actions, likely to adversely affect multiple life stages, across multiple generations. Because these effects multiply across the life cycle and generations, "small effects at individual life stages can result in large changes in the overall dynamics of populations" (Stout *et al*. 2012, p. 62). Without implementing the proposed management direction, restoration, and strategy actions that are built into the proposed action and operate to restore and protect ecological processes and functions (e.g. riparian management strategy), other activities included in the proposed actions could result in negative effects on ESA-listed species in the action area over the succeeding decades.

The PRMP applies to BLM administered lands throughout western Oregon and overlaps with ESA-listed species. Consequently, the more proximal the species distribution is to the action, the greater the effects of any adverse action on individuals and populations. Where river basins do not contain BLM lands, the species inhabiting those stream reaches are generally not exposed to the proposed action. Exceptions may occur, such as where log haul traverses from one basin to another. Actions that result in the transmittance of contaminants downstream will expose species that do not spawn or rear in proximity to the BLM lands. Examples of these include the transmittance of mercury or stormwater contaminants to the Columbia River estuary; therefore exposing individuals migrating downstream to the ocean.

Columbia River Estuary. The Columbia River estuary refers to the mainstem portions of the Willamette River below Willamette Falls and the Columbia River below Bonneville Dam downriver to the mouth of the Columbia River and out to include the near-shore plume (*i.e.*, that portion of the plume within the continental shelf). All populations of all species in the Willamette-Lower Columbia Recovery Domain and Interior Columbia Recovery Domain occur in the Columbia River estuary. Therefore, the Columbia River Estuary ESA Recovery Plan Module for Salmon and Steelhead (Estuary Module) is relevant to all 13 ESA-listed salmon and steelhead species in these domains, and their associated 184 populations (NMFS 2011d).

The Columbia River estuary is about 20% smaller than it was prior to development (NMFS 2011d). The reduction is predominately due to "diking and filling practices used to convert the floodplain to agricultural, industrial, commercial, and residential uses" (NMFS 2011d, p. ES-4). The other dominant alteration is due to a 44% reduction in spring freshets or floods and changes in the timing, magnitude, and duration of flows due to flood control and hydropower projects (NMFS 2011d). Historically, floodplains supplied macrodetritus inputs that were the basis of the estuary's food web. The loss of floodplain connectivity has reduced macrodetritus inputs by about 84% and changed the food web to a microdetritus based system (NMFS 2011d, p. ES-4). "In addition, access to and use of floodplain habitats by ocean-type ESUs (salmonids that typically rear for a shorter time in tributaries and a longer time in the estuary) have been severely compromised through alterations in the presence and availability of these critical habitats" (NMFS 2011d, p. ES-4).

The most relevant threats and limiting factors in the estuary include (NMFS 2011d, Chapter 4):

- Riparian Practices - Sediment/nutrient-related estuary habitat changes, reduced macrodetrital inputs, water temperature, and exotic plants.
- Urban and Industrial Practices - Non-bioaccumulative toxicity, bioaccumulation toxicity, and increased microdetrital inputs.

- Diking and Filling - Reduced macrodetrital inputs, sediment/nutrient-related estuary habitat and plume changes, bankfull elevation increases, and exotic plants.

The effects of the proposed action would not contribute to these limiting factors. The proposed action, for the most part, occurs far upstream in the upper basin of the Willamette River basin. In the mainstem Willamette River and Columbia River, we describe the effects of the proposed action in terms of the fate and downstream transport of mercury (methylmercury) and stormwater contaminants. For LCR coho salmon, LCR steelhead, LCR Chinook salmon, CR chum salmon, UW steelhead, and UW Chinook salmon these effects would be in addition to those associated with the proposed action that the species would be exposed to elsewhere in the basin. For individuals of the interior Columbia species migrating through the action area, (SR sockeye, SR fall-run Chinook salmon, SR spring/summer Chinook salmon, SRB steelhead, MCR steelhead, UCR steelhead, UCR spring-run Chinook salmon, and green sturgeon) will only be exposed to the stormwater and methylmercury effects caused by the proposed action.

Common to all Domains except the Interior Columbia Domain. The subwatershed classifications for riparian reserves that are designed for the forest Management element are very protective for the ecological processes such as wood recruitment and water quality aspects such as maintenance of cool water temperatures and sediment filtering through a protective inner buffer and restricted thinning in the outer buffer. The amount of acres within the action areas for the various salmonids for Class I, Class II, and Class III subwatersheds are shown in Table 93. Class I and Class II subwatersheds are designed to protect ecological process in key watersheds within critical habitat and intrinsic habitat for listed salmonid species, whereas Class III streams, although very protective of perennial and fish bearing streams, are not located within critical habitat for listed salmonids and are not as protective within the intermittent streams for large wood and sediment filtration. This management direction within the Class I and Class II subwatersheds results with protective riparian reserves that allow present and future wood recruitment, and shade producing vegetation which to keep stream temperatures cool.

Management direction and best management practices such as limiting road construction in riparian reserves to only where there is no operationally feasible and economically viable alternative to accomplish other resource management objectives, hauling only during the dry periods, hydrologically disconnecting streams from the roads and filtering sediment and stormwater through upland vegetation, road resurfacing with rock, and requiring vegetative ditchlines, have the collective effect of limiting the magnitude of effects to a minor level that may adversely affect individual juvenile salmonids, but does not significantly affect the species at the population level. This is because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity.

The projected timber harvests for the listed salmonids are shown in Figure 18. Figure 18 shows that the majority of harvest is occurring in the OC and SONCC coho salmon domains, while the lowest harvest rates are shown in the Lower Columbia River Domain.

The environmental effects from forestry management were described in Section 2.4.1 and species effects in Section 2.4.21.

Table 93. Number of acres within BLM ownership for the 6th Field HUC subwatersheds riparian reserve classification listed per listed salmonids within the action area.

ESU/DPS	Subwatersheds by 6th Field HUC Riparian Reserve Management Type			Total Acres of Riparian Reserve
	Class I	Class II	Class III	
Lower Columbia River Chinook salmon	6,912	3,065	0	9,977
Lower Columbia River coho salmon	6,912	3,065	0	9,977
Lower Columbia River steelhead	4,926	2,414	0	7,339
Columbia River Chum	6,244	1,504	0	7,748
Upper Willamette River Chinook salmon	46,965	27,655	2,523	76,057
Upper Willamette River steelhead	36,498	27,655	2,774	66,926
Oregon Coast coho salmon	304,422	29,389	8,147	341,957
Southern Oregon Northern California coho salmon	145,522	19,794	1,267	166,583

Willamette-Lower Columbia Recovery Domain. There are six ESA-listed salmonid species that originate in this domain. We discuss these species life history, relevant limiting factors, and VSP evaluation below.

The adverse effect pathways and project elements for the Willamette-Lower Columbia River Domain are presented in Table 94. There are significant effects differences between the Lower Columbia River (LCR) listed salmonid species and the Upper Willamette River (UWR) listed salmonid species when comparing the different project elements. For example, suction mining is primarily limited to Southern Oregon, and thus only a limited amount of mining claims (Table 38 and Figure 7) occurs in the UWR and non in the LCR.

PRMP management only allows fuel removal in the inner buffer of the subwatershed classifications in dry forest, but does not allow it to occur in the inner buffers within subwatersheds classifications of the UWR/LCR domain. The UWR/LCR domain only contains moist forest. Therefore, the temperature indicator and large wood indicator are not affected by the Fire and Fuels program within the Willamette-Lower Columbia Recovery Domain.

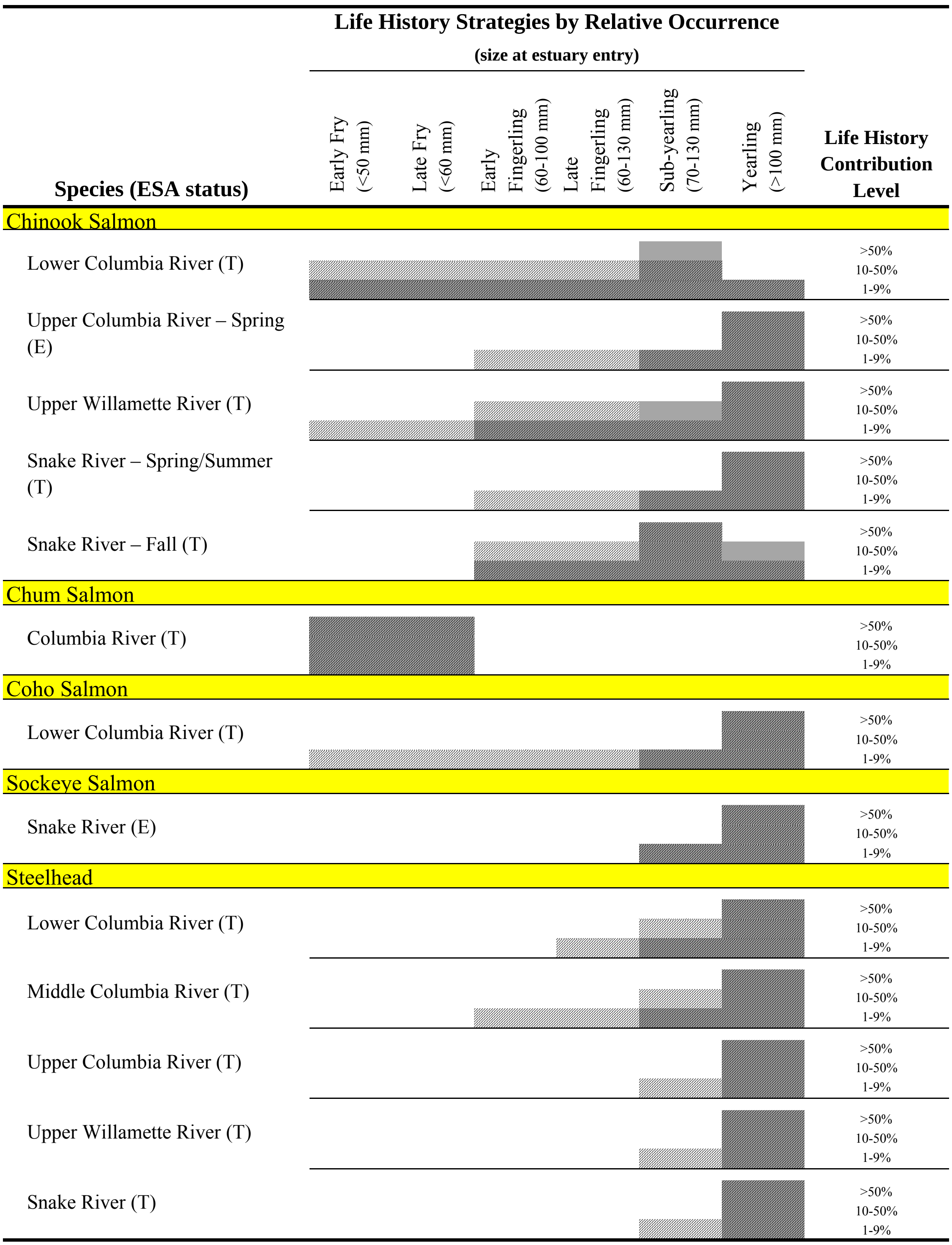
Table 94. Adverse effect pathways by project element for LCR Chinook salmon, LCR coho salmon, LCR steelhead, LCR steelhead, UWR Chinook salmon, UWR Steelhead, and LCR Chum Salmon.

Project Element	Water Temperature	Suspended Sediment	Large Wood	Flow	Substrate	Forage	Chemical Contaminants	Non-Habitat (Harassment & Entrainment)
Forest Management (new road construction)	X	X	X	X		X	X	
Minerals		X			X	X	X	X
Recreation & Visitor Services		X			X	X	X	X
Trails & Travel Management		X				X	X	

Lower Columbia River Chinook salmon. This species is listed as “threatened” under the ESA. All 32 populations that comprise this species occur in the action area. However, 12 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for LCR Chinook salmon (NMFS 2013).

Life History. LCR Chinook salmon currently exhibit a predominately ocean-type life history and typically display a sub-yearling life history strategy. However, the species also displays fry, fingerling, and yearling life history strategies (NMFS 2011d, p. 2-5; Table 95).

Table 95. The life history strategies for ESA-listed salmon and steelhead in the Columbia River currently display less diversity than they historically did. Diagonal hashing indicates historical occurrence. Shading indicates current occurrence. Absence of hashing or shading indicates <1% contribution by that life history strategy. Adapted from Fresh *et al.* 2005.



Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,
- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The primary limiting factors for LCR Chinook salmon are summer and winter rearing habitat related to stream complexity (winter and summer) and water temperature (summer). The PRMP riparian management subwatershed classification and key watershed strategy protects current sources of wood recruitment to streams. The riparian management strategy also protects vegetation producing shade (trees and brush) with the 120 foot no-harvest zones around perennial stream and fish bearing streams. This is consistent with the recovery goals of the LCR Chinook Salmon (NMFS 2013).

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect LCR Chinook salmon (Table 94). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of LCR Chinook salmon.

VSP Evaluation. The LCR Chinook salmon populations are grouped into six strata: Cascade spring, Gorge spring, Coast fall, Cascade fall, Gorge fall, and Cascade late fall. The recovery plan provides the following recovery and biological goals (NMFS 2013).

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[51] High probability of stratum persistence is defined as:
    a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);

[51] A probability of persistence consistent with historical condition refers to the concept that strata that historically were small or had complex population structures may not have met all three criteria, but could still be considered sufficiently viable if they provide a contribution to overall ESU viability similar to their historical contribution.

b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (*i.e.*, the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.

2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
   a. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
      - Habitat-related threats:
        - recovery plan actions addressing habitat limiting factors have been substantially implemented;
        - threat reduction targets identified in the recovery plan have been met;
        - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and water temperature and other water quality parameters, are stable or improving;
        - functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.
      - Hydropower and/or flood control dam-related threats/
   b. Over-utilization for commercial, recreational, scientific, or educational purposes.
      - Harvest-related threats.
      - Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes)/
   c. Disease or predation.
      - Predation-related threats.
      - Disease-related threats.
   d. The inadequacy of existing regulatory mechanisms.
      - Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
        - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
        - states have established and protected instream flow levels;
        - regulatory programs are in place and are adequate to manage fisheries;
        - regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;
        - regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

e. Other natural or human-made factors affecting the species' continued existence.
    - Hatchery-related threats.
    - Other natural or human-caused factors have been accounted for.

The effects of the proposed action would not influence limiting factors where populations of LCR Chinook salmon overlap with watersheds containing BLM administered lands. The amount of BLM land that overlaps with this ESU is small, and not all populations of LCR Chinook salmon overlap with BLM lands. In populations where overlap occurs, considering the nature and duration of the effects, we assume the proposed action would, on balance, be consistent with the recovery goals of the LCR Chinook salmon ESU the LCR Chinook salmon ESU. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. It was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors. The primary life stages affected by the action are eggs through rearing juveniles. These effects are only expected to affect a few individuals and thus will not affect the population level. In addition to these upstream freshwater life stages, individuals in the Columbia River estuary will be exposed to stormwater and methylmercury contaminants. The effects of these chemical contaminates are concentrated around urban cities and mining locations such that chemical concentrations are diluted with addition of the Willamette and lower Columbia rivers. The proposed action would have very limited effects on limiting factors associated with the estuary and, on balance, is consistent with the recovery goals of the ESU.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on LCR Chinook salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action would, on balance, be consistent with the recovery goals of the ESU of LCR Chinook salmon. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long term functioning of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of LCR Chinook salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Lower Columbia River coho salmon. This species is listed as "threatened" under the ESA. All 24 populations that comprise this species occur in the action area. However, 8 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for LCR coho salmon (NMFS 2013).

Life History. LCR coho salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. However, the species also does display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,
- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The primary limiting factors for LCR coho salmon are summer and winter rearing habitat related to stream complexity (winter and summer) and water temperature (summer). The PRMP riparian management subwatershed classification and key watershed strategy protects current sources of wood recruitment to streams. The riparian management strategy also protects vegetation producing shade (trees and brush) with the 120 foot no-harvest zones around perennial stream and fish bearing streams. This is consistent with the recovery goals of the LCR coho Salmon (NMFS 2013).

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect LCR coho salmon (Table 94). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the Columbia River Estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of LCR coho salmon using the estuary.

VSP Evaluation. The LCR coho salmon populations are grouped into three strata: Coast, Cascade, and Gorge. The recovery plan provides the following recovery and biological goals (NMFS 2013).

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[52] High probability of stratum persistence is defined as:

[52] *Id.*

a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);
b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (*i.e.*, the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.

2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
   a. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
      - Habitat-related threats:
        - recovery plan actions addressing habitat limiting factors have been substantially implemented;
        - threat reduction targets identified in the recovery plan have been met;
        - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and water temperature and other water quality parameters, are stable or improving;
        - functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.
      - Hydropower and/or flood control dam-related threats.
   b. Over-utilization for commercial, recreational, scientific, or educational purposes.
      - Harvest-related threats.
      - Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes).
   c. Disease or predation.
      - Predation-related threats.
      - Disease-related threats.
   d. The inadequacy of existing regulatory mechanisms.
      - Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
        - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
        - states have established and protected instream flow levels;
        - regulatory programs are in place and are adequate to manage fisheries;
        - regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;

- regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

e. Other natural or human-made factors affecting the species' continued existence.
    - Hatchery-related threats.
    - Other natural or human-caused factors have been accounted for.

The effects of the proposed action would not influence limiting factors where populations of LCR coho salmon overlap with watersheds containing BLM administered lands. The amount of BLM land that overlaps with this ESU is small, and not all populations of LCR coho salmon overlap with BLM lands. In populations where overlap occurs, considering the nature and duration of the effects, we assume the proposed action would, on balance, be consistent with the recovery goals of the LCR coho salmon ESU. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are eggs through rearing juveniles. These effects are only expected to affect a few individuals and thus will not affect the population level. In addition to these upstream freshwater life stages, individuals in the Columbia River estuary will be exposed to stormwater and methylmercury contaminants. The effects of these chemical contaminates are concentrated around urban cities and mining locations such that chemical concentrations are diluted with addition of the Willamette and lower Columbia rivers. The proposed action would have very limited effects on limiting factors associated with Columbia River Estuary and would, on balance, be consistent with the recovery goals of the ESU.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on LCR coho salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action would, on balance, be consistent with the recovery goals of the LCR coho salmon ESU. This is because the proposed action will, on balance, allow for the development and maintenance of habitat quality suitable to support viable populations.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long term functioning of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of LCR coho salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Lower Columbia River steelhead. This species is listed as "threatened" under the ESA. All 23 populations that comprise this species occur in the action area. However, 6 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for LCR steelhead (NMFS 2013).

Life History. LCR steelhead currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. However, the species also displays a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,
- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The primary limiting factors for LCR steelhead are summer and winter rearing habitat related to stream complexity (winter and summer) and water temperature (summer). The PRMP riparian management subwatershed classification and key watershed strategy protects current sources of wood recruitment to streams. The riparian management strategy also protects vegetation producing shade (trees and brush) with the 120 foot no-harvest zones around perennial stream and fish bearing streams. This is consistent with the recovery goals of the LCR steelhead (NMFS 2013).

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect LCR steelhead (Table 94). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the Columbia River Estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of LCR steelhead migrating/rearing in the estuary.

VSP Evaluation. The LCR steelhead populations are grouped into four strata: Cascade summer, Gorge summer, Cascade winter, and Gorge winter. The recovery plan provides the following recovery and biological goals (NMFS 2013).

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[53] High probability of stratum persistence is defined as:

[53] *Id.*

a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);
b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (*i.e.*, the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.

2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
   a. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
      - Habitat-related threats:
        - recovery plan actions addressing habitat limiting factors have been substantially implemented;
        - threat reduction targets identified in the recovery plan have been met;
        - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and water temperature and other water quality parameters, are stable or improving;
        - functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.
      - Hydropower and/or flood control dam-related threats.
   b. Over-utilization for commercial, recreational, scientific, or educational purposes.
      - Harvest-related threats.
      - Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes).
   c. Disease or predation.
      - Predation-related threats.
      - Disease-related threats.
   d. The inadequacy of existing regulatory mechanisms.
      - Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
        - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
        - states have established and protected instream flow levels;
        - regulatory programs are in place and are adequate to manage fisheries;
        - regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;

- regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

e. Other natural or human-made factors affecting the species' continued existence.
   - Hatchery-related threats.
   - Other natural or human-caused factors have been accounted for.

The effects of the proposed action would not influence limiting factors where populations of LCR steelhead overlap with watersheds containing BLM administered lands. The amount of BLM land that overlaps with this ESU is small, and not all populations of LCR steelhead overlap with BLM lands. In populations where overlap occurs, considering the nature and duration of the effects, we assume the proposed action would, on balance, be consistent with the recovery goals of the LCR steelhead DPS. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are eggs through rearing juveniles. These effects are only expected to affect a few individuals and thus will not affect the population level. In addition to these upstream freshwater life stages, individuals in the Columbia River estuary will be exposed to stormwater and methylmercury contaminants. The effects of these chemical contaminates are concentrated around urban cities and mining locations such that chemical concentrations are greatly diluted by the confluence of the Willamette and Columbia River. The proposed action would have very limited effects on limiting factors associated with Columbia River Estuary and would, on balance, be consistent with the recovery goals of the ESU.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on LCR steelhead. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action would, on balance, be consistent with the recovery goals of the LCR steelhead DPS. This is because the proposed action will, on balance, allow for the development and maintenance of habitat quality suitable to support viable populations.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of LCR steelhead viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Columbia River chum salmon. This species is listed as "threatened" under the ESA. All 17 populations that comprise this species occur in the action area. However, 8 populations originate in the action area and are likely to be most affected by the proposed action. A recovery plan has been completed for Columbia River chum salmon (NMFS 2013).

Life History. CR chum salmon exclusively exhibit an ocean-type life history and display a fry life history strategy (NMFS 2011d, p. 2-5; Table 95).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- riparian condition,
- channel structure and form,
- side channels and wetland conditions,
- floodplain conditions,
- sediment conditions,
- water temperature,
- flow,
- toxic contaminants, and
- estuary condition.

The effects of the proposed action are very limited for the populations of this species. The vast majority of the chum populations remain extirpated or nearly so. There are reports of chum spawning in some of the Cascade Range, Upper Gorge, and Lower Gorge tributaries.

We identified that chemical contaminants from roads and mining as the primary causal mechanisms that will directly and indirectly adversely affect CR chum salmon (Table 94). We did assess the potential habitat for recovery from the stream classification system of protection when LCR chum salmon population number increase and distribution once again enters the lower Columbia River streams. We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing those within the estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of CR chum salmon when using the estuary.

VSP Evaluation. The Columbia River chum salmon populations are grouped into three strata: Coast, Cascade, and Gorge. The recovery plan provides the following recovery and biological goals (NMFS 2013):

1. All strata that historically existed have a high probability of persistence or have a probability of persistence consistent with their historical condition.[54] High probability of stratum persistence is defined as:
    a. at least two populations in the stratum have at least a 95% probability of persistence over a 100-year time frame (*i.e.*, two populations with a score of 3.0 or higher based on the TRT's scoring system);

[54] *Id.*

   b. other populations in the stratum have persistence probabilities consistent with a high probability of stratum persistence (i.e., the average of all stratum population scores is 2.25 or higher, based on the TRT's scoring system);
   c. populations targeted for a high probability of persistence are distributed in a way that minimizes risk from catastrophic events, maintains migratory connections among populations, and protects within-stratum diversity.
2. The identified threats have been ameliorated so as not to limit attainment of the species' desired biological status, and such that the desired status will be maintained. The consideration of threats are organized into five factors.
   i. The present or threatened destruction, modification, or curtailment of the species' habitat or range.
      - Habitat-related threats:
         - recovery plan actions addressing habitat limiting factors have been substantially implemented;
         - threat reduction targets identified in the recovery plan have been met;
         - trends in overall habitat conditions, based on evaluation of the combined effect of factors, including, but not limited to, habitat access, hydrograph/water quantity, physical habitat quality and quantity, and water temperature and other water quality parameters, are stable or improving;
         - functioning habitat areas, including those expected to be less vulnerable to impacts from climate change, have been protected; and other actions to support adaptation to climate change impacts have been implemented.
      - Hydropower and/or flood control dam-related threats.
   ii. Over-utilization for commercial, recreational, scientific, or educational purposes.
      - Harvest-related threats.
      - Any other threats related to overutilization for commercial, recreational, scientific, or educational purposes (*e.g.*, research purposes).
   iii. Disease or predation.
      - Predation-related threats.
      - Disease-related threats.
   iv. The inadequacy of existing regulatory mechanisms.
      - Regulatory mechanisms have been maintained and/or established and are being implemented in a way that supports attaining and maintaining the desired status of the species:
         - regulatory programs that govern land use and resource utilization are in place and are adequate to protect salmon and steelhead habitat, including water quality, water quantity, and stream structure and function, and to attain and maintain the biological recovery criteria in the recovery plan;
         - states have established and protected instream flow levels;
         - regulatory programs are in place and are adequate to manage fisheries;
         - regulatory, control, and education measures are in place to prevent introductions of non-native plant and animal species;
         - regulatory programs have adequate funding, prioritization, enforcement, coordination mechanisms, and research, monitoring, and evaluation to ensure habitat protection and effective management of fisheries.

v. Other natural or human-made factors affecting the species' continued existence.
   - Hatchery-related threats.
   - Other natural or human-caused factors have been accounted for.

The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. Juvenile and adult LCR chum salmon in the Columbia River estuary will be exposed to stormwater and methylmercury contaminants. The effects of these chemical contaminates are concentrated around urban cities and mining locations such that chemical concentrations are greatly diluted by the confluence of the Willamette and Columbia River. The proposed action would have very limited effects on limiting factors associated with Columbia River Estuary and would, on balance, be consistent with the recovery goals of the ESU.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on CR chum salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action would, on balance, be consistent with the recovery goals of the CR chum salmon ESU. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of CR chum salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Upper Willamette River Chinook salmon. This species is listed as "threatened" under the ESA. All 7 populations that comprise this species originate in the action area. A recovery plan has been completed for UWR Chinook salmon (ODFW and NMFS 2011).

<u>Life History</u>. UWR Chinook salmon currently exhibit a predominately ocean-type life history, and typically display a yearling life history strategy. However, the species also displays fingerling and sub-yearling life history strategies (NMFS 2011d, p. 2-5; Table 95).

<u>Relevant Limiting Factors</u>. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- food web - change from macrodetritus-based to microdetritus-based inputs;
- habitat access - diked streams;
- hydrograph/water quantity – altered hydrograph, timing, and magnitude of flows;
- physical habitat quality/quantity - habitat characteristics include floodplain connectivity and function, channel structure and complexity, channel morphology, riparian condition (including loss or alteration of stream habitat) and large wood recruitment, sediment

routing (fine and coarse sediment), and upland processes; and quantity refers to the amount of accessible habitat for different life history stages; and
- water quality – temperature, dissolved oxygen, suspended sediment, pH, toxics.

The effects of the proposed action would vary across the populations of this species. The programs and actions proposed in the RMP were described in Section 1.3 are being implemented, to the most part, in the upstream freshwater areas where UWR Chinook salmon spawn and rear. The sub-watershed riparian strategy (Table 6-Table 11, Figure 3 and Figure 5) includes primarily Class I and II, and only a few Class III strategy designations within the boundaries of this ESU. The primary limiting factors for UWR Chinook salmon are summer and winter rearing habitat related to stream complexity (winter and summer) and water temperature (summer). The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The PRMP riparian management subwatershed classification and key watershed strategy protects current sources of wood recruitment to streams. The riparian management strategy also protects vegetation producing shade (trees and brush) with the 120 foot no-harvest zones around perennial stream and fish bearing streams. This is consistent with the recovery goals of the UWR Chinook salmon (ODFW and NMFS 2011).

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect UWR Chinook salmon (Table 94). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of UWR Chinook salmon.

VSP Evaluation. The UWR Chinook salmon populations were not grouped into strata or major population groups, so it is assumed the attributes of a viable stratum are attributes of a viable ESU. The recovery plan provides the following population-based biological goals and delisting criteria (NMFS 2011d, p. 3-5 and p. 6-3):

- At least two populations meet the population viability criteria (extinction risk classification score of 3 or 4).
- The average of all population extinction risk category scores is 2.25 or greater.
- Three of the 4 "core" populations are viable (Clackamas, North Santiam, McKenzie, and Middle Fork Willamette populations).
- Remaining "genetic legacy" population is improved to a very low extinction risk (McKenzie population).
- All populations do not deteriorate and are maintained at a minimum at their current risk of extinction.

In addition, threats delisting criteria must also be satisfied. Consequently, riparian and stream habitat loss and degradation particularly in the lowland, valley must be addressed, including the adequacy of existing regulatory mechanisms (NMFS 2011d, p. 3-6). Several specific metrics are required. One metric is:

> Major tributaries and the mainstem Willamette River must have sufficient habitat conditions to allow juvenile spring Chinook salmon adequate "rest areas" (*e.g.*, thermal refugia, off-channel areas).

The proposed action has conservation measures designed to directly address some of the limiting factors. All populations of UWR Chinook salmon overlap with BLM lands. Where overlap occurs, considering the nature and duration of the effects, we assume the proposed action would, on balance, be consistent with the recovery goals of the UWR Chinook salmon ESU. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are eggs through rearing juveniles. These effects are only expected to affect a few individuals and thus will not affect the population level. In addition individuals will be exposed to stormwater and methylmercury contaminants. The affects are localized around urban cities and mining location, and may affect a minor amount of juveniles, but not likely to adversely affect more than a few adults. This is because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on UWR Chinook salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action would, on balance, be consistent with the recovery goals of the UWR Chinook salmon ESU. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of UWR Chinook salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Upper Willamette River steelhead. This species is listed as "threatened" under the ESA. All 4 populations that comprise this species originate in the action area. A recovery plan has been completed for UWR steelhead (ODFW and NMFS 2011).

<u>Life History</u>. UWR steelhead currently exhibit a stream-type life history with individuals exhibiting a yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- food web - change from macrodetritus-based to microdetritus-based inputs;
- habitat access - diked streams;
- hydrograph/water quantity – altered hydrograph, timing, and magnitude of flows;
- physical habitat quality/quantity - habitat characteristics include floodplain connectivity and function, channel structure and complexity, channel morphology, riparian condition (including loss or alteration of stream habitat) and large wood recruitment, sediment routing (fine and coarse sediment), and upland processes; and quantity refers to the amount of accessible habitat for different life history stages; and
- water quality – temperature, dissolved oxygen, suspended sediment, pH, toxics.

The effects of the proposed action would vary across the populations of this species. The programs and actions proposed in the RMP were described in section 1.3 are being implemented, to the most part, in the upstream freshwater areas where UWR steelhead spawn and rear. The sub-watershed riparian strategy (Table 6-Table 11, Figure 3 and Figure 5) includes primarily Class I and II, and only a few Class III strategy designations within the boundaries of this ESU. The primary limiting factors for UWR steelhead are summer and winter rearing habitat related to stream complexity (winter and summer) and water temperature (summer). The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The PRMP riparian management subwatershed classification and key watershed strategy protects current sources of wood recruitment to streams. The riparian management strategy also protects vegetation producing shade (trees and brush) with the 120 foot no-harvest zones around perennial stream and fish bearing streams. This is consistent with the recovery goals of the UWR steelhead (ODFW and NMFS 2011).

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect UWR steelhead (Table 94). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of UWR steelhead.

VSP Evaluation. The UWR steelhead populations were not grouped into strata or major population groups, so it is assumed the attributes of a viable stratum are attributes of a viable ESU. The recovery plan provides the following population-based biological goals and delisting criteria (NMFS 2011d, p. 3-5 and p. 6-3):

- At least two populations meet the population viability criteria (extinction risk classification score of 3 or 4).
- The average of all population extinction risk category scores is 2.25 or greater.

- Both of the "core" populations are viable (North Santiam and South Santiam).
- Remaining "genetic legacy" populations are improved to a very low extinction risk (Santiam populations).
- All populations do not deteriorate and are maintained at a minimum at their current risk of extinction.

In addition, threats delisting criteria must also be satisfied. Consequently, riparian and stream habitat loss and degradation particularly in the lowland valley must be addressed, including the adequacy of existing regulatory mechanisms (NMFS 2011d, p. 3-6). Several specific metrics are required. One metric is:

> Major tributaries and the mainstem Willamette River must have sufficient habitat conditions to allow juvenile steelhead adequate "rest areas" (*e.g.*, thermal refugia, off-channel areas).

The proposed action has conservation measures designed to directly address some of the limiting factors for UWR steelhead. All populations of UWR steelhead overlap with BLM lands. Where overlap occurs, considering the nature and duration of the effects, we assume the proposed action would, on balance, be consistent with the recovery goals of the UWR steelhead DPS. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are eggs through rearing juveniles. These effects are only expected to affect a few individuals and thus will not affect the population level. In addition individuals will be exposed to stormwater and methylmercury contaminants. The affects are localized around urban cities and mining location, and may affect a minor amount of juveniles, but not likely to adversely affect more than a few adults. This is because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on UWR steelhead. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action would, on balance, be consistent with the recovery goals of the UWR steelhead DPS. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of UWR steelhead viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Interior Columbia Recovery Domain. There are seven ESA-listed salmonid species that originate in this domain.

Upper Columbia River spring-run Chinook salmon. This species is listed as "endangered" under the ESA. All three populations of this species originate in eastern Washington outside of the action area. However, all populations migrate through the action area (Columbia River mainstem) as juveniles and returning adults. A recovery plan has been completed for this species (UCSRB 2007).

Life History. UCR spring-run Chinook salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Rarely, individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Relevant Limiting Factors. The relevant limiting factors for this ESU are associated with the mainstem Columbia River and its estuary. Mainstem factors above Bonneville Dam are primarily related to hydropower and agricultural (*e.g.*, water withdrawals) uses. Therefore, we concentrated on the estuary and referred to the Estuary Module (NMFS 2011d) to identify relevant limiting factors. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24).

Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- Effects related to hydropower system in the mainstem Columbia River , including reduced upstream and downstream fish passage, altered ecosystem structure and function, altered flows, and degraded water quality
- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality
- Degraded estuarine and nearshore marine habitat
- Hatchery-related effects
- Persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species
- Harvest in Columbia River fisheries

The effects of the proposed action will occur during the rearing/migration of juvenile fish and returning migrating adults in the three populations of the UCR spring-run Chinook salmon. The programs and actions proposed in the RMP that were described in Section 1.3 are being implemented in the Willamette River Watershed and Lower Columbia River tributaries such that they have no causal mechanism to effect the upstream freshwater areas where 3 populations of UCR spring-run Chinook salmon spawn and rear.

We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect the UCR spring-run Chinook salmon. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing UCR spring-run Chinook juvenile and adult fish during their migration through the lower Columbia River, including those rearing within the estuary. Limited suction dredge mining will occur in the Willamette River Watershed; therefore the exposure to methyl mercury may also occur during the rearing/migration UCR spring-run Chinook salmon in the Lower Columbia River including the estuary. The programs that generated the chemical contaminants are far in proximity to the migrating UCR spring-run Chinook salmon such that these chemicals are diluted with addition of the Willamette and Lower Columbia rivers. Thus by the time these chemical are added to the Columbia River and its estuary, the chemical concentrations are very low.

VSP Evaluation. The recovery plan indicates that all three populations are needed for recovery and must meet abundance and productivity criteria that represents a 5% extinction risk over a 100-year period (UCSRB 2007, p. 115).

The effects of the PRMP is limited to chemical contaminates from both stormwater from road use and methylmercury from mining. The concentrations of these chemicals are highest near the urban cities in the Willamette River and are extremely small once they reach the Columbia River. No other program will affect the ESA species migrating through the Columbia River. The duration of time the juveniles are migrating through the estuary and the small concentration of chemical contaminants remaining in the Columbia River estuary, only a very few individuals have the potential to be adversely affected. Chemical contaminants will therefore not affect the population because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity. The proposed action has conservation measures designed to directly address limiting factors for UCR spring-run Chinook salmon. Considering the nature and duration of the effects, we determined the proposed action would, on balance, be consistent with the recovery goals of the UCR spring-run Chinook salmon ESU. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are rearing/migration in the estuary, and returning migrating adults. The proposed action would have very limited effects on limiting factors associated with estuaries and would, on balance, be consistent with the recovery goals for species displaying life history strategies that use the estuaries. The effects of the BLM action are expected to only affect a few individuals and thus will not affect the population levels.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on UCR spring-run Chinook salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, we determined that the proposed action would, on balance, be consistent with the recovery goals of the UCR spring-run Chinook salmon ESU.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of UCR spring-run Chinook salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Upper Columbia River steelhead. This species is listed as "threatened" under the ESA. All four populations of this species originate in eastern Washington outside of the action area. However, all populations migrate through the action area as juveniles and returning adults. A recovery plan has been completed for this species (UCSRB 2007).

Life History. UCR steelhead currently exhibit a stream-type life with individuals exhibiting a yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Relevant Limiting Factors. The relevant limiting factors for this DPS are largely associated with the mainstem Columbia River and its estuary. Mainstem factors above Bonneville Dam are primarily related to hydropower and agricultural (*e.g.*, water withdrawals) uses. Therefore, we concentrated on the estuary and referred to the Estuary Module (NMFS 2011d) to identify relevant limiting factors. The Estuary Module indicates that the limiting factors most likely affected by the proposed action would have moderate effects on stream-type populations (NMFS 2011d, p. 3-24).

Limiting Factors. Limiting factors for this species include UCSRB 2007; NOAA Fisheries 2011):

- Adverse effects related to the mainstem Columbia River hydropower system
- Impaired tributary fish passage
- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality
- Hatchery-related effects
- Predation and competition
- Harvest-related effects

The effects of the proposed action will occur during the migration of juvenile fish and returning adults in the four populations of the UCR steelhead. The programs and actions proposed in the RMP that were described in Section 1.3 are being implemented in the Willamette River Watershed and Lower Columbia River tributaries such that they have no causal mechanism to effect the upstream freshwater areas where 4 populations of UCR steelhead spawn and rear.

We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect the UCR steelhead. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing UCR steelhead juvenile and adult fish during their migration through the lower Columbia River. Limited suction dredge mining will occur in the Willamette River Watershed; therefore the exposure to methyl mercury may also occur during the migration UCR steelhead in the Lower Columbia River including the estuary. The programs that generated the chemical contaminants are far in proximity to the migrating UCR steelhead such that these chemicals are diluted with addition of the Willamette and Lower Columbia rivers. Thus by the time these chemical are added to the Columbia River and its estuary, the chemical concentrations are very low.

VSP Evaluation. The recovery plan indicates that all four populations are needed for recovery and must meet abundance and productivity criteria that represents a 5% extinction risk over a 100-year period (UCSRB 2007, p. 116).

The effects of the PRMP is limited to chemical contaminates from both stormwater from road use and methylmercury from mining. The concentrations of these chemicals are highest near the urban cities in the Willamette River and are extremely small once they reach the Columbia River. No other program will affect the ESA species migrating through the Columbia River. The duration of time the juveniles are migrating through the estuary and the small concentration of chemical contaminants remaining in the Columbia River estuary, only a very few individuals have the potential to be adversely affected. Chemical contaminants will therefore not affect the population because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity. The proposed action has conservation measures designed to directly address for UCR steelhead. Considering the nature and duration of the effects, we determined the proposed action would, on balance, be consistent with the recovery goals of the UCR steelhead DPS. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are migrating smolts and returning adults. The effects of the BLM action are expected to only affect a few individuals and thus will not affect the population levels.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on UCR steelhead. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, we determined that the proposed action would, on balance, be consistent with the recovery goals of the UCR steelhead DPS.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of UCR steelhead viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Snake River spring/summer-run Chinook salmon. This species is listed as "threatened" under the ESA. All 27 populations that comprise this species migrate through the action area. A recovery plan has not been completed for this species.

Life History. SR spring/summer-run Chinook salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Rarely, individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Limiting Factors. Limiting factors for this species include (NOAA Fisheries 2011):

- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality. Effects related to the hydropower system in the mainstem Columbia River, including reduced upstream and downstream fish passage, altered ecosystem structure and function, altered flows, and degraded water quality
- Harvest-related effects
- Predation

The effects of the proposed action will occur during the migration of juvenile fish and returning adults in the 27 populations of the SR spring/summer-run Chinook salmon. The programs and actions proposed in the RMP that were described in Section 1.3 are being implemented in the Willamette River Watershed and Lower Columbia River tributaries such that they have no causal mechanism to effect the upstream freshwater areas where 27 populations of SR spring/summer-run Chinook salmon spawn and rear.

We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect the SR spring/summer-run Chinook salmon. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing SR spring/summer-run Chinook salmon juvenile and adult fish during their migration through the lower Columbia River. Limited suction dredge mining will occur in the Willamette River Watershed; therefore the exposure to methyl mercury may also occur during the migration SR spring/summer-run Chinook salmon in the Lower Columbia River including the estuary. The programs that generated the chemical contaminants are far in proximity to the migrating SR spring/summer-run Chinook salmon such that these chemicals are diluted with addition of the Willamette and Lower Columbia rivers. Thus by the time these chemical are added to the Columbia River and its estuary, the chemical concentrations are very low.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations are important to the survival and recovery of the species.

The effects of the PRMP is limited to chemical contaminates from both stormwater from road use and methylmercury from mining. The concentrations of these chemicals are highest near the urban cities in the Willamette River and are extremely small once they reach the Columbia River. No other program will affect the ESA species migrating through the Columbia River. The duration of time the juveniles are migrating through the estuary and the small concentration of chemical contaminants remaining in the Columbia River estuary, only a very few individuals have the potential to be adversely affected. Chemical contaminants will therefore not affect the population because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity. The proposed action has conservation measures designed to directly address limiting factors for SR spring/summer-run Chinook salmon. Considering the nature and duration of the effects, we determined the proposed action would, on balance, be consistent with the recovery goals of the SR spring/summer-run Chinook salmon ESU. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are migrating smolts and returning adults. The effects of the BLM action are only expected to affect a few individuals and thus will not affect the population level of any of the 27 populations.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on SR spring/summer-run Chinook salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, we determined that the proposed would, on balance, be consistent with the recovery goals of the SR spring/summer-run Chinook salmon ESU.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of SR spring/summer-run Chinook salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Snake River fall-run Chinook salmon. This species is listed as "threatened" under the ESA. All individuals of this population migrate through the action area as juveniles and returning adults. A recovery plan was proposed for this species (NMFS 2015c).

Life History. SR fall-run Chinook salmon currently exhibit a predominately ocean-type life history and typically display a sub-yearling life history strategy. However, the species displays two other life history strategies. Individuals rarely display a fingerling life history strategy and more commonly a yearling life history does occur (NMFS 2011d, p. 2-5; Table 95).

Limiting Factors. Limiting factors for this species include (NOAA Fisheries 2011):

- Degradation of floodplain connectivity and function and channel structure and complexity
- Harvest-related effects
- Loss of access to historical habitat above Hells Canyon and other Snake River dams
- Impacts from mainstem Columbia River and Snake River hydropower systems
- Hatchery-related effects
- Degraded estuarine and nearshore habitat.

The effects of the proposed action will occur during the migration of juvenile fish and returning adults of the SR fall-run Chinook salmon. The programs and actions proposed in the RMP that were described in Section 1.3 are being implemented in the Willamette River Watershed and Lower Columbia River tributaries such that they have no causal mechanism to effect the upstream freshwater areas where SR fall-run Chinook salmon spawn and rear.

We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect the SR fall-run Chinook salmon. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing SR fall-run Chinook salmon juvenile and adult fish during their migration through the lower Columbia River. Limited suction dredge mining will occur in the Willamette River Watershed; therefore the exposure to methyl mercury may also occur during the migration SR fall-run in the Lower Columbia River including the estuary. The programs that generated the chemical contaminants are far in proximity to the migrating SR fall-run Chinook salmon such that these chemicals are diluted with addition of the Willamette and Lower Columbia rivers. Thus by the time these chemical are added to the Columbia River and its estuary, the chemical concentrations are very low.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations are important to survival and recovery of the species.

The effects of the PRMP is limited to chemical contaminates from both stormwater from road use and methylmercury from mining. The concentrations of these chemicals are highest near the urban cities in the Willamette River and are extremely small once they reach the Columbia River. No other program will affect the ESA species migrating through the Columbia River. The duration of time the juveniles are migrating through the estuary and the small concentration of chemical contaminants remaining in the Columbia River estuary, only a very few individuals have the potential to be adversely affected. Chemical contaminants will therefore not affect the population because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity. The proposed action has conservation measures designed to directly address limiting factors for SR fall-run Chinook salmon. Considering the nature and duration of the effects, we determined the proposed action would, on balance, be consistent with the recovery goals of the SR fall-run Chinook salmon ESU. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are migrating smolts and returning adults. The effects of the BLM action are only expected to affect a few individuals and thus will not affect the population level.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on SR fall-run Chinook salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, we determined that the proposed action would, on balance, be consistent with the recovery goals of the SR fall-run Chinook salmon ESU.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of SR fall-run Chinook salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Snake River sockeye salmon. This species is listed as "endangered" under the ESA. A single population that originates outside of the action area comprises this species. However, all individuals of this population migrate through the action area as juveniles and returning adults. A recovery plan has been completed for this species.

Life History. SR sockeye salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Rarely, individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Limiting Factors. The key factor limiting recovery of SR sockeye salmon ESU is survival outside of the Stanley Basin. Portions of the migration corridor in the Salmon River are impaired by reduced water quality and elevated temperatures (Idaho Department of Environmental Quality 2011). The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals. Survival rates from Lower Granite dam to the spawning grounds are low in some years (*e.g.*, average of 31%, range of 0-67% for 1991-1999) (Keefer *et al.* 2008). Keefer *et al.* (2008) conducted a radio tagging study on adult SR sockeye salmon passing upstream from Lower Granite Dam in 2000 and concluded that high in-river mortalities could be explained by "a combination of high migration corridor water temperatures and poor initial fish condition or parasite loads." Keefer *et al.* (2008) also examined current run timing of SR sockeye salmon versus records from the early 1960s, and concluded that an apparent shift to earlier run timing recently may reflect increased mortalities for later migrating adults. In the Columbia and lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown, but terns and cormorants consume 12% of all salmon smolts reaching the estuary, and piscivorous fish consume an estimated 8% of migrating juvenile salmon (NOAA Fisheries 2011).

The effects of the proposed action will occur during the migration of juvenile fish and returning adults of the SR sockeye salmon. The programs and actions proposed in the RMP that were described in section 1.3 are being implemented in the Willamette River Watershed and Lower Columbia River tributaries such that they have no causal mechanism to effect the upstream freshwater areas where SR sockeye salmon spawn and rear.

We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect the SR sockeye salmon. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing SR sockeye salmon juvenile and adult fish during their migration through the lower Columbia River. Limited suction dredge mining will occur in the Willamette River Watershed; therefore the exposure to methyl mercury may also occur during the migration SR sockeye salmon in the Lower Columbia River including the estuary. The programs that generated the chemical contaminants are far in proximity to the migrating SR sockeye salmon such that these chemicals are diluted with addition of the Willamette and Lower Columbia rivers. Thus by the time these chemical are added to the Columbia River and its estuary, the chemical concentrations are very low.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations are important to the survival and recovery of the species..

The effects of the PRMP is limited to chemical contaminates from both stormwater from road use and methylmercury from mining. The concentrations of these chemicals are highest near the urban cities in the Willamette River and are extremely small once they reach the Columbia River. No other program will affect the ESA species migrating through the Columbia River. The duration of time the juveniles are migrating through the estuary and the small concentration of chemical contaminants remaining in the Columbia River estuary, only a very few individuals have the potential to be adversely affected. Chemical contaminants will therefore not affect the population because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity. The proposed action has conservation measures designed to directly address limiting factors for SR sockeye salmon. Considering the nature and duration of the effects, we determined the proposed action would, on balance, be consistent with the recovery goals of the SR sockeye salmon ESU. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are migrating smolts and returning adults. The effects of the BLM action are only expected to affect a few individuals and thus will not affect the population level.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on SR sockeye salmon. Considering these effects on individual fish from all future cohorts and the population exposed to those effects, we determined that the proposed action would, on balance, be consistent with the recovery goals of the SR sockeye salmon ESU.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of SR sockeye salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Snake River Basin steelhead. This species is listed as "threatened" under the ESA. All 24 populations that comprise this species migrate through the action area. A recovery plan has not been completed for this species.

Life History. SRB steelhead currently exhibits a stream-type life history with individuals exhibiting a yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

Limiting Factors. Limiting factors for this species include (NMFS 2011a; NMFS 2011b):

- Adverse effects related to the mainstem Columbia River hydropower system
- Impaired tributary fish passage

- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality
- Increased water temperature
- Harvest-related effects, particularly for B-run steelhead
- Predation
- Genetic diversity effects from out-of-population hatchery releases

The effects of the proposed action will occur during the migration of juvenile fish and returning adults in the 24 populations of the SRB steelhead. The programs and actions proposed in the RMP that were described in Section 1.3 are being implemented in the Willamette River Watershed and Lower Columbia River tributaries such that they have no causal mechanism to effect the upstream freshwater areas where 24 populations of SRB steelhead spawn and rear.

We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect the SRB steelhead. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing SRB steelhead juvenile and adult fish during their migration through the lower Columbia River. Limited suction dredge mining will occur in the Willamette River Watershed; therefore the exposure to methyl mercury may also occur during the migration SRB steelhead in the Lower Columbia River including the estuary. The programs that generated the chemical contaminants are far in proximity to the migrating SRB steelhead such that these chemicals are diluted with addition of the Willamette and Lower Columbia rivers. Thus by the time these chemical are added to the Columbia River and its estuary, the chemical concentrations are very low.

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations are important to the survival and recovery of the species.

The effects of the PRMP is limited to chemical contaminates from both stormwater from road use and methylmercury from mining. The concentrations of these chemicals are highest near the urban cities in the Willamette River and are extremely small once they reach the Columbia River. No other program will affect the ESA species migrating through the Columbia River. The duration of time the juveniles are migrating through the estuary and the small concentration of chemical contaminants remaining in the Columbia River estuary, only a very few individuals have the potential to be adversely affected. Chemical contaminants will therefore not affect the population because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity. The proposed action has conservation measures designed to directly address limiting factors for SRB steelhead. Considering the nature and duration of the effects, we determined the proposed action would, on balance, be consistent with the recovery goals of the SRB steelhead DPS. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are migrating smolts and returning adults. The effects of the BLM action are only expected to affect a few individuals and thus will not affect any of the 24 populations.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on SRB steelhead. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, we determined that the proposed action would, balance, be consistent with the recovery goals of the SRB steelhead DPS.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of SRB steelhead viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Middle Columbia River steelhead. This species is listed as "threatened" under the ESA. All 17 populations that comprise this species migrate through the action area. A recovery plan has been completed for MCR steelhead (NMFS 2009).

<u>Life History</u>. MCR steelhead currently exhibit a predominately stream-type life history with individuals exhibiting a yearling life history strategy. However, some individuals display a sub-yearling life history strategy (NMFS 2011d, p. 2-5; Table 95).

<u>Limiting Factors.</u> Limiting factors for this species include (NMFS 2009; NOAA Fisheries 2011):

- Degradation of floodplain connectivity and function, channel structure and complexity, riparian areas, fish passage, stream substrate, stream flow, and water quality
- Mainstem Columbia River hydropower-related impacts
- Degraded estuarine and nearshore marine habitat
- Hatchery-related effects
- Harvest-related effects
- Effects of predation, competition, and disease.

The effects of the proposed action will occur during the migration of juvenile fish and returning adults in the 17 populations of the MCR steelhead. The programs and actions proposed in the RMP that were described in Section 1.3 are being implemented in the Willamette River Watershed and Lower Columbia River tributaries such that they have no causal mechanism to effect the upstream freshwater areas where 17 populations of MCR steelhead spawn and rear.

We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect the MCR steelhead. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing MCR steelhead juvenile and adult fish during their migration through the lower Columbia River. Limited suction dredge mining will occur in the Willamette River Watershed; therefore the exposure to methylmercury may also occur during the migration MCR steelhead in the Lower Columbia River including the estuary. The programs that generated the chemical contaminants are far in proximity to the migrating MCR steelhead such that these chemicals are diluted with addition of the Willamette and Lower Columbia rivers. Thus by the time these chemical are added to the Columbia River and its estuary, the chemical concentrations are very low.

VSP Evaluation. Viability ratings for these populations range from extirpated to viable. A recovery plan has been developed.

The effects of the PRMP is limited to chemical contaminates from both stormwater from road use and methylmercury from mining. The concentrations of these chemicals are highest near the urban cities in the Willamette River and are extremely small once they reach the Columbia River. No other program will affect the ESA species migrating through the Columbia River. The duration of time the juveniles are migrating through the estuary and the small concentration of chemical contaminants remaining in the Columbia River estuary, only a very few individuals have the potential to be adversely affected. Chemical contaminants will therefore not affect the population because it takes several hundred juvenile salmonids to create an adult equivalence, and several adults do not significantly affect the population abundance, productivity, distribution, or diversity. The proposed action has conservation measures designed to directly address limiting factors for MCR steelhead. Considering the nature and duration of the effects, we determined the proposed action would, on balance, be consistent of recovery goals of the MCR steelhead DPS. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are migrating smolts and returning adults. The would, on balance, be consistent with the recovery goals of the 17 populations that are exposed.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on MCR steelhead. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, we determined that the proposed action, would on balance, be consistent with the recovery goals of the MCR steelhead DPS.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of MCR steelhead viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Oregon Coast Recovery Domain. There is one ESA-listed salmonid species that originates in this domain.

Oregon Coast coho salmon. This species is listed as "threatened" under the ESA. The OC coho salmon ESU is comprised of 56 populations (Table 57). All 56 populations that comprise this species originate in the action area and would be exposed to habitat changes associated with implementation of the proposed action. A draft recovery plan provided strategies and actions required to ensure the survival and recovery of this species (NMFS 2015b)

Life History. OC coho salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. To a lesser extent, individuals display a fry or sub-yearling life history strategy (Stout *et al*. 2012, p. 98).

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded.
- Fish passage barriers that limit access to spawning and rearing habitats (*e.g.*, culverts, dikes, tide gates).
- Loss of estuarine and tidal freshwater habitat.

The effects of the proposed action would vary across the populations of this species. The programs and actions proposed in the RMP were described in Sections 4.2.1 through 4.2.21 are being implemented, to the most part, in the upstream freshwater areas where OC coho salmon spawn and rear. The sub-watershed riparian strategy (Tables 6-11) includes primarily Class I and II, and only a few Class III strategy designations within the boundaries of this ESU. The primary limiting factors for OC coho salmon are summer and winter rearing habitat related to stream complexity (winter and summer) and water temperature (summer). The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. By protecting wood recruitment sources the proposed action sustain ecological functions that contribute to the stream complexity limiting factors for OC coho salmon summer and winter rearing habitat. Protection of stream shade maintains stream shade and continued growth of riparian stands provides adequate water temperature protection, the other limiting factor related to summer rearing habitat.

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect OC coho salmon (Table 89). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of OC coho salmon.

Individuals of this species may use freshwater and low-salinity portions of coastal estuaries for extended periods of rearing. Widespread estuarine and tidal freshwater wetland losses have "likely diminished the expression of sub-yearling migrant life histories within and among coho salmon populations" (Stout *et al*. 2012, p. 101). The greatest tidal wetland losses have "occurred across populations in the North Coast and Mid-South Coast strata" (Stout *et al*. 2012, p. 101). Habitat effects are likely to affect all life history stages, all life history strategies, and all populations of OC coho salmon in freshwater and estuaries. In evaluating areas within 100 meters (328 feet) of channels, Burnett *et al*. (2007) stated that recovery of OC coho salmon is “unlikely unless habitat can be improved in high-intrinsic-potential reaches on private lands.” High-intrinsic-potential reaches where characterized as being unconstrained and having a low slope (Burnett *et al*. 2007).

VSP Evaluation. Since a recovery plan has not been completed for this species, we assume all populations are important to the survival and recovery of the species.

The proposed action has conservation measures designed to directly address some of the limiting factors of OC coho salmon. Not all populations of OC coho salmon overlap with BLM lands along the mid to north coast. In populations where overlap occurs, considering the nature and duration of the effects, we assume the proposed action would, on balance, be consistent with the recovery goals of the OC coho salmon ESU. This is because the proposed action will allow for the development and maintenance of habitat quality suitable to support viable populations. The proposed action’s riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are eggs through rearing juveniles. These effects are only expected a few individuals and thus will not affect the population level. In addition to these upstream freshwater life stages, individuals in some estuaries will be exposed to stormwater contaminants. The proposed action would have very limited effects on limiting factors associated with estuaries and would, on balance, be consistent with the recovery goals for species displaying early life history strategies that use the estuaries.

The proposed action’s programs include activities with short- and long-term effects on the environment with direct and indirect effects on OC coho salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action would, on balance, be consistent with the recovery goals of the OC coho salmon ESU.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of OC coho salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Southern Oregon/Northern California Coasts Recovery Domain. There is one ESA-listed species in this domain that occurs in Oregon.

Southern Oregon and Northern California Coasts coho salmon. This species is listed as “threatened” under the ESA. The SONCC coho salmon ESU is comprised of 45 populations, of which 11 populations originate in the action area (Table 58) and would be exposed to habitat changes associated with implementation of the proposed action. A recovery plan has been completed for this species (NMFS 2014a). The recovery plan identified independent core, independent non-core, and dependent populations (Table).

<u>Life History</u>. SONCC coho salmon currently exhibit a predominately stream-type life history and typically display a yearling life history strategy. Based on data from other Pacific Northwest coho salmon populations (NMFS 2011d, Stout *et al*. 2012, p. 98), individuals likely also display a sub-yearling life history strategy, albeit to a lesser extent.

<u>Relevant Limiting Factors</u>. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- 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, and
- barriers to migration.

The effects of the proposed action would vary across the populations of this species. The programs and actions proposed in the RMP are being implemented, to the most part, in the upstream freshwater areas where SONCC coho salmon spawn and rear. The sub-watershed riparian strategy includes primarily Class I and II, and only a few Class III strategy designations within the boundaries of this ESU. Of the limiting factors listed above, the primary limiting factors for SONCC coho salmon are summer and winter rearing habitat related to stream complexity (winter and summer) and water temperature (summer). The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams, albeit the fuels treatment program, which is most prevalent in this recovery domain, allows additional fuels reduction to manage fire risk. The management direction and implementation of the fuels program provides direction for minimum canopy cover and results in fire resiliency for the landscape. By protecting wood recruitment sources the proposed action will sustain ecological functions that contribute to the stream complexity limiting factors for SONCC coho salmon summer and winter rearing habitat. Protection of stream shade maintains stream shade and continued growth of riparian stands provides adequate water temperature protection, the other limiting factor related to summer rearing habitat.

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect SONCC coho salmon (Table 89). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. Most of the roads within this ESU are located some distance from major population centers and have much lower traffic volumes; therefore lower contaminant loading. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur. Within the range of SONCC coho salmon, suction dredge mining is more prevalent than any other ESU and considered a significant influence on the availability of methyl mercury and sedimentation. Livestock management occurs within this ESU, but represents a small portion of the ESUs range within the action area.

Individuals of this species may use freshwater and low-salinity portions of coastal estuaries for extended periods of rearing. Coastal estuaries of the southern Oregon coast are small with low complexity.

VSP Evaluation. The recovery plan identified core and non-core (1 and 2) populations, as well as dependent populations. To ensure survival and recovery of this ESU, core populations must achieve a low risk rating for extinction. The non-core 1 populations must achieve a moderate risk of extinction. Non-core 2 and dependent populations must provide sufficient habitat occupied by rearing juveniles. Consequently, while not all populations must reach a low risk of extinction, all populations must not experience further declines in their VSP parameters and must provide some occupied suitable habitat.

The proposed action has conservation measures designed to directly address some of the limiting factors for SONCC coho salmon. All core populations overlap with some BLM administered lands. Most populations of SONCC coho salmon overlap with BLM lands. In populations where overlap occurs, considering the nature and duration of the effects, we assume the proposed action would, on balance, be consistent with the recovery goals of the SONCC coho salmon ESU. The proposed action's riparian management strategy protects current sources of wood recruitment and provides the opportunity for future wood recruitment to streams. The riparian management strategy also protects stream shade with the 120 foot no-harvest zones around perennial streams. The primary life stages affected by the action are eggs through rearing juveniles. These effects are only expected to affect a few individuals and thus will not affect the population level. In addition to these upstream freshwater life stages, individuals in some estuaries will be exposed to stormwater contaminants and mining contaminants. The proposed action would have very limited effects on limiting factors associated with estuaries and would, on balance, be consistent with the recovery goals of the SONCC coho salmon ESU.

The proposed action's programs include activities with short- and long-term effects on the environment with direct and indirect effects on SONCC coho salmon. Considering these effects on individual fish from all future cohorts and populations exposed to those effects, NMFS determines that the proposed action, would, on balance, be consistent with the recovery goals of the SONCC coho salmon ESU.

Furthermore, the effects of the proposed action would not exacerbate anticipated habitat changes associated with climate change. The long-term maintenance of ecological processes established with the riparian management strategies related to wood recruitment and water temperature would work in favor of SONCC coho salmon viability in the face of climate change because the riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Southern Green Sturgeon. The Southern Green Sturgeon DPS is listed as "threatened" under the ESA. The species includes all naturally-spawning populations of green sturgeon that occur south of the Eel River in California, with the only known spawning population in the Sacramento River (71 FR 17757). To our knowledge, individuals from all populations spend time in the action area. A recovery plan has not been completed for this species.

Life History. Adult and sub-adult life stages occur in the action area. In many Oregon coastal systems inadequate data exists to dismiss their presence, but presence has been established in Coos Bay, Winchester Bay (Umpqua River), Yaquina Bay, Nehalem Bay, and the Columbia River estuary.

Relevant Limiting Factors. The only identified limiting factor for this species that potentially applies to the action area is degradation of freshwater and estuarine habitat quality. The threat of contaminants is unknown, but is identified as a potentially serious threat (NOAA Fisheries 2011).

Abundance and Productivity. Southern green sturgeon consist of a single known spawning population. Unknown populations south of the Eel River may also exist. Individuals of all populations likely use estuaries and tidally-influenced reaches within the action area that may be impacted by the proposed action. However, population abundance and the proportion of the population that use estuaries in the action area are unknown. Some exposed sub-adult and adult individuals will be adversely affected by exposure to those habitat effects, particularly those that are repeatedly exposed over their long lifespan.

The species is well distributed, presence in the affected portion of the action area is spatially and temporally limited, and only a small proportion of the population occupies any given estuarine or tidally-influenced river reach within the action area at any given time. Therefore, because the population is well distributed, repeat exposure to detrimental changes in habitat associated with the proposed action is likely limited to a portion of the total population, and detrimental responses are likely further limited to a few of the exposed individuals, we conclude that there would not be effect on the population level.

The effects of the proposed action will occur during the rearing/migration of subadults and adults into the coastal and Columbia River estuaries (Table 96). We identified chemical contaminants as the causal mechanism that will directly and indirectly adversely affect green sturgeon. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing green sturgeon subadult adult fish during their rearing and migration through the estuary. The proposed action also includes suction dredge; we concluded that the exposure to methyl mercury may also occur green sturgeon. Green sturgeon long life span can lead to repeated exposure to contaminants in the estuary. The exposure to these stormwater chemicals are greatest in proximity of urban areas as traffic increases, while exposure to methyl mercury is greatest in the Rogue and Chetco estuaries as dredging is primarily located in Southern Oregon. Since the concentrations reaching the estuaries are very small, adverse effects may occur within a few individuals, but not at the population level.

Table 96. PRMP programs and likely environmental and ecological pathways resulting in adverse effects to green sturgeon within the action area

PRMP Programs	Water Temperature	Suspended Sediment	Substrate	Large Wood	Flow	Forage	Chemical Contaminants Stormwater
Forest Management (wood delivery, new road construction, timber felling and yarding)						X	X
Minerals						X	X
Trails and Travel Management						X	X

Spatial Structure and Diversity. Distribution of this species is wide ranging along the northwest coast of North America. Within their distribution in the action area, the proposed action may indirectly affect green sturgeon through forage contamination. However, based on the information available, the effects are only expected to affect a few individuals and thus will not affect the population level. Because the primary rearing locations within the action area are the Oregon coastal estuaries (Coos Bay, Winchester Bay, Yaquina Bay, and Tillamook Bay) and in the Columbia River (up to Bonneville Dam, but predominantly in the lower 60 km) (Adams *et al.* 2002), individuals of this species will be exposed primarily to only the water quality impacts that occur with BLM planning effort, which are likely insufficient to inhibit the species use of these rearing areas.

Southern Eulachon. This species is listed as “threatened” under the ESA. The species includes all naturally-spawned populations that originate in rivers south of the Nass River in British Columbia to the Mad River in California. The species is comprised of a single population. Only one subpopulation identified by the BRT occurs in the action area, Columbia River subpopulation. In many Oregon coastal systems inadequate data exists to dismiss their presence. While Southern eulachon may occur in coastal Oregon estuaries, they have not been identified as part of a particular subpopulation. A recovery plan has not been completed for this species.

Life History. The primary spawning and rearing of eulachon are located on the Columbia River, outside of the action area. However, critical habitat for the coastal subpopulation is located on the Umpqua River and Tenmile Creek. The coastal subpopulation of eulachon is very rare.

Relevant Limiting Factors. The following relevant limiting factors, previously presented in the Status of the Species section of this opinion, have been identified for the species:

- Water quality
- Climate change impacts on freshwater habitats
- Predation
- Disease
- Dredging

Abundance and Productivity. Southern eulachon, like anadromous salmonids, return to their natal freshwater habitats to spawn. The species is comprised of a single population. Only one subpopulation identified by the BRT occurs in the action area, the Columbia River subpopulation. While Southern eulachon may occur in coastal Oregon estuaries, they have not been identified as part of a particular subpopulation. Individuals of the population that occur in Oregon may be impacted by the proposed action, including segments of the Columbia River subpopulation that spawn in Washington State rivers. Some exposed individuals will be adversely affected by exposure to those habitat effects, including mortal injury or reduced reproductive success.

Species presence in the action area is temporally limited, as with anadromous salmonids, occurring in the early and late life history stages of any given individual's lifespan. For Southern eulachon, these life stages are as an egg, larval, and spawning adult. During spawning, individuals aggregate and occur in great numbers on spawning sites. Within the action area, spawning sites of the lower Columbia River subpopulation are limited to the mainstem Columbia River and estuary and the Sandy River. Other spawning sites for the subpopulation occur in Washington rivers that are outside of the action area. Individuals that occur elsewhere in Oregon (*i.e*., coastal Oregon river basins) have spawning areas wholly within the action area.

The effects of the proposed action would vary across the populations of this species. The programs and actions proposed in the RMP were described in Section 1.3 are being implemented, to the most part, in the upstream freshwater areas where coastal eulachon spawn and rear. The eulachon spawning in the tributaries of the Columbia River use the lower Columbia River and estuary for rearing and migration, and are only affected by chemical contaminants.

The sub-watershed riparian strategy discussed in Section 1.3.8 includes primarily Class I and II, and only a few Class III strategy designations within the boundaries of this ESU. The primary limiting factors for eulachon included water quality related to water temperature. The riparian management strategy protects stream shade with the 120 foot no-harvest zones around perennial streams.

We identified a variety of programs and causal mechanisms that will directly and indirectly adversely affect eulachon (Table 97). We concluded use of the road system by motorized public use, as well as, timber management related traffic contributes the most to fine suspended sediment levels and stream substrate embeddedness. Stormwater from the paved roads designated as collector roads and near populations have the highest level of contaminant contribution during storm events. These contaminants will carry down to the ocean; therefore exposing all life history strategies, including those within the estuary. Suction dredge mining does occur within the range of this species; therefore the exposure to methyl mercury may occur, but to a very limited extent within the range of eulachon. The effects of these contaminates are greatest near urban cities and mining locations, thus the concentration levels are greatly reduced where eulachon are observed. Thus the overall effect to the eulachon is small, limited mostly to juvenile rearing and feeding, and although may affect individuals, significant adverse effects will not occur at the population level.

Table 97. PRMP programs and likely environmental and ecological pathways resulting in adverse effects to eulachon within the action area.

PRMP Programs	**Water Temperature**	**Suspended Sediment**	**Substrate**	**Large Wood**	**Flow**	**Forage**	**Chemical Contaminants Stormwater**
Forest Management (wood delivery, new road construction, timber felling and yarding)	X			X	X	X	X
Minerals						X	X
Trails and Travel Management						X	X

Spatial Structure and Diversity. As discussed above, the spatial structure of the Southern eulachon DPS within its estuarine and riverine distribution is limited. Estuarine and riverine occurrence of Oregon coastal groups wholly occurs within the affected portion of the action area. A significant proportion of the Columbia River subpopulation (*i.e.*, mainstem Columbia River and Sandy River spawners, and migrating adults and larvae from all segments) occurs within the affected portion of the action area. Eulachon located in the Columbia River Basin are only affected by stormwater and methyl mercury. Mining is very limited in the Willamette River which generates methyl mercury. The greatest concentration of mining occurs high in the Willamette River watershed and is not in close proximity to the Columbia River. Additionally high concentrations of stormwater is located surrounding urban areas of the BLM planning process, again, which is not in close proximity to eulachon rearing in the Columbia River estuary.

The species diversity of Southern eulachon is not well known. However, the effect of habitat changes are only expected to affect a few individuals and thus will not affect the population level.

2.4.22 Effects of the Action on Designated Critical Habitat

Salmon and Steelhead Critical Habitat Biological Features.

Designated critical habitat within the action area for salmonid and steelhead includes: (1) Freshwater spawning sites with substrate, water quantity, and water quality supporting spawning, (2) freshwater rearing sites with floodplain connectivity, forage, natural cover, water quantity, and water quality supporting juvenile rearing, (3) freshwater migration corridors with areas that are free of obstruction, natural cover, water quantity, and water quality supporting migration of juveniles and adults, and (4) estuarine areas with forage, areas free of artificial obstruction, natural cover, salinity, water quality, and water quantity supporting rearing of juveniles and smolts.

The essential features for salmon and steelhead critical habitat are as follows:

1) Freshwater Spawning
    a) *Substrate*- Substrate embeddedness downstream of sediment generating activities described in the previous section can result in temporary decreases in available spawning areas because embedded substrate makes it more difficult for fish to dig redds, clogs interstitial spaces, reduces intergravel velocities, and reduces dissolved oxygen concentrations in redds.

        Areas immediately below an operating suction dredge will have the greatest amount of deposition and substrate embeddedness because decreasing sedimentation rates are typically associated with increased downstream distance; however, coarser sediments are deposited nearest the dredge site and finer sediments travel farther downstream (Thomas 1985). Suction dredge mining tailings are highly unstable, have a high potential for scour, and can mobilize under slight increases in stream discharge and velocity because they are unconsolidated and frequently deposited above the armor layer (Thomas 1985, Hassler *et al.* 1986, Stern 1988, Harvey and Lisle 1998, Harvey and Lisle 1999). These characteristics degrade spawning substrate and mining activities will create unstable tailings when salmonids spawn.

        Roads contribute a large percentage of the forestry related sediment. Management direction for hydrology (Section 1.3.9.5) and road best management practices (BMPs) will reduce sediment to the stream through dry hauling, relief ditches to disconnect the road drainage from the streams, and BMPs such as water barring, ditchlines maintenance, etc.

        Sediment from Forest Management is greatly reduced through the watershed classification that provides 120’ buffers on fish bearing and perennial streams; and 50’ buffer on intermittent streams. These buffers will provide vegetation and large wood such to filter and hold sediment from reaching the streams.

        Critical habitat within sub-watersheds with the greatest road miles, combined with active suction dredge mining are at greatest risk. These areas are located throughout the action area where harvest is to occur and near urban cities. Sediment will be greatest near road runoff, and will pulse through the stream reach with each storm event. Although sediment will reach stream reaches, and the overall accumulation may impact spawning grounds and associated bedloads; the reduction of spawning for ESA listed salmonids will not appreciable reduce the amount of juveniles rearing in the summer or winter since spawning is not a limiting factor. Therefore sediment will not preclude or significantly delay development of this critical habitat feature and its ability to conserve listed fish within the action area.

b) *Water quantity*- Effects are limited to any increased peak flow in the winter due to timber harvest and road work. Elevated peak flows occur when a high proportion of timber basal area has been removed by forest harvest, particularly within rain-on-snow watersheds (Grant et al. 2008). BLM management direction (see Hydrology Management Direction Section 1.3.9.5) will limit harvest and road build such to avoid increases in peak flow (see reasoning in Effects to the Environment section). Therefore, only a very small localized effect is expected located near harvest areas above snow elevation, located high in the watershed. This increase in peak flow will not be measureable as it travels downstream because it will join additional stream confluences and the effect will become absorbed in those greater flows. Therefore change in peak flow from harvest and road construction will not preclude or significantly delay development of the critical habitat function to conserve listed species.

c) *Water quality*-Water quality will be temporarily and locally degraded by increases in suspended sediment from road work, harvest management, cattle grazing, and suction dredging. We described management direction for sediment effects in *substrate section* above.

   Water quality will be degraded from increases in methylmercury from mining, and PCBs and PAHs from stormwater inputs. Our analysis determined that methylmercury is a concern in the Rogue and Chetco estuaries since most mining occurs in the BLM Medford District. The amount of methylmercury may cumulate in forage, but repeated exposure is needed to result in detrimental effects. Stormwater is limited to paved roads near urban cities where most traffic will occur. BLM management direction to disconnect the drainage system from the streams and maintain vegetation in the ditchlines will greatly minimize the overall effects of stormwater to critical habitat. Minor localized adverse effects (near urban cities) are still expected to occur, but will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

2) Freshwater Rearing

   a) *Floodplain connectivity*-The proposed action will only affect floodplain connectivity with the construction of new roads. This effect is limited due to BLM management direction such as 1) roads construction is limited to where no other practical and economic feasible alternatives exist, 2) BLM will require fish passage culverts and bridges to have sizing limited to 1 ½ times the active stream channel and maintain stream simulation, and 3) BLM management direction for subwatershed classifications will also provide 120' buffers on fish bearing and perennial streams and wood restoration through tree tipping that will provide addition large wood structure to enhance floodplain connectivity. The overall affect to floodplain connectivity with the BLM PRMP is therefore minimal and will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

b) *Forage* - Substrate disturbance from suction dredging will directly cause localized and temporary reductions of macroinvertebrates. Increases in suspended sediment from road work will cause minor reductions in the production of macroinvertebrates. The mild climate of the western Oregon will provide habitat to quickly colonize (2 to 3 weeks) any disturbed areas. Increases in methylmercury from mining, and PCBs and PAHs from stormwater inputs can negatively affect food webs. The quality of forage and food will decrease due to the potential for bioaccumulation (Neff 1985). Repeated exposure is needed for bioaccumulation to occur from methylmercury, and stormwater is localized around urban cities. The overall effect to forage is therefore limited and will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

c) *Natural cover*- Reductions in wood recruitment potential are expected to occur from forest harvest management (new road construction), livestock grazing, and fire and fuels programs. Management direction will severely limit the amount of new road construction in riparian reserves; however, it is still expected to occur. Livestock grazing pertinent to this analysis is limited to the Medford District of BLM, and management direction will minimize the effects to riparian reserves. Fuel reduction treatments in the Riparian Reserve are limited to the dry forest of southern Oregon within the Medford District, Klamath Falls Field Office of the Lakeview District, and South River Field Office of the Roseburg District. Therefore we expect the magnitude of wood reduction at the 5th field HUC scale for critical habitat to be minor. Additionally, BLM will fall and trip trees into the critical habitat, and provide inner buffers within the riparian reserves to protect wood recruitment for the future. Therefore the effect from wood loss within the BLM PRMP for natural cover is minimal and will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

d) *Water Quality*-Sediment is similar as described above for freshwater spawning for its affect for juvenile rearing. New road construction and cattle grazing can cause localized increases in water temperature as discussed in *Effects of the action on ESA-Listed salmonids* (Section 2.4.21). BLM management directives severely restrict new road construction in riparian reserves. Additionally, the proposed subwatershed classification will provide 120' buffers on all perennial and fish bearing reaches to maintain and cool water temperature. Only minor increases in temperature is expected to occur, localized where new road construction occurs within riparian reserves, and with cattle grazing within meadows where grazes are the dominate shade. This temperature increase will be immeasurable as it travels downstream and additional confluence of other streams enter the watershed and will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

e) *Water Quantity*-Same as above described in Freshwater spawning.

3) Freshwater migration

a) *Free of artificial obstruction*- Delays in adult upstream passage from suspended sediment are unlikely to occur because adults are highly mobile with the ability to avoid these localized and temporary effects. Similarly, out-migrating juveniles are also likely to avoid localized and temporary water quality degradation events with only a slight delay in migration due to their mobility. Flow velocities at the intake of suction dredge nozzles > 2.5 inches are sufficient to entrain out-migrating smolts and impede freshwater migration via entrainment or attempting to avoid entrainment. Therefore, the PRMP will not preclude or significantly delay development of the critical habitat feature and its ability to provide free passage.

b) *Natural cover*- Same as above.
c) *Water quality*- Same as above.
d) *Water quality*- Same as above.

4) <u>Estuarine Areas</u>

a) *Forage.* It is unlikely that forage will be measurably affected by methylmercury in the estuaries. Mining is primarily located in the Medford District of BLM, and although it could reach concentrations in the Rogue and Chetco estuaries that cause detrimental effects, these two estuaries are very small and have quick turnover "flushing" rates that minimize the concentration levels within the estuary to a small concentration that will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
b) *Free of artificial obstruction*-No effect.
c) *Natural cover*-No effect.
d) *Salinity*-No effect.
e) *Water Quality*-Water quality will be degraded from stormwater inputs; however, because listed fish obtain methylmercury mostly from forage, rather than from the water, it is unlikely that water quality will be affected by methylmercury and stormwater in the estuaries so as to preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
f) *Water Quantity*-No effect.

Adverse effects to forage and water quality from increases in suspended sediment will affect rearing and spawning habitat within critical habitat within OC coho salmon, SONCC coho salmon, LCR Chinook salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead, and eulachon ESUs. However, the magnitude and implication of those effects are as set out above. There will not be any effects on rearing habitat for Columbia River chum salmon, Upper Columbia River spring-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Snake River fall-run Chinook salmon, Middle Columbia River steelhead, Upper Columbia River steelhead, Snake River sockeye salmon, and green sturgeon because suspended sediment will not affect the Columbia River mainstem where these species are present.

Adverse effects to forage and water quality from PCBs and PAHs from stormwater inputs will affect rearing and migration habitats for all juvenile and adult species considered in this opinion. Adverse effects from mining from methylmercury will affect rearing habitat for listed juvenile species and are greatest in the SONCC Recovery Domain as most of the mining occurs in the Medford District of BLM. Mining also occurs in the OC Recovery Domain, but at a reduced level. Very little mining occurs in the Willamette Recovery Domain such that effect of Methylmercury is minimal. These effects will also carry through the Columbia River Estuary such that similar effects will also occur to habitat within the Interior Columbia River Domain. However, the magnitude and implication of those effects are as set out above.

Adverse effects to water quantity from increased peak flows from timber harvest and road work, and decreased peak flows from water withdrawals will affect rearing, migration, and spawning habitat for juvenile and adult OC coho salmon, SONCC coho salmon, LCR Chinook salmon, LCR steelhead, UWR Chinook salmon, and UWR steelhead. However, the magnitude and implication of those effects are as set out above. There will not be any effects on rearing, migration, and spawning habitat for Columbia River chum salmon, Upper Columbia River spring-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Snake River fall-run Chinook salmon, Middle Columbia River steelhead, Upper Columbia River steelhead, Snake River sockeye salmon, and green sturgeon because the effects on water quantity will not occur in the Columbia River mainstem where these species are present.

Eulachon Critical Habitat Biological Features.

Critical habitat for eulachon includes: (1) Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles; (2) freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted; and, (3) nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. The Oregon Coast (Umpqua River and Tenmile Creek) and Lower Columbia River tributaries would likely be subject to actions under this opinion.

The essential features for eulachon critical habitat are as follows:

1. Freshwater spawning sites and incubation
    a. Similar to salmonid critical habitat listed above, although since eulachon are located in close proximity within tidal reaches of the estuaries, the effects are greatly reduced and will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    b. *Water quality* – Similar to Salmonid critical habitat listed above. Water quality will be degraded from increases in methylmercury from mining, and PCBs and PAHs from stormwater inputs. The effects of these contaminates are greatest near the urban areas for stormwater and mining locations for methylmercury. The effects of chemical contaminants once reaching the eulachon habitat are very minor will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    c. *Substrate* – Eulachon eggs found in areas of silt or organic debris suffer higher mortality than those found in sand or gravel (76 FR 65325). Sedimentation and substrate embeddedness from road work and suction dredging will temporarily reduce the quality of substrate for spawning and incubation, similar to salmonid habitat detailed above. Areas immediately below the action will have the greatest amount of deposition and substrate embeddedness because decreasing

sedimentation rates are typically associated with increased downstream distance. Again, we expect a very minor effect because of the action location and the distance to eulachon habitats and we do not expect those effects to preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

d. *Water temperature*. Minor adverse effect for localized temperature increases from new road construction, cattle grazing, and fire and fuels. Even though thermal loading occurs due to these program activities, the proposed riparian management strategy is expected to protect stream shade, wood recruitment, and channel processes in the sub-watersheds and ensure cold water inputs and temperature recovery from hyporheic flows will result in maintaining stream temperatures. Thus, we do not expect the proposed action will preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

2. <u>Freshwater and estuarine migration corridors</u>
    a. *Free passage* – Delays in adult upstream passage from suspended sediment are unlikely to occur because adults are highly mobile with the ability to avoid these localized and temporary effects. Similarly, out-migrating juveniles are also likely to avoid localized and temporary water quality degradation events with only a slight delay in migration due to their mobility. Thus, we do not expect the proposed action will preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    b. *Flow* –similar to salmonid habitat as noted above. The effect of flow decrease at the 5th field HUC is immeasurable to eulachon critical because of the proximity of harvest locations to eulachon critical habitat, and we do not expect they will preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    c. *Water quality* – Water quality will be temporarily and locally degraded by increases in suspended sediment from road work and suction dredging in freshwater tributaries. Water quality will be degraded from increases in methylmercury from mining, and heavy metals and PAHs from stormwater inputs in freshwater and estuarine migration corridors. These effects are small because of distance of the action to eulachon critical habitat and we do not expect they will preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    d. *Temperature*– Minor adverse effect for localized temperature increases from new road construction, cattle grazing, and fire and fuels will occur in freshwater tributaries. The addition of stream confluences through the lower stream reaches will mask the localized temperature increase thus causing temperature to be unmeasurable at the eulachon habitat. Additionally, the proposed subwatershed classification will provide 120’ buffers on all perennial and fish bearing reaches to maintain and cool water temperature. Thus, we do not expect the proposed action will preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    e. *Food* – Increases in methylmercury from mining, and PCBs and PAHs from stormwater inputs can negatively affect food webs. The quality of forage and food

will decrease due to the potential for bioaccumulation (Neff 1985). These effects are localized near road runoff near paved roads and urban areas. Methylmercury is limited to the BLM Medford District where mining occurs, and is not expected to be measurable once it reaches the estuaries. The effects are minimal to critical habitat within the estuaries in the action area. Thus, we do not expect the proposed action will preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

Adverse effects described above will only affect the critical habitat in the Umpqua and Tenmile Creek subpopulation along coastal Oregon. These effects will not occur in the Columbia River population.

Effects of the action on Green Sturgeon Critical Habitat.

Designated critical habitat within the action area for green sturgeon includes: (1) Freshwater riverine systems with food resources, migration corridors, sediment quality, substrate type and size, water depth, water flow, and water quality supporting rearing, migration, and spawning, and (2) estuarine areas with food resources, migratory corridors, sediment quality, water flow, water depth and water quality supporting rearing, migration, and spawning.

The essential features for green sturgeon critical habitat are as follows:

1. **Freshwater riverine system.**
    a. *Food Resources*-Increases in methylmercury from mining and PCBs and PAHs from stormwater inputs have the potential to negatively affect food webs. The quality of food will decrease due to the potential for methylmercury, PCB, and PAH bioaccumulation. The effects are of these chemical contaminants are expected to be very minor once they reach the estuary due to the low concentrations of these chemicals once they reach the estuary; thus, they will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    b. *Migration corridor*-No effect.
    c. *Sediment Quality*- It is unlikely that effects from suspended sediment will occur in the mainstem Columbia River and coastal estuaries for the reasons outlined above, therefore suspended sediment, sedimentation, and substrate embeddedness are not expected to preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish. *Substrate type and size*- It is unlikely that effects from suspended sediment will occur in the mainstem Columbia River and coastal estuaries for the reasons outlined above, therefore suspended sediment, sedimentation, and substrate embeddedness are unlikely to adversely affect critical habitat for green sturgeon.
    d. *Water depth*-No effect.
    e. *Water flow*-No effect.
    f. *Water quality*-No effect.

2. **<u>Estuarine areas</u>.**
    a. *Food resources*- It is unlikely that forage will be measurably affected by methylmercury in the estuaries. Increases in PCBs and PAHs from stormwater inputs have the potential to negatively affect food webs. The quality of food will decrease due to the potential for PCB and PAH bioaccumulation. However, those effects are not expected to preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish because repeated exposure is needed, and the extremely low concentrations of the contaminants in the estuary.
    b. *Migratory corridor*-No effect.
    c. *Sediment quality*-It is unlikely that effects from suspended sediment will occur near the estuaries for the reasons outlined in the Environmental Effects section, therefore suspended sediment, sedimentation, and substrate embeddedness are not expected to preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.
    d. *Water flow*-No effect.
    e. *Water depth*-No effect.
    f. *Water quality*-No effect.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within the action area was described in the Status of the Species and Environmental Baseline sections, and are expected to continue into the future. Some adjacent lands are in private timber production. Private forest management can produce adverse effects to listed fish, including increased suspended sediment, increased stream temperature, reduced woody inputs, and increased road density. Chemical fertilizers or pesticides likely are used on these lands, but no specific information is available regarding their use. On some streams, forestry operations conducted in compliance with the Oregon Forest Practices Act are likely to reduce stream shade, slow the recruitment of large woody debris, and add fine sediments. Since cumulative watershed effects are not limited by the Act, road density on private forest lands, which is high throughout the range of ESA-listed species considered in this opinion, is likely to increase or stay the same (71 FR 834).

Mining has historically been a major component of western state economies. With national output for metals projected to increase by 4.3% annually, output of western mines is expected increase markedly (Figueroa and Woods 2007). Increases in mining not associated with a Federal action will add to existing significant levels of mining contaminants entering rivers. Given this trend, we expect existing water degradation in Oregon streams that feed into or provide spawning habitat for threatened and endangered species to be exacerbated.

Historically, resource-based industries caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as state-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. The economic and environmental significance of Oregon's natural resource-based economy is declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology (Brown 2011). Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the action area for the indefinite future. The activity level of some industries, such as forest products, may increase in intensity as the nation's economy improves and export opportunities increase, raising the value of extracted materials.

While natural resource extraction within Oregon may be declining, general resource demands (*e.g.*, demands due to urban and suburban development, recreational activities, road construction and maintenance, shipping, and water withdrawals) are increasing with growth in the size and standard of living of the local and regional human populations. As of 2010, Oregon has a population of approximately 3.8 million residents. During the most recent 50-year period (1960-2010), decadal growth averaged 16.9%, with a range of 7.9% (1980s) to 25.9% (1970s). During the latest census period (2000-2010), the population of Oregon grew 12% (Mackun *et al*. 2011, PSU 2012).

Furthermore, future changes in condition of the environmental baseline associated with climate change are likely to negatively influence trends in habitat quality and exacerbate the impact of cumulative effects, deepening the threat to anadromous fish populations (Ward *et al*. 2015). Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline versus cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the Environmental Baseline section.

In general, we expect trends in habitat quality in the action area to generally remain flat with gradual declines or improvements in some areas depending on spatial scale (*e.g.*, site, reach, watershed, basin), level of development (*i.e.*, forest, rural, suburban, urban), and variation in levels of economic activity in different geographic regions (*e.g.*, valley, coastal). At best, these trends will increase population abundance and productivity for the species affected by this consultation. However, given the degraded state of the environmental baseline and the small population levels of the listed species, listed species exposed to additional negative effects in the action area are likely to be sensitive to those changes and exhibit a disproportionate adverse response, particularly those populations at an elevated risk of extinction (*i.e.*, high or very high extinction risk). Therefore, in most instances, we expect cumulative effects will have a minor, negative effect on population abundance trends. Similarly, we expect the quality and function of critical habitat PBFs generally to express a minor negative trend over time as a result of the cumulative effects, with the possibility of a gradual positive or negative trend depending on the balance between economic activity and habitat protection and restoration.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).

This Proposed Resource Management Plan/Final Environmental Impact Statement addresses revision of the 1995 Resource Management Plans for the Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office. The purpose of this Resource Management Plan revision is to provide a sustained yield of timber, contribute to the conservation and recovery of threatened and endangered species, provide clean water in watersheds, restore fire-adapted ecosystems, provide recreation opportunities, and coordinate management of lands surrounding the Coquille Forest with the Coquille Tribe.

The Coquille Tribal Land consists of 5,000 acres of forest land located in the Middle Fork of the Coquille River, in the Oregon Coast Domain. Because this land is fully contained within the Coquille River basin, only green sturgeon, eulachon, and the Coquille population of the OC coho salmon ESU are exposed to the activities occurring within the Coquille Forest. The roads within the Coquille Forest are managed by Bureau of Indian Affairs and the Coquille Tribe, and their effects are materially similar to our analysis in the Forest Management Section 2.4.1 above. We assumed in general that the indirect effects of Coquille Tribal Land management are the same as the direct effects of the PRMP, albeit on a smaller scale. In particular, we expect the management direction of the subwatershed classification for riparian reserve protections to limit effects to the same degree as on BLM-administered land. No mining occurs on the Coquille Tribal Lands, and so there are no associated indirect effects. Stormwater from roads on Coquille Forest land will have similar effects on OC coho salmon, green sturgeon and eulachon as is described for stormwater from BLM roads. The indirect effects on OC coho salmon are expected to be similar to the direct effects that occur as a result of the PRMP (see discussion below), but on a scale commensurate with the size of the Tribal forest. Any activities proposed in the future from the Coquille Indian Tribe will be consulted under the authority of the Bureau of Indian Affairs under Section 7 of the ESA with NMFS.

These purposes require the BLM to exercise its discretion to determine how best to achieve sustained-yield timber production over the long term and avoid future limitations on timber production. The proposed action is to revise the 1995 RMPs with land use allocations, management objectives, and management direction that best meet the purpose and need. The planning area includes approximately 2.5 million acres of BLM-administered land in western Oregon managed by the BLM's Coos Bay, Eugene, Medford, Roseburg, and Salem Districts and the Lakeview District's Klamath Falls Field Office. While the planning area encompasses the 2.5 million acres of BLM administered lands these lands lie within western Oregon surrounded by over 22 million acres of non-BLM administered land comprised of state, private, and other Federal land, each managed for different goals. We also included our analysis of the indirect effects to listed species of the BLM Proposed RMP on the 5,000 acres of Tribal Lands of the Coquille Indian Tribe.

In this document we described the various BLM programs, the management direction, and the predicted landscape distribution and intensity of the program activities. Based on this information we assessed the likely effect of implementing the proposed RMPs on the environment, designated critical habitat, and combined the effects of all of the different program activities to describe the response of individuals of each species. In the preceding VSP analysis, we combined the proposed action's effects on ecological processes, habitat features, and individuals to assess how implementing this proposed action would affect the limiting factors for survival and recovery of each species within the action area. For brevity, we combined in the following discussion the ESA-listed anadromous fishes where they had similar geographic distribution, exposure, and responses to the effects of the action.

2.6.1 Anadromous Fishes

There are 15 anadromous fish species that are listed in the action area. Of these, 13 are listed under the ESA as threatened and two species are listed as endangered. Each of these 15 species occur in the non-marine portion (includes freshwater and estuaries) of the action area (Table 98). Comprising these species are 256 salmonid populations (Table 98), and an unknown number of green sturgeon populations and eulachon subpopulations[55] that all occur in the action area. Degraded floodplain connectivity and function, large wood complexity, and available winter habitat has been identified as factors for decline, and limiting recovery, for each of the salmonid species. Specific to the Columbia River estuary, the modification of the food web to one that is less productive is also identified as a limiting factor for Columbia River salmonid species. For coastal species, such as OC coho salmon and SONCC coho salmon, limiting factors are primarily related to juvenile summer and winter rearing habitat associated with the lack of complex instream habitat and water temperature. Degraded freshwater and estuarine habitat quality has been identified as a limiting factor for Southern green sturgeon, though not the principal factor. In addition, contaminants are identified as a potential threat to Southern green sturgeon. Increased water temperatures, insufficient flow, and water pollution are among the limiting factors identified for Southern eulachon. Available information indicate some increases in salmonid abundance in recent years, but population trends for many populations have not been discernible, and the extinction risk for most populations remains high to very high.

[55] Individual populations have not been well identified for Southern green sturgeon and Southern eulachon at this time.

Table 98. ESA salmonid species present in the action area by habitat use and the relevant limiting factors adversely affected by the proposed action by habitat category

	Populations (#)					Limiting Factors Adversely Affected		
		Action Area Use						
Species	Sp. Total	Spawning	FW Rearing	Migration	Nr-Shore Rearing	FW	Estuary	Nr-Shore
Willamette-Lower Columbia Domain								
LCR Chinook	32	12	32	32	32	X	X	
LCR coho	24	8	24	24	24	X	X	
LCR steelhead	23	6	23	23	23	X	X	
CR chum	17	8	17	17	17	X	X	
UWR steelhead	7	7	7	7	7	X	X	
UWR Chinook	4	4	4	4	4	X	X	
Interior Columbia Domain								
UCR sp Chinook	3	0	migration	3	3		X	
UCR steelhead	4	0	migration	4	4		X	
SR sp/su Chinook	28	6	6	28	28		X	
SR fall Chinook	1	1	1	1	1		X	
SR sockeye	1	0	migration	1	1		X	
SR steelhead	24	5	5	24	24		X	
MCR steelhead	19	11	19	19	19		X	
Oregon Coast Domain								
OC coho	56	56	56	56	56	X	X	
Southern Oregon & Northern California Coasts Domain								
SONCC coho	40	13	13	13	13	X	X	
Total	283	137	207	256	256			

The existing environmental baseline is degraded for all listed species and the quality of habitat in the non-marine portion of the action area has been substantially reduced by a wide-range of practices that convert forest and plains to agricultural fields, buildings, and impervious surfaces. This has caused many of the PBFs in designated critical habitats to fit under the category of not fully functioning. This applies to habitat indicators such as (and not limited to) stream temperature, large wood, sediment, off-channel habitat, floodplain connectivity, and pool frequency. The effect of this baseline condition of critical habitat (not fully functioning) is a general and systemic reduction in carrying capacity for each of the anadromous species considered in this opinion. Land conversion due to urban and agricultural development has greatly affected the quantity and quality of freshwater and estuarine habitat. Habitat conversion has occurred in all four recovery domains. In Oregon, conversion to developed land use continues to increase. Additional large scale actions include construction, maintenance, and use of transportation systems, that is, primarily highways and road ways. These contribute sediment and stormwater contaminants throughout the action area. Previously described urbanization and agricultural development of forest land also contributes to sedimentation and stormwater.

Although tree harvests from non-Federal land follow state forest practice rules they do not benefit from the protection of the ESA.

The environmental baseline also includes the anticipated impacts of all Federal actions in the action area that have undergone formal consultation. NMFS has conducted hundreds of formal consultations within the action area, all of which had some form of associated incidental take, and most of which had some element of habitat degradation, either temporary or permanent in nature. The impacts to the environmental baseline from previous Federal actions include a wide range of short and long-term effects that may be adverse or beneficial depending on the type of activities involved (*e.g.*, development, restoration). In many cases, adverse effects associated with these Federal actions have been minimized, but not wholly avoided. In some cases, Federal actions have included restoration of freshwater salmon habitat in tributaries and the estuary that are designed to mitigate for adverse effects. The future effects of implementing the BLM program activities are added to this baseline.

Interior Columbia

SR sockeye salmon, MCR steelhead, UCR steelhead, SRB steelhead, SR spring/summer Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon.

The majority of population for the UCR spring-run Chinook salmon and the SR spring/summer-run Chinook salmon are at high risk of extinction. The SRB fall-run Chinook has only one viable population remaining at moderate of extinction. The majority of MCR steelhead, UCR steelhead, and SRB steelhead are at a high rate of extinction. Many of the PBFs for designated critical habitat in the domain are considered not fully functioning.

The species of salmonids in the Interior Columbia Recovery Domain all show a predominately "stream-type" life history, and only utilize the action area for migration to the ocean both as smolts and returning adults. No spawning occurs for salmonids of the Interior Columbia Domain in the action area. Our analysis has shown that the only adverse effects reaching the lower Columbia River where these species are affected is stormwater (heavy metals and PAHs) from roads and methylmercury from mineral extraction.

The environmental baseline of the Lower Columbia River estuary is degraded by loss of floodplains, chemical contaminates, dredging and hydropower. Limiting factors for salmonid species of the Interior Columbia Recovery Domain include degraded estuarine and nearshore habitat. The proposed action will add to the chemical contaminants of the Columbia River Estuary; however, the addition of these chemicals will have a minor impact due to very low mining claims in the Willamette and stormwater concentrations being highest near urban cities located in the Willamette Basin.

The effects of the proposed action are be consistent with the recovery goals of salmonids of the Interior Columbia recovery Domain because spawning does not occur in the action area, rearing is very limited to juvenile migration in estuaries, and the exposure pathways are predominately limited to chemical contaminants and its indirect effects to prey. BLM management direction such as limiting road construction in the riparian reserves, and future travel management plan development will reduce stormwater exposure to the Columbia River estuary. Furthermore, we assume that repeated exposure is necessary to result in adverse effects in exposed individuals, and that repeat exposures sufficient to adversely affect individuals is limited to only a small portion of the population. Our analysis also showed similar results for designated critical habitat.

Therefore, the proposed action is not likely to appreciably reduce the survival or preclude the recovery of listed species in the Interior domain, and would, on balance, be consistent with the recovery goals of the species. The proposed action will also not appreciable diminish the value of the critical habitat for the conservation of the listed species in the Interior Recovery Domain.

LCR Chinook salmon, LCR coho salmon, LCR steelhead, and CR chum salmon

The majority of the populations for CR chum salmon are at high to very high risk, with very low abundance. LCR Chinook salmon are at a very high risk of extinction. LCR coho salmon are at a moderate rate of extinction. LCR steelhead are at a moderate risk of extinction with low abundances. Many of the PBFs for designated critical habitat in the domain are considered not fully functioning.

All populations of LCR Chinook salmon, LCR coho salmon, LCR steelhead, and CR chum salmon will be exposed to effects of the proposed action; however, the effects will vary across populations. Twelve of the populations of LCR Chinook salmon, eight populations of LCR coho salmon, and six populations of LCR steelhead will be exposed to increases in suspended sediment from road related activities and recreation; increased temperature, decreased in-stream wood recruitment, increased peak flow, and decreased base flow from timber harvest and road related activities.

There is only a small amount of BLM lands within their planning area located in the Lower Columbia River. These tributaries of the Lower Columbia River are affected by the proposed action that overlaps with spawning and rearing habitat of these species. In these freshwater areas where these species spawn and rear, all populations of LCR Chinook salmon, LCR coho salmon, and LCR steelhead will be exposed to sediments, heavy metals and PAHs from stormwater inputs, and exposed in the lower Columbia River estuary to methylmercury derived from Willamette basin mining. Chum salmon do not currently exist in these areas, although we have analyzed these tributaries for recovery when distribution once again occurs.

The environmental baseline in the action area is degraded by past practices including road construction, timber harvest adjacent to streams and lowland agriculture practices. Effects from forest management include increased suspended sediment, increased stream temperature, reduced woody inputs, and increased road density. Lowland agriculture has removed riparian vegetation, channelized the streams, and diked off the estuary.

Limiting factors for these species included degraded floodplain connectivity and function, degraded channel structure and complexity, degraded riparian areas and large wood recruitment, degraded stream substrate, degraded water quality from altered water temperature, and degraded stream flows. The proposed action has conservation measures designed to address limiting factors for stream complexity and water temperature; however, the proposed action would continue to worsen the baseline for suspended sediment and stormwater contaminants. The habitat changes from sediment and stormwater contaminants are only expected to affect a few individuals and thus will not affect the population level.

The proposed action is likely to cause a decrease in the rate of egg and fry survival, and injury in juveniles and adults as result of increased suspended sediment. However, the effects are not expected to cause a biologically meaningful effect at the species scale. This is because the effects will be spatially and temporally separated and will likely only affect a small number of fish at any one time because of the limited amount of BLM land and subsequent proposed action activity occurring within the watersheds inhabited by these ESUs. In addition, only small numbers of these fish are in the action area compared to the range of the species, and so the number of fish impacted will, by definition, be small. Sediment is not a limiting factor for these species. Therefore, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of LCR Chinook salmon, LCR coho salmon, LCR steelhead, and CR chum salmon. Additionally, adverse effects from the proposed action will cause a slight decline in the quality and function of spawning PBFs in the action area; however, at the designation level the effects to spawning PBFs are only small and the proposed action will maintain the ecological processes (large wood, cool water temperature, complexity, floodplain connectivity, etc.) for PBFs that are limiting factors for LCR Chinook salmon, LCR coho salmon, LCR steelhead, and CR chum salmon. The effects of the proposed action will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed fish.

UWR Chinook salmon and UWR steelhead

UWR Chinook salmon are at a moderate risk of extinction. UWR steelhead are at a moderate risk of extinction with low abundance. Designated habitat for these species are not fully functioning.

All populations of UWR Chinook salmon and UWR steelhead are exposed to the proposed action. These effects include increases in suspended sediment from road related activities and recreation; increased temperature, decreased in-stream wood recruitment, increased peak flow, and decreased base flow from timber harvest and road related activities; increases in heavy metals and PAHs from stormwater inputs; and increases in methylmercury from mining. The effects to PBFs within designated critical habitat include reduced spawning and substrate from sediment, increased temperature and chemical contaminants to water quality, increased peak flow and decreased flow effects to Water Quantity.

The environmental baseline in the action area is degraded by past practices including road construction and timber harvest adjacent to streams. Effects from forest management include increased suspended sediment, increased stream temperature, reduced woody inputs, and increased road density. Lowland agriculture has removed riparian vegetation, removed streamflow, and channelized the streams. Urbanization and highway construction has contributed to increased stormwater. Dams have created fish passage barriers and disrupted ecological process of the river. Many of the PBFs for designated critical habitat in the domain are considered not fully functioning.

Limiting factors for these species included degraded floodplain connectivity and function, degraded channel structure and complexity, degraded riparian areas and large wood recruitment, degraded stream substrate, degraded water quality from altered water temperature, and degraded stream flows. The proposed action has conservation measures designed to directly address sine of the limiting factors for stream complexity and water temperature; however, the proposed action would continue to worsen the baseline for suspended sediment and contaminants. The habitat changes from sediment and stormwater contaminants are only expected to affect a few individuals and thus will not affect the population level.

The proposed action is likely to cause a decrease in the rate of egg and fry survival, and injury in juveniles and adults as a result of increased suspended sediment. However, these effects are not expected to cause a biologically meaningful effect at the species scale. This is because the effects will be spatially and temporally separated and will likely only affect a small number of fish at any one time, and so the number of fish impacted will, by definition, be small. Therefore, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of UWR Chinook salmon and UWR steelhead.

Adverse effects to the quality and function of critical habitat PBFs influenced by this action will be moderate intensity due to moderate magnitude of suspended sediment and sediment deposition likely to occur, and small intensity of degraded water quality from stormwater and methylmercury inputs. The proposed action has conservation measures, that on balance, directly address the ecological processes (large wood, cool water temperature, complexity, floodplain connectivity, etc.) for PBFs that are limiting factors for listed fish. The effects of the proposed action will not preclude or significantly delay development of the critical habitat feature and its ability to conserve UWR Chinook salmon and UWR steelhead.

OC coho salmon

OC coho salmon are at a moderate risk of extinction. Many of the PBFs for designated critical habitat in the domain are considered not fully functioning. The majority of OC coho salmon populations are exposed to the proposed action, but that varies considerably depending on the overlap the location of the populations and the effects of the species. These effects of the action include increases in suspended sediment from road related activities, increases in heavy metals and PAHs from stormwater inputs, recreational uses, and increases in methylmercury from mining. PBFs affected by the action include water quantity, water quality, spawning and substrate, water temperature, and forage.

The environmental baseline in the action area is degraded by past practices including road construction and timber harvest adjacent to streams. Effects from forest management include increased suspended sediment, increased stream temperature, reduced woody inputs, and increased road density. Lowland agriculture has removed riparian vegetation, removed streamflow, diked, and channelized streams. Urbanization and highway construction has contributed to increased stormwater.

Limiting factors for these species included degraded floodplain connectivity and function, degraded channel structure and complexity, degraded riparian areas and large wood recruitment, degraded stream substrate, degraded water quality from altered water temperature, and degraded stream flows. The proposed action has conservation measures that designed to directly address limiting factors for stream complexity and water temperature; however, the proposed action would continue to worsen the baseline for suspended sediment and contaminants. The habitat changes from sediment and stormwater contaminants are only expected to affect a few individuals and thus will not affect the population level. The primary limiting factors for OC coho salmon are summer and winter rearing habitat and these are associated primarily with wood recruitment and water temperature.

The proposed action is likely to cause a decrease in the rate of egg and fry survival, and injury in juveniles and adults as a result of sedimentation, stormwater, temperature increases and reduction of large wood from new roads, limited mining. However, the effects are not expected to cause a biologically meaningful effect at the species scale. This is because the effects will be spatially and temporally separated and will likely only affect a small number of fish at any one time, and so the number of fish impacted will, by definition, be small. Therefore, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of OC coho salmon.

Adverse effects to the quality and function of critical habitat PBFs influenced by this action will be moderate intensity due to moderate magnitude of suspended sediment and sediment deposition likely to occur, and small intensity of degraded water quality from stormwater and methylmercury inputs. However, these effects are localized to the immediate action and therefore the proposed action will not preclude or significantly delay development of the critical habitat feature and its ability to conserve OC coho salmon. The proposed action will has conservation measures designed to directly address the ecological processes (large wood, cool water temperature, complexity, floodplain connectivity, etc.) for PBFs that are limiting factors for listed fish. The effects of the proposed action will not preclude or significantly delay development of the critical habitat feature and its ability to conserve OC coho salmon.

SONCC coho salmon

SONCC coho salmon are at a moderate risk of extinction. Many of the PBFs for designated critical habitat in the domain are considered not fully functioning. The majority of SONCC coho salmon populations are exposed to the proposed action, but that varies considerably depending on the amount of BLM administered land within the population's subwatersheds. The effects of the action include increases in suspended sediment from road related activities, increases in heavy metals and PAHs from stormwater inputs, and increases in methylmercury from mining. The environmental baseline in the action area is degraded by past practices including road construction and timber harvest adjacent to streams. Effects from past forest management include increased suspended sediment, increased stream temperature, reduced woody inputs, and increased road density. Urbanization and highway construction has contributed to increased stormwater.

Limiting factors for these species included degraded floodplain connectivity and function, degraded channel structure and complexity, degraded riparian areas and large wood recruitment, degraded stream substrate, degraded water quality from altered water temperature, and degraded stream flows. Several programs are concentrated within the SONCC coho salmon ESU and include grazing, suction dredge mining, and fire and fuels. All three of these programs add to the sedimentation issues and potential stream temperature factors. The proposed action has conservation measures designed to directly address limiting factors for stream complexity and water temperature; however, the proposed action would continue to worsen the baseline for suspended sediment and contaminants. The habitat changes from sediment and stormwater contaminants are only expected to affect a few individuals and thus will not affect the population level.

Although the proposed action is likely to cause a decrease in the rate of egg and fry survival, and injury in juveniles and adults, the effects are not expected to cause a biologically meaningful effect at the species population scale or their designated habitat. This is because the effects will be spatially and temporally separated and will likely only affect a small number of fish at any one time, and so the number of fish impacted will, by definition, be small. Therefore, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of SONCC coho salmon or their designated habitat.

Adverse effects to the quality and function of critical habitat PBFs influenced by this action will be moderate intensity due to moderate magnitude of suspended sediment and sediment deposition likely to occur, and small intensity of degraded water quality from stormwater and methylmercury inputs. These effects are localized to the immediate action and therefore the proposed action, on balance, is consistent with the recovery goals for the ESU for SONCC coho salmon critical habitat. The proposed action has conservation measures designed to directly address the ecological processes (large wood, cool water temperature, complexity, floodplain connectivity, etc.) for PBFs that are limiting factors for listed fish. The effects of the proposed action will not preclude or significantly delay development of the critical habitat feature and its ability to conserve SONCC coho salmon.

Green sturgeon

The Southern Green Sturgeon DPS is listed as “threatened” under the ESA. The species includes all naturally-spawning populations of green sturgeon that occur south of the Eel River in California, with the only known spawning population in the Sacramento River (71 FR 17757). A recovery plan has not been written at this time.

The effects of the proposed action are unlikely to appreciably reduce the viability of Southern green sturgeon, largely because the population is well distributed, spawning does not occur in the action area, the duration of their presence in estuaries within the action area varies, and is limited to rearing (sub-adults) and over-summering (sub-adults and adults), and the exposure pathways are predominately limited to chemical contaminants and its indirect effects to prey. These chemical contaminants both stormwater and methylmercury have the highest concentration near the urban areas and mining locations such that the concentration levels in the estuaries are extremely small. Furthermore, we assume exposure is limited to a portion of that population, that repeated exposure is necessary to result in adverse effects in exposed individuals, and that repeat exposures sufficient to adversely affect individuals is limited to only a small portion of the population. Therefore, the proposed action is not likely to appreciably reduce the survival and recovery of this species.

Adverse effects to the quality and function of critical habitat PBFs influenced by this action is limited to small intensity of degraded water quality from stormwater and methylmercury inputs described above, and the proposed action has conservation measures designed to directly address some of the ecological functions of PBFs of the coastal and Columbia River estuaries. The effects of the proposed action will not preclude or significantly delay development of the critical habitat feature and its ability to conserve green sturgeon.

Eulachon

This species is listed as "threatened" under the ESA. The species is comprised of a single population, the Columbia River population. In many Oregon coastal systems inadequate data exists to dismiss their presence. While Southern eulachon may occur in coastal Oregon estuaries, they have not been identified as part of a particular subpopulation. A recovery plan has not been completed for this species.

Less is known about southern DPS of eulachon although the distribution and biology of this species make it reasonable to assume that the effects of the proposed action on them are likely to be within range of effects on salmon and steelhead described above. Eulachon are broadly distributed in marine areas along the western coast of North America and only enter the action area in a relatively few subtidal and intertidal areas.

Eulachon are also limited to a relatively few subtidal and intertidal areas and the mainstem Columbia River below Bonneville Dam, but they return to those areas with a presumed fidelity that indicates close association between a particular stock and its spawning environment (Gustafson *et al.* 2012; Gustafson *et al.* 2010). Moreover, eulachon face numerous potential threats throughout every stage of their life cycle, although the severity of shoreline construction effects and water quality, the most significant effects described above, have been ranked as "very low" and "low," respectively (Gustafson *et al.* 2012; Gustafson *et al.* 2010).

The proposed action is likely to cause water quality degradation that will likely cause adverse effects to the species. However, the effects are not expected to cause a biologically meaningful effect at the species scale. This is because the effects will be spatially and temporally separated and will likely only affect a small number of fish at any one time, and so the number of fish impacted will, by definition, be small. Therefore, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery of eulachon.

Adverse effects to the quality and function of critical habitat PBFs influenced by this action will be mild intensity due to moderate magnitude of suspended sediment and sediment deposition likely to occur, and small intensity of degraded water quality from stormwater and methylmercury inputs. Critical habitat is limited to the Umpqua River, Tenmile Creek, and the Columbia River.

Based on our analysis, adverse effects from the proposed action will cause a slight decline in the quality and function of PBFs in the action area. However, the majority of critical habitat is located on the Columbia River Tributaries outside of the action area, and the proposed action has conservation measures designed to directly address the ecological functions of PBFs of the coastal and Columbia River estuaries. Therefore, effects of the proposed action will not appreciably diminish the value of the critical habitat for the conservation of the listed species.

NMFS must also consider anticipated habitat changes associated with climate change. The effects of climate change on habitat conditions is generally expected to be negative, but are not well predicted for any particular locale. The effects of the proposed action, with few localized exceptions, are likely to maintain and moderate anticipated habitat changes associated with climate change. Lawrence *et al*. (2014) predicted that changes in water temperature in streams lacking intact riparian vegetation may cause the near total loss of rearing habitat for stream-rearing juvenile salmonids and expand the distribution of warm-water predators (*i.e*., bass). Salmonid species that exhibit a stream-type life history are likely to be exposed to progressively greater stressors (*e.g.*, increased water temperatures, higher peak flows, lower summer flows, disease) resulting in greater dependence on early life history strategies (*i.e.*, fry, fingerling, and sub-yearling strategies). The proposed action's riparian management strategy was developed specifically to protect stream shade and maintain stream temperatures to counter anticipated climatic stressors.

Put briefly, our analysis indicated that the effects of the proposed action are negative for sedimentation and contaminants from stormwater and occur across the range of ESA-listed anadromous species in Oregon, and aggregate over time. Implementing the BLM's riparian strategy and the associated management direction will provide protection of ecological process dependent on wood recruitment. Protecting stream shade with riparian management strategies and minimizing loss of shade through actions, such as road construction, can protect water temperature. Stream complexity, largely associated with wood recruitment, and stream temperature, are the most limiting factors for most of these species. Some programs, such as the use of the road system, will result in long term disturbance of the aquatic system through sedimentation and stormwater contaminants. Despite some localized adverse effect, the effects of implementing the proposed action across the action area has conservation measures designed to directly address some of the limiting factors associated with all of the 17 listed species occurring in the action area. Therefore, the effects of the proposed action are not likely to appreciably delay or prevent the recovery or survival of the 17 anadromous species occurring in the action area.

Critical habitat has been designated in the action area for all 17 anadromous species. The specific PBFs that occur in the action vary depending on the species, but there is considerable overlap. The quality and function of critical habitat varies within ownership with most remaining high quality habitat located on Federal lands, where this proposed action occurs. Private forest and agriculture lands have been determined through our recovery plans as providing inadequate protection of ecological features to preserve the PBFs for limiting factors.

As appropriate for the life stages that occur in the action area, the PBFs focus on suitable freshwater spawning, freshwater rearing, and freshwater migration, estuarine areas, and to a lesser extent nearshore marine areas. The proposed action would occur in many watersheds in western Oregon, many of which are occupied by anadromous fish and have been identified by NMFS as having a high conservation value. Based on our analysis, adverse effects from the proposed action will occur, but the action will not preclude or significantly delay development of the relevant quality, quantity, and function of PBFs that affect the overall conservation values at the designation scale for affected critical habitats of all salmonid species, eulachon, and green sturgeon. Therefore, the effects of the action will not preclude or significantly delay development of the critical habitat feature and its ability to conserve listed species.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of SR sockeye salmon, MCR steelhead, UCR steelhead, SRB steelhead, LCR coho salmon, LCR Chinook salmon, LCR steelhead, CR chum salmon, UCR spring-run Chinook salmon, SR fall-run Chinook salmon, SR spring/summer Chinook salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, green sturgeon, or eulachon, or destroy or adversely modify critical habitat that we have designated for these species.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). “Incidental take” is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

This consultation analyzes a mixed programmatic action and the incidental take statement addresses program actions that are reasonably certain to cause take and are not subject to further section 7 consultation (50 CFR 402.14(i)(6)). The programs in this latter category are related to the use of the transportation system (see Section 1.3.9.15) and some recreation activities (see Section 1.3.11). Public and administrative use of the existing roads and trails will not require subsequent section 7 consultation, yet the use of these roads and trails by the public and for administrative use is reasonably certain to cause take and will occur without further consultation. In a similar fashion, use of existing recreational facilities on BLM administered lands, including access to the lands and the waterways, will occur without future consultation and, in particular, use of existing recreational facilities located within one site potential tree height (216 feet) of occupied habitat or critical habitat (Table 38) is reasonably certain to result in take.

2.8.1 Amount or Extent of Take

In the biological opinion, NMFS determined that the proposed action was reasonably certain to result in several take pathways among 17 ESA-listed species from these identified programs (see Section 2.4) and this take would be in the form of harassment and harm. This incidental take statement is specific to these previously identified programs that do not receive subsequent section 7 consultation (see Proposed Action Section 1.3.9) where our analysis (see Section 2.4) described the mechanisms for take, in the form of harm, associated with road and trail use from administrative use and the public, as well as harm and harassment related to recreational users The identified causal mechanisms for take from use of roads and trails are increased sediment and stormwater contaminants entering streams. People entering the water (by boat or otherwise) while recreating may lead to harassment and harm, represented by the non-habitat (harassment category) in Section 2.4.7, with people entering waterways and physically harming individuals such as trampling eggs in redds or harassing individuals resulting in behavioral modifications resulting in delayed spawning or abandonment of preferred habitat.

We determined that incidental take would include harm due to stormwater contaminants derived from the public and administrative use of roads and result in take of all life stages of the ESA-listed fish species within the action area, which include SR sockeye, SR fall-run Chinook salmon, SR spring/summer Chinook salmon, SRB steelhead, MCR steelhead, UCR steelhead, UCR spring-run Chinook salmon, UWR Chinook salmon, OC coho salmon, SONCC coho salmon, UWR steelhead. LCR Chinook salmon, LCR coho salmon, LCR steelhead, LCR coho salmon, green sturgeon, and eulachon. Stormwater pollutants are a well-known source of potent adverse effects to salmon and steelhead, and we concluded they will have similar effects on eulachon and green sturgeon. These pollutants may also accumulate in the prey and tissues of fish. Depending on the type of contaminant, exposure process, and level of exposure, these contaminants cause a variety of lethal and sublethal effects including disrupted behavior, reduced olfactory function, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities.

Sedimentation from the use of trails and roads enters the stream system and adversely affects those species inhabiting streams in close proximity to the source. Harm from sediments include the more sensitive young life stages of rearing and outmigrating juvenile, eggs, embryos, and emerging fry, and include the following species that are proximal to the sediment sources: UWR Chinook salmon, OC coho salmon, SONCC coho salmon, UWR steelhead. LCR Chinook salmon, LCR coho salmon, LCR steelhead, LCR coho salmon, and eulachon. Sediments generated by the use of roads and trails and enter the streams have lethal and sub-lethal effects, including direct physical harm to species, as well as indirect effects due to changes in the prey base, feeding behavior, embeddedness of the substrate, and reduction of oxygen transfer in redds.

Additional take pathways associated with the PRMP include harassment or harm from recreational activities such as wading, swimming, and boating (Section 2.4.7). Disturbance related to these activities is reasonably certain to result in harassment or harm of juvenile and adult UWR Chinook salmon, OC coho salmon, SONCC coho salmon, UWR steelhead. LCR Chinook salmon, LCR coho salmon, LCR steelhead, LCR coho salmon, and adult eulachon. In addition, eggs, embryos, and emerging fry may be trampled primarily by people swimming or wading.

Table 99. Take pathways for each species occurring in the action area of the proposed RMP as the result of the recreation and trails and travel management programs.

	Suspended Sediment	Substrate	Forage	Chemical Contaminants – Stormwater and methyl mercury	Non-Habitat (harassment)
LCR Chinook	X	X	X	X	X
LCR coho	X	X	X	X	X
LCR steelhead	X	X	X	X	X
CR chum	X	X	X	X	X
UWR steelhead	X	X	X	X	X
UWR Chinook	X	X	X	X	X
UCR sp Chinook				X	
UCR steelhead				X	
SR sp/su Chinook				X	
SR fall Chinook				X	
SR sockeye				X	
SR steelhead				X	
MCR steelhead				X	
OC coho	X	X	X	X	X
SONCC coho	X	X	X	X	X
So. Green Sturgeon			X	X	
So. Eulachon	X		X	X	

Table 100. Take category associated with use of the transportation system and certain recreational activities and facilities for each species occurring within the action area of the proposed RMP.

	Take Category									
	Harass	Har m	Pursue	Hunt	Shoo t	Wound	Kill	Trap	Capture	Collect
Salmon and Steelhead										
Willamette-Lower Columbia Domain										
LCR Chinook	X	X								
LCR coho	X	X								
LCR steelhead	X	X								
CR chum	X	X								
UWR steelhead	X	X								
UWR Chinook	X	X								
Interior Columbia Domain										
UCR sp Chinook		X								
UCR steelhead		X								
SR sp/su Chinook		X								
SR fall Chinook		X								
SR sockeye		X								
SR steelhead		X								
MCR steelhead		X								
Oregon Coast Domain										
OC coho	X	X								
Oregon & Northern California Coasts Domain										
SONCC coho	X	X								
Other Anadromous Fishes										
So. Green Sturgeon		X								
So. Eulachon		X								

Accurately quantifying the number of fish taken by these actions is not possible. Fish population sizes fluctuate annually and seasonally within a watershed, basin and species, depending on many complex environmental variables. Fish distribution within a watershed also varies in response to many other environmental variables. In addition, the challenges of accurately estimating fish numbers and determining exposure is beyond the scientific capabilities across this vast landscape. Even if such an effort were attempted, collecting or sampling fish populations at this scale would also add significant additional stress and risk of injury to these fish. Additionally, take caused by habitat-related pathways cannot be accurately predicted as a number of fish because the relationship between habitat conditions and the distribution and abundance of those individuals in the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the actions described for these proposed programs. Thus, the distribution and abundance of fish within the proposed RMP action area cannot be attributed entirely to habitat conditions, nor can we precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by actions that will be completed under the proposed programs. In such cases, we use a take surrogate or take indicator that rationally reflects the incidental take caused by the proposed action. For the best available indicators for the extent of incidental take caused by the proposed action, we have identified three indicators: (a) the number of identified recreational facilities within 216 feet of occupied habitat or critical habitat; (b) the number of BLM paved road miles within 200 feet of a stream; and (c) the total BLM road miles within 200 feet of a stream.

For this action, NMFS will use the following as surrogates for the amount of incidental take due to the action to be taken by BLM:

1. Recreational facilities within 216 feet of occupied habitat or designated critical habitat.
2. Miles of BLM paved roads occurring within 200 feet of streams.
3. Miles of BLM roads (all surface types) within 200 feet of streams.

As explained in more detail below, the calculations of these metrics are designed to reflect the existing sites and roads, because it is incidental take associated with the use of those sites and roads that is exempted by this Opinion.

Table 101. Extent of take indicators by species within the action area of the proposed RMP. Recreational facilities represent the number of BLM identified facilities within 216 feet of occupied habitat and critical habitat. "BLM paved roads" is a surrogate indicator for stormwater and represent the linear distance of BLM roads that lie within 200 feet of a stream. Similarly, "All BLM roads" include all surface types (paved, unknown, native, and aggregate) located within 200 feet of a stream and is a surrogate indicator for sediment. N/A where this pathway is not applicable. U/A is where the data is unavailable.

Species	Recreation facilities	BLM paved roads	All BLM roads
LCR Chinook	2	7	57
LCR coho	2	7	57
LCR steelhead	2	7	57
CR chum	2	3	45
UWR steelhead	5	22	450
UWR Chinook	7	43	527
UCR sp Chinook	N/A	49	584
UCR steelhead	N/A	49	584
SR sp/su Chinook	N/A	49	584
SR fall Chinook	N/A	49	584
SR sockeye	N/A	49	584
SR steelhead	N/A	49	584
MCR steelhead	N/A	49	584
OC coho	40	303	2635
SONCC coho	7	144	1844
Green Sturgeon	N/A	497	N/A
Eulachon	U/A	497	5063

These road-related surrogates are rationally related to the take pathways because the number of road miles proximate to streams is proportionally related to the amount of sediment (all BLM roads) and stormwater contaminants (paved roads) that enter the waterways and expose fish to detrimental environmental conditions. The number of recreational facilities within 216 feet correlates to the numbers of recreational users congregating near waterways which is in turn proportionally related to the likelihood of recreational water use causing take. We use 216 feet because that is the best available information to characterize and enumerate the number of recreational facilities in close proximity to occupied habitat. More specifically, sediment and stormwater from public and administrative use of these roads and trails are reasonably certain to cause harm of the ESA-listed species in the action area and the analysis in the Opinion identified road segments within 200 feet of a stream were the most likely delivery zones for sediment and stormwater. Stormwater from paved roads are likely the greatest contributors of stormwater run-off due to the higher traffic volume and efficacy of the surface to transmit water to the ditchlines and waterways. We consider the paved road miles that occur within 200 feet of a waterway as a reasonable indicator of incidental take caused to each of these ESA-listed species by introducing stormwater contaminants to water. Sedimentation caused by the public and administrative use of roads and trails is best represented by all of the road surface types; therefore we consider the total BLM road miles within 200 feet of streams to be a reasonable indicator of the magnitude and intensity of adverse effects of road and trail derived sediment. Green sturgeon and eulachon surrogates are conservative due to the poor distribution information available for these two species, which hampers refining the road sources. By accepting the total road miles as representative of the potential take sources NMFS is conservatively identifying the potential sources of stormwater for green sturgeon and eulachon. Road miles identified for sediment take pathways for eulachon represents all BLM road miles within 200 feet of a stream. Our third take pathway is represented by the number of recreational facilities occurring within 216 feet of a waterbody occupied by ESA-listed species or designated as critical habitat. BLM recreational facilities adjacent to waterways (216 feet) are most likely to attract and congregate users to a specific site where associated water use will occur – and the operation of these facilities by BLM represents the causal linked to this potential form of take to ESA-listed species. This harassment and harm identified here and exempted as take is incidental to BLM's operation of the identified recreation facilities and does not offer any take exemption to any individual knowingly harming and harassing ESA-listed species.

Given that the extent of take is represented by road miles and number of facilities, NMFS believes BLM can routinely quantify these surrogates within the action area for each species. Each of these values are dependent on the spatial database of their origin; therefore our surrogates are dependent on the accuracy and perpetuation of that database. Because such databases may contain errors, the road miles represented in Table 86 are considered representative of the known data as of the date of this biological opinion. Considering errors could occur within the database, NMFS is reluctant to rely solely on these specific numbers without some margin of error for a reinitiation trigger. We consider a 5% margin of error to be sufficiently small enough that future database reports resulting in equal to or less than a 5% increase over the values in Table 86 is within the margin of error, does not represent any effects that were not analyzed in the Opinion, and thus reinitiation is not required. Within one year of the effective date of the ROD, and every three years thereafter, the BLM will report to NMFS a calculation of the

1. Recreational facilities within 216 feet of occupied habitat or designated critical habitat.
2. Miles of BLM paved roads occurring within 200 feet of streams.
3. Miles of BLM roads (all surface types) within 200 feet of streams

Any road miles or recreational sites addressed in project-specific consultations subsequent to the issuance of the ROD or for which BLM makes a no-effect determination subsequent to the issuance of the ROD should be deducted from the totals because the incidental take exempted in this Opinion relates to use of existing roads and sites. New roads and sites are addressed at a framework programmatic level in this Opinion: specific actions will be subject to future ESA consultation obligations and any associated incidental take that is reasonably certain to occur will be exempted in those consultations; or, in the unique factual situations where BLM makes a no-effect determination,[56] BLM will have made a determination that there is no take.

[56] BLM anticipates that there may be some no effect situations, for example, where a dam interrupts the causal connection between a new road and ESA-listed fish habitat or within watersheds with no proposed or listed

If the resultant totals are greater than 5 % more than the values in Table 100 for any one species, then the extent of take is exceeded, which will trigger reinitiation of consultation.

Although the surrogates are somewhat coextensive with the proposed action, they nevertheless function as effective reinitiation triggers because they are based on the best information currently available (and assumed in our effects analysis), and there will be periodic checks on that information (1 year and then every 3 years), which will allow for any more refined information to be used and/or errors >5% to be realized, and applied to a consideration of whether reinitiation is warranted.

2.8.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. BLM shall implement measures through Management Direction and anticipated travel management plans to minimize take of listed species due to sediment and stormwater contaminants derived from the use of roads.
2. BLM shall implement measures to minimize take of listed species due to use of recreational facilities by implementing an educational program.
3. BLM shall monitor and report the measures implemented to minimize take for RPM #1 and #2.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the BLM or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The BLM or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

To implement RPM number 1:

- a) BLM will maintain a spatial database containing the following minimum information on their road system.
    - i. Road segments identified by surface type.

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threatened or endangered species or their proposed or designated critical habitat, such as portions of the Klamath Falls Field Office.

ii. Road classification (Collector, Local, and Resource), or some equivalent classification representing relative type, purpose, and traffic volume.
iii. A complimentary stream and watershed boundary spatial layer to facilitate water related analysis.

b) BLM will initiate travel management plans in areas with listed fish or designated critical habitat covered by this biological opinion within five years of the effective date of the ROD.
i. Travel management plans will fully implement Management Direction related to identifying resource conflicts and consider opportunities to reduce roads most likely to introduce sediment and stormwater to streams inhabited by ESA-listed species.
ii. BLM will use travel management plans and additional planning opportunities to identify and prioritize erosion and stormwater reduction measures associated with road use.
iii. BLM will incorporate into watershed restoration strategies the identification and prioritization of opportunities, measures, and methods to reduce road derived sediment and stormwater contaminants.

c) BLM will complete all travel management plans in areas with listed fish or designated critical habitat covered by this biological opinion within ten years of the effective date of the ROD.

d) The BLM will provide to NMFS within three years of the effective date of the ROD a report on progress of completion of travel management plans and a schedule for completion of travel management plans. The BLM will provide NMFS with additional reports on the progress and schedule for completion of travel management plans every three years until all travel management plans in areas with listed fish or designated critical habitat covered by this biological opinion are completed.

e) BLM will coordinate with NMFS on the data and roads assessment needs required for access and travel management plans to facilitate the effort to achieve term and condition 1.b.

To implement RPM number 2:

a) BLM will develop and expand existing public educational programs directed at minimizing harm and harassment of ESA-listed species at recreational facilities.
i. BLM will develop and acquire educational signs educating the public on the importance of not disturbing ESA-listed fish.
ii. BLM will prioritize the distribution of these signs to recreational facilities within 216 feet of waterbodies designated as critical habitat or inhabited by ESA-listed fish species. BLM will distribute these signs to other recreational facilities where they deem to have a high value opportunity for educating the public on the importance of not harming and harassing ESA-listed species.
iii. BLM will assess recreational user education information (for example recreational boating, camping, and hiking pamphlets) to determine the current level of information related to protecting ESA-listed fish species. When these products are revised, BLM will incorporate education information regarding the harming and harassment of ESA-listed fish species.

iv. BLM will follow management objectives and direction to mitigate (reduce) recreational impacts on natural resources (ESA-listed species). This includes using management direction that requires the use of recreational management tools where resource damage (harassment and harm of ESA species) is occurring.

b) BLM will partner with NMFS regarding these educational opportunities.

To implement RPM number 3:

a) BLM will notify NMFS of the spatial data layers developed for the access and travel management planning process in support of term and condition 1.b.

b) BLM will monitor the road system and track spatially where:

i. BLM removes a road segment within 200 feet of a stream.

ii. BLM implements a road related sediment reduction action.

iii. BLM implements a stormwater reduction action.

iv. BLM builds a new road within 200 feet of a stream.

c) BLM, by March 31st three years following the signature of the record of decision, will provide a report containing the following:

i. Progress towards collecting information to support the travel and access management plans.

ii. Examples of accomplishments fulfilling term and conditions 1 and 2.

iii. Travel and access management plan completion timelines, including ESA consultation timelines.

d) BLM will send any reports to:

National Marine Fisheries Service
Oregon Washington Coastal Area Office
Attn: WCR-2016-4089
1201 NE Lloyd Blvd., Ste. 1100
Portland, Oregon 97232-1274

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. Assist NMFS efforts to implement Recovery Plans for listed species within the Action Area
    a. Work with NMFS to coordinate species recovery actions within Western Oregon.
    b. Work with Watershed Councils to prioritize restoration actions that address limiting factors identified in recovery plans to enhance critical habitat for listed fish.
2. Work with other landowners to promote improved habitat conditions for listed species and their habitat.

a. Work with education programs within watershed councils.
b. Ongoing one-on-one discussions with contractors, operators, and neighboring property owners.
c. Work with other landowners to manage the road system in the action area to reduce road-related effects to listed fish species and their habitat.

2.10 Reinitiation of Consultation

This concludes formal consultation for Resource Management Plan for Western Oregon.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

Reinitiation of this consultation could be triggered by new information concerning climate change-caused water temperature increases in action area rivers and streams occupied by NMFS listed fish species. However, current global climate change models are not precise enough to know specifically when this will occur.

2.11 "Not Likely to Adversely Affect" Determinations

BLM did not make an ESA determination for Southern Killer Whales. We conclude that the proposed action may affect but is not likely to adversely affect southern resident killer whales, or their designated critical habitat. NMFS does not anticipate the proposed action will take Southern Resident killer whales.

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Our conclusions are based on the following considerations.

Southern Resident killer whales spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and typically move south into Puget Sound in early autumn (NMFS 2008b). Pods make frequent trips to the outer coast during this season. In the winter and early spring, Southern Resident killer whales move into the coastal waters along the outer coast from the Queen

Charlotte Islands south to central California, including coastal Oregon and off the Columbia River although they do not have critical habitat designated in Oregon (NMFS 2008b). No documented sightings exist of Southern Resident killer whales in coastal bays, and there is no documented pattern of predictable Southern Resident occurrence along the outer coast and any potential occurrence would be infrequent and transitory. Southern Residents primarily eat salmon and prefer Chinook salmon (Hanson *et al.* 2010; NMFS 2008b).

The proposed action may affect the quantity of their preferred prey, Chinook salmon, and the critical habitat PCE of "prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development." We anticipate that the effects to Chinook salmon in coastal waters are similar to OC and SONCC coho salmon. The effects to Chinook salmon as a result of the proposed action are the total of UWR Chinook salmon, LCR Chinook salmon, UCR spring-run Chinook salmon, SR fall-run Chinook, and SR spring-summer Chinook. These were described in the ESA portion of this Opinion and we rely on that information here. In sum, the reduction in Chinook as a result of the proposed action, when converted to adult equivalence is minor; it would therefore result in an insignificant reduction in adult equivalent prey resources for Southern Resident killer whales. In addition, given the spatial distribution of the prey base impact and of Southern Resident killer whales themselves, the likelihood that the minor reduction in prey would geographically overlap with individuals of these species is extremely unlikely.

Due to the very small reduction in the adult equivalent prey resources and the spatial distributions involved, we expect that any affect the proposed action may have on Southern Resident killer whales or their critical habitat will be insignificant and/or discountable. Therefore, NMFS finds that the proposed action may affect, but is not likely to adversely affect Southern Resident killer whales or their critical habitat.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the RRSNF and descriptions of EFH for Pacific coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and

Pacific coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The PFMC described and identified EFH for groundfish, coastal pelagic species, and Pacific coast salmon. The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of groundfish, coastal pelagic species, and Pacific Coast salmon.

3.2 Adverse Effects on Essential Fish Habitat

See Section 2.4 of the biological opinion for a description of the adverse effects on anadromous species habitat for Pacific salmon. The effects of the action, as proposed, on Pacific Coast Salmon are similar to those described above in the ESA portion of this document. The estuarine and marine habitats potentially occupied by marine groundfish, and coastal pelagic species are impacted primarily from chemical contaminants similar to ESA listed salmon and green sturgeon described in Section 2.4.

NMFS concludes that the proposed action will have adverse effects on EFH designated for Pacific Coast salmon in freshwater habitats where BLM program activities occur. Pacific salmon, groundfish, and coastal pelagic species will also be adversely affected in estuaries, including estuarine areas designated as HAPCs where minor increases in methylmercury concentrations and stormwater will occur.

Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document (Section 2.4), we conclude that the proposed action will have the following adverse effects on EFH designated Pacific Coast salmon, groundfish, and coastal pelagic species, including spawning habitat designated as habitat areas of particular concern (HAPCs).

1. Freshwater EFH quantity and quality, including salmon spawning habitat HAPC, will be temporarily reduced by substrate disturbance and sedimentation/substrate embeddedness at the localized project area within the BLM PRMP.
2. Freshwater EFH quality will be reduced due to a short-term increase in turbidity, dissolved oxygen demand, and temperature due to riparian and channel disturbance.
3. Freshwater EFH quality will be reduced due to long-term impacts associated with new road construction in riparian reserves that increase temperature and reduce large wood potential.
4. Forage will have a short-term decrease in availability due to riparian and channel disturbance, sediment inputs, and chemical contaminants.
5. Freshwater, estuarine and nearshore EFH quality will experience a longer-term degradation due to continued stormwater discharge that contains PAHs, dissolved and suspended metals, and other persistent contaminants of concern that will be absorbed or ingested by salmon, sometimes in prey that will increase the concentration of contaminants through a process of bioaccumulation.

6. Estuarine EFH quality, including the estuarine area HAPC and forage quality, will be degraded by minor increases in methylmercury increases in large estuaries. Greater effects are possible for EFH for groundfish and coastal pelagic species due to exposure occurring in spawning and rearing habitats. Greater effects are also possible for EFH for Chinook salmon, groundfish, and coastal pelagic species due to longer exposure.

3.3 Essential Fish Habitat Conservation Recommendations

The BLM should minimize adverse effects on freshwater EFH quantity and quality, including spawning habitat HAPC, and on estuarine EFH quality, including the estuarine area HAPC, by:

1. The BLM shall follow Terms and Conditions #1 and # 2 above (Section 2.8.4) in the ESA portion of this document to offset adverse effects to EFH from use of roads and recreational facilities.
2. The BLM shall follow Term and Condition #3 to monitor and report the measures implemented in item "1" above.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the BLM must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The BLM must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. Other interested users could include the Coquille Indian Tribe, State of Oregon, Oregon Counties Association, citizens of affected areas, others interested in the conservation of the affected species, state and parties interested in commercial and recreational fishing. Individual copies of this opinion were provided to the BLM. The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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