https://doi.org/10.25923/60yd-0k76

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 97232-1274

Refer to NMFS No:
WCRO-2019-04010

September 3, 2020

Robert Sanchez
Forest Supervisor, Siuslaw National Forest
3200 Southwest Jefferson Way
Corvallis, Oregon 97331

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Siuslaw National Forest Vegetation and Aquatic Restoration Program (USFS File Code: 2600)

Dear Mr. Sanchez:

Thank you for your letter of September 21, 2019, 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 Siuslaw Vegetation and Aquatic Restoration Programmatic. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016). In this opinion, we determined that the proposed action is not likely to jeopardize the continued existence of Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*) or Upper Willamette River steelhead (*Oncorhynchus mykiss*) or destroy or adversely modify their designated critical habitat. We also issue this conference report that the proposed action is not likely to adversely affect proposed critical habitat for the Distinct Population Segment (DPS) of the Southern Resident killer whale (*Orcinus orca)*.

As required by section 7 of the ESA, we are providing an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this program. The ITS also sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal action agencies 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 the listed species considered in this opinion.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action. We concluded that the action would adversely affect the EFH of Pacific Coast salmon. Therefore, we have included the results of that review in Section 3 of this document, including conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH.

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 action agency must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the program and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, we 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 Jeff Young, fish biologist in the Oregon Coast Branch of the Oregon Washington Coastal Office at 541.957.3389 or jeff.young@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Brandy Langum, Siuslaw National Forest

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Conference Report, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Siuslaw National Forest Vegetation and Aquatic Restoration Program
(USFS File Code: 2600)

NMFS Consultation Number: WCRO-2019-04010

Action Agency: U.S. Forest Service, Siuslaw National Forest

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Oregon Coast coho salmon (*Oncorhynchus kisutch*)	Threatened	Yes	No	Yes	No
Upper Willamette River Steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
Southern Resident killer whales (*Orcinus orca*)	Endangered	No	No	No	No

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: September 3, 2020

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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 (ITS) 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, as amended.

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 (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome].

1.2 Consultation History

On January 25, 2019, we met with the U.S. Forest Service (USFS), Siuslaw National Forest (SNF) to discuss the SNF's proposal for a programmatic consultation for their vegetation and aquatic restoration program. Since then, we have met with the SNF ten times, and attended one field visit to discuss SNF's program and proposed action. On September 21, 2019, we received a request for ESA section 7 consultation from the SNF along with a final biological assessment (BA). The SNF determined that the proposed action may affect and is likely to adversely affect Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*) and Upper Willamette River (UWR) steelhead (*Oncorhynchus mykiss*) and their designated critical habitat. Between September 21, 2019 and May 20, 2020, we worked with the SNF in meetings and phone conferences to obtain information needed to clarify the proposed action and for analysis in the opinion. Consultation was initiated on May 20, 2020 after the final clarification for the proposed action was received. This opinion is based on the above-mentioned meetings and field visit, the BA, and additional information.

In September 2019, we proposed to modify the critical habitat designation for Southern Resident killer whales (*Orcinus orca*) to expand the geographic area of the designation for prey species (Chinook,) of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth. The SNF requested conferencing on the proposed critical habitat for Southern Resident killer whales on November 14, 2019, and for the species on September 1, 2020.

We listed OC coho salmon as threatened on June 6, 2011 (76 FR 35755) and designated critical habitat and issued protective regulations on February 11, 2008 (73 FR 7816). UWR steelhead were listed as threatened on January 5, 2006 (71 FR 834) with critical habitat designated on September 2, 2005. We listed Southern Resident killer whales as endangered on November 18, 2005, and designated critical habitat on November 29, 2006. On September 19, 2019, we issued a proposed rule to revise Southern Resident killer whale designated critical habitat to include six new areas off the West Coast including the Oregon coast.

1.3 Proposed Federal 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). For EFH, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910). We considered whether the proposed action would cause any other activities that required analysis in this opinion. To determine an activity is a result of the proposed action, we must determine that the activity would not occur but for the proposed action and that, it would be reasonably certain to occur. After pre-consultation with the SNF and after reviewing the BA, we did not identify additional activities caused by the proposed action.

The proposed action includes activities that directly and/or indirectly contribute to the achievement of restoration goals. These include tree felling, snag creation, tree tipping, fell and leave, tree yarding, tree removal, fuels treatments, site preparation for tree regeneration, tree planting, tree culturing (brush release, animal damage control, pruning, etc.), invasive species control, large wood placement, aquatic passage restoration, large- and small-scale aquatic restoration projects, heavy equipment operation, quarry operations, road construction and reconstruction, road decommissioning, road closure, road maintenance, and road use.

The primary guidance documents for planning activities on the SNF are the Land Resource and Management Plan (LRMP) for the Siuslaw National Forest (USDA 1990) and the Northwest Forest Plan amendment (NWFP) (USDA - USDI 1994). It is important to note that when the LRMP was written, clearcutting was the most common silvicultural practice on the SNF. This changed with the implementation of the NWFP and subsequent analyses. The current silvicultural practice across the SNF is the thinning of existing plantations with the intent to expedite the movement to a later seral stage.

The SNF management focuses on management for and restoration of late–successional forests and riparian habitats that would contribute to the recovery of both federally-listed species and the habitat and ecological processes they represent. In response to the need identified in the NWFP analysis area for older, late-successional forests, the SNF vegetation restoration program manages the plantations previously established after clearcuts to accelerate the development of characteristics found in older forests. This includes greater tree and understory plant diversity, greater number of larger trees (above 30 inches in diameter), a greater diversity in the age of trees, more complex canopy structures, and greater number and size of decadence components (standing and downed dead and dying trees) while trying to create natural landscape patterns. Under the proposed action, the SNF will only conduct any commercial thinning activities in existing plantations. There is no clearcutting or regeneration harvest. Openings in the forest up to

5 acres may occur and are limited within the plantations. These openings are for wildlife management or to increase the stand diversity within the plantations. In the riparian zones, openings will not be more than ¼ of an acre.

The SNF estimated the amount of vegetation and aquatic restoration and related activities that are likely to be implemented on the SNF annually for the foreseeable future (up to the next 30 years) (Table 1) that would be completed, monitored, and reported.

Table 1. Annual estimate vegetation restoration and related actions pertinent to effects analysis that are likely to be implemented under this programmatic in the foreseeable future. These estimates represent estimated actual treatments and a range of actual treatments, which are on average about 70% of what is planned in the National Environmental Policy Act (NEPA) documents on the SNF.

Treatment Type	Estimated Annual	Range of Treatment
Vegetation restoration – upland thinning	3,000 acres	1,500 – 10,000 acres
Vegetation/aquatic restoration - riparian reserve thinning (tree felling, tipping, snag creation, fell and leave)	1,500 acres	1,000-3,000 acres
Tree planting, culturing, invasive plant removal	500 acres	400-2,000 acres
Road construction and reconstruction	50 miles	20-100 miles
Road Maintenance	200 miles	50-400 miles
Road Decommissioning and closure	80 miles	30-200 miles
Wet season haul	300 miles	100-500 miles
Fuels Treatments	300 acres	50-1,000 acres
In-stream Large Wood Implementation	15 miles	5-50 miles
Aquatic Passage Restoration	3 per year	1-8 per year

The SNF proposed vegetation and aquatic restoration within the riparian reserves to improve degraded conditions, for which they provide site specific project design criteria (PDCs) and best management practices (BMPs). Riparian reserve widths are delineated by the NWFP and are shown in Table 2 below. Some of the SNF restoration work occurs within the delineated riparian reserves of plantations and even-aged single story stands to increase diversity and promote complex stand structure. The goal of the SNF with this consultation effort is to develop a method to ensure proposed treatments achieve SNF restoration goals, while contributing to the goals set forth by NMFS for the recovery of OC coho salmon and UWR steelhead.

Table 2. Riparian reserve widths as defined by the NWFP amendment. SPTH = site potential tree height, which in the SNF is 190 to 200 feet. The SNF applied the larger distance to the riparian reserve width.

Stream Class	Definition	Riparian Reserve Width
Class 1	A waterbody containing species listed under the Endangered Species Act (ESA), or municipal water source	2 SPTH (400 feet)
Class 2 and ponds	Fish-bearing streams	2 SPTH (400 feet)
Class 3	Non-fish-bearing streams that flow perennially	1 SPTH (200 feet)

Stream Class	Definition	Riparian Reserve Width
Class 4	Non-fish-bearing streams that flow intermittently	1 SPTH (200 feet)

The SNF defined inner and outer zones within the riparian restoration zones as shown in Table 3. Within the inner and outer riparian restoration zones on all stream classes, only restoration activities, regardless of their primary focus that contribute or are neutral towards aquatic restoration may be completed. Within the inner riparian restoration zone, on all stream classes, only aquatic restoration may be completed and no tree removal will occur for commercial purposes.

Table 3. Riparian restoration zones by stream class within riparian reserves. Site Potential Tree Height (SPTH) = 200 feet.

Stream Class/Definition	Riparian Restoration Zones		
	Outer Zone	Inner Zone	No Equipment Zone
Class 1 - A waterbody containing species listed under the Endangered Species Act (ESA), or municipal water source	100 feet – two SPTH vegetation and aquatic restoration activities	0-100 feet aquatic restoration only	50 feet
Class 2 – Fish-bearing streams and ponds	75 feet – two SPTH vegetation and	0-75 feet Aquatic restoration	50 feet
Class 3 - Non-fish-bearing streams and ponds that flow perennially	30 – one SPTH Vegetation and aquatic restoration	0-30 feet Aquatic restoration only	30 feet
Class 4 - Non-fish-bearing streams and ponds that flow intermittently	15 – one SPTH Vegetation and aquatic restoration	0-15 feet Aquatic restoration only	15 feet

Given limitation of the cable yarding systems and the steep side slopes along stream channels on the SNF the actual buffer widths are often determined by the terrain and are typically 150 to 200 feet from the stream channel on each side. The pursuit of narrow minimum buffer widths are, in part, in response to the SNF watershed analysis's recommendation to manage young vegetation to produce large trees to increase the potential supply of LWD. The SNF identifies and prioritizes protection or enhancement of salmonid fisheries and aquatic species habitat as a critical issue in all watershed analyses, highlighting the substantial reduction in large trees in riparian areas due to past logging and settlement activities. Recovery of large diameter trees is retarded because most riparian stands in the early seral stage are either densely stocked Douglas fir (*Psuedotsuga menziesii*) plantations or alder and brush patches. Management emphasizes maintaining and enhancing dispersal habitat with the long-term goal of creating large blocks of late-successional forest. Treatment areas are densely stocked, not complex or diverse stands that would only achieve late-successional conditions on their own over a long period due to stocking levels. Desirable components of riparian forests, such as large-limbed, open-grown trees, may not develop because of stocking levels. The dominant species is Douglas fir. There is a need in those stands dominated by Douglas fir to develop a more natural mix of hemlock (*Tsuga heterophylla*), spruce (*Picea spp.*), cedar (*Cedrus spp.*), and alder (*Alnus rubra*) as appropriate. In planning riparian activities, the SNF will use Standards and Guidelines from the SNF LRMP (USDA 1990), the NWFP (USDA and USDI 1994) and BMPs from USDA 2012. The Standards and Guidelines provide guidance during the project planning process.

1.3.1 Project Design Criteria

Projects must be consistent with the Standards and Guidelines found in the SNF LRMP (USDA 1990), the NWFP (USDA - USDI 1994), and the National Best Management Practices for Water Quality Management on National Forest System Lands (USDA 2012) for the protection of water quality. In addition, PDCs have been developed and will be implemented for the activities associated with the proposed action. The goal is to ensure mid- and long-term impacts are beneficial, despite possible short-term measurable effects. The PDCs include design measures necessary to minimize impacts to OC coho salmon and UWR steelhead and listed fish habitat (LFH) for the proposed actions.

1.3.1.1 Review, Verification, and Reporting Process

This proposed action includes a process designed to ensure that only activities that properly fall within the proposed action are treated as such and to provide a mechanism by which the agencies can track the number and nature of projects proceeding under this programmatic consultation. In sum, the review and verification process involves early notification to allow involvement by the NMFS during the project's NEPA stage. The SNF makes a determination as to whether each project meets the criteria of this opinion and request NMFS verifies that determination. This review and verification process is not an ESA consultation and does not involve either agency making a likely to adversely affect/not likely to adversely affect determination or jeopardy/no jeopardy decisions about a project; rather, it provides a protocol by which SNF decides whether it is appropriate to consider projects as being consistent with the proposed action and covered by this ESA programmatic consultation.

1. ***Initial Rollout***. The SNF will collaborate with NMFS to provide an initial rollout of this opinion for SNF staff and leadership. This will ensure the specifics of this proposed action are considered at the planning of each project, the decision-making process, and incorporated into each phase of implementation.
2. ***Initial project notification***. SNF will notify NMFS of upcoming projects. NMFS will have the opportunity to review project details at least 90 days ahead of the formal notification. This would be the optimal time for agency representatives to discuss project specifics and overall project consistency.
3. ***SNF consistency review***. For each project proposed to be carried-out under this programmatic, SNF will review the project to determine whether it meets the following criteria and is therefore appropriately considered to be covered by this opinion:
   a. Falls within the description of an activity in the proposed action, as set out in Section 1.3 above;
   b. Conforms with the Standards and Guidelines found in the Siuslaw National Forest Land and Resource Management Plan (USDA 1990), the NWFP (USDA - USDI

1994), National Best Management Practices for Water Quality Management on National Forest System Lands (USDA 2012); and,
   c. Conforms to all applicable terms and conditions in the incidental take statement of this opinion.
4. ***Formal project notification***. Once the SNF makes a determination that a project satisfies 3 a, b, and c above, and at least 60 days prior to a decision, SNF will submit a Project Notification Form (PNF) to NMFS using the SNFVegMGT.WCR@noaa.gov email box. An example PNF is located in Appendix A of this BO.
5. ***Annual project completion summary***. The SNF will submit an Annual Project Completion Summary to NMFS each year that describes the SNF's implementation of this opinion. The Annual Project Completion Summary will include 1) current 5-year plan; 2) annual timber sale schedule (gates); 3) timber sales proposed to be sold that year; 4) map of proposed sales by NEPA document and 5th field watershed; 5) timber sales under contract, miles of road proposed for construction associated with each sale, and acres of non-commercial manual/mechanical vegetation treatments completed by 5th field watershed; 6) a list of open timber sales and anticipated close date and a map of proposed sales by NEPA document and 5th field watershed; 7) aquatic restoration projects by 5th field watershed, number of acres and timing of the projects; and 8) any other take indicators as described in A through E in the incidental take statement. This information may be utilized to refine activity projections that were estimated on the PNFs, and to produce a more accurate accounting of management activity by 5th field watershed annually. The information provided in the Annual Project Completion Summary based on the fiscal year, is subject to modification, and will be updated, and reviewed during the Annual Coordination Meeting.
6. ***Annual coordination meeting***. Prior to May 15th of each year, the agencies will attend an annual coordination meeting to discuss the Annual Project Completion Summary, review incidental take thresholds, discuss changes needed to the PNF, identify steps needed to improve the review and verification process, and any actions that can improve conservation under this opinion, or make the program more efficient or accountable. Results of regional habitat monitoring from the Aquatic and Riparian Effectiveness Monitoring Program (AREMP) may also be discussed, as well as other trends in listed fish populations and/or habitat conditions that may be relevant to actions covered in this opinion. If the SNF approaches take thresholds listed in the incidental take statement, options to reduce the risk of take exceedances would be discussed at the Annual Coordination Meeting. If an unexpected occurrence exceeds take, SNF must notify NMFS as soon as possible and not later than one business day.
7. ***Minor project modification***. The following minor project modification is allowed under the proposed action on a case-by-case basis, when NMFS verifies the resulting environmental and biological effects of the modification fit within the opinion:
   a. Work outside the in-water work window, given that it will not affect more fish or expose other life-stages to effects not already analyzed in this opinion.

1.3.1.2 General Criteria Common to All Activities

The following general PDCs are proposed to minimize short-term effects on ESA-listed species, their designated critical habitats, and EFH from construction activities associated with the proposed activity types. All general PDCs may not be applicable to every activity type, but those that are applicable to the activity type or types that are being proposed during implementation of this opinion must be met for an activity to be eligible for coverage under this opinion:

8. ***Climate change***. Current regional climate change projections, such as changes in flow magnitude and duration, and sea level elevation, will be considered during project design for the life of the project.
9. ***Timing of in-water work***. In-water work will be completed during the appropriate Oregon Department of Fish and Wildlife (ODFW) in-water work window (ODFW 2008).
10. ***Site layout and flagging***. Prior to construction, action areas within 300 feet of streams will be clearly flagged to identify the following:
    a. Sensitive resource areas, such as areas below ordinary high water (OHWM), spawning areas, springs, and wetlands (identified by a qualified biologist or wetland specialist, as appropriate).
    b. Equipment entry and exit points.
    c. Road and stream crossing alignments.
    d. Staging, storage, and stockpile areas.
    e. No-spray areas and buffers.
11. ***Temporary access roads and paths***.
    a. Existing access roads and paths will be used. The number and length of temporary access roads and paths through riparian areas and floodplains will be minimized to lessen soil disturbance and compaction, and impacts to vegetation.
    b. Temporary access roads and paths will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure.
    c. When constructing temporary access roads, the SNF will remove the least amount of riparian vegetation necessary to complete the road. When temporary vegetation removal is determined necessary, vegetation will be cut at ground level (not grubbed).
    d. At project completion, all temporary access roads and paths will be obliterated, and the soil will be stabilized and revegetated. Road and path obliteration refers to the most comprehensive degree of decommissioning and involves decompacting the surface and ditch, pulling the fill material onto the running surface, and reshaping to match the original contour.
    e. Temporary roads and paths in wet areas or areas prone to flooding will be obliterated each year by the end of the in-water work window.
12. ***Temporary stream crossings***.
    a. Existing stream crossings will be preferentially used whenever reasonable, and the number of temporary stream crossings will be minimized.
    b. Temporary bridges and culverts will be installed to allow for equipment and vehicle crossing over perennial streams during construction.
    c. Vehicles and machinery will cross streams at right angles to the main channel.
    d. The location of the temporary crossing will avoid areas that may increase the risk of channel re-routing or avulsion.
    e. Potential spawning habitat (i.e., pool tail-outs) and pools will be avoided.

    f. No stream crossings will occur at active spawning sites, when holding adult listed fish, or when eggs or alevins are in the gravel. The ODFW will be contacted for specific timing information.
    g. After project completion, temporary stream crossings will be obliterated and the stream channel and banks restored the original condition or better.
13. ***Staging, storage and stockpile areas***.
    a. Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) will be 150 feet or more from any natural water body or wetland, or on an adjacent, established road area in a location and manner that will preclude erosion into or contamination of the stream or floodplain.
    b. Natural materials used for implementation of aquatic restoration, such as large wood (LW), gravel, and boulders, may be staged within the 100-year floodplain.
    c. Any LW, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration outside of sensitive areas such as wetlands and floodplains expected to be inundated during storage.
    d. Any material not used in restoration, and not native to the floodplain, will be removed to a location outside of the 100-year floodplain for disposal.
14. ***Equipment***. Mechanized equipment and vehicles will be selected, operated, and maintained in a manner that minimizes adverse effects on the environment (e.g., minimally-sized, low pressure tires; minimal hard-turn paths for tracked vehicles; temporary mats or plates within wet areas or on sensitive soils). Gas-powered equipment with tanks larger than 5 gallons will be refueled in a vehicle staging area placed 150 feet or more from a natural waterbody or wetland, or in an isolated hard-surfaced area (e.g., paved parking lot; adjacent, established road; etc.). All vehicles and other mechanized equipment will be:
    a. Stored, fueled, and maintained in a vehicle staging area placed 150 feet or more from any natural water body or wetland or on an adjacent, established road area.
    b. Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150 feet of any natural water body or wetland.
    c. Thoroughly cleaned, repeated as often as necessary during operation, to remain grease free before operation in areas below OHWM (or highest astronomical tide for marine environments).
15. ***Erosion control***. Erosion control measures will be prepared and carried out, commensurate in scope with the action that may include the following:
    a. Temporary erosion controls will be in place before alteration of the action site and appropriately installed downslope of project activity within the riparian buffer area until site rehabilitation is complete.
        i. If there is a potential for eroded sediment associated with landings, system or non-system roads, decommissioned roads, etc. to enter the stream, exposed soils will be seeded or mulched with weed-free seed or weed-free mulch, or other erosion control measure, to prevent off-site movement of soil and facilitate vegetative recovery. Seeding, mulching and/or planting can be completed following completion of work in the outer and inner riparian zone, in late summer to early winter seasons (generally September 15 – December 1). In addition to seeding, effective erosion control

measures (e.g. wattles, certified straw bales and/or silt fencing) will be implemented.

b. Emergency erosion controls will be available at the work site and include the following:
    i. A supply of sediment control materials.
    ii. An oil-absorbing floating boom whenever surface water is present.
c. For projects involving near- and in-water construction, the SNF will obtain and implement the appropriate state water quality certification and its associated construction stormwater permits.

16. ***Dust abatement***. The SNF will determine the appropriate dust control measures (if necessary) by considering soil type, equipment usage, prevailing wind direction, and the effects caused by other erosion and sediment control measures. In addition, the following criteria will be used:
    a. Work will be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.
    b. Water trucks will be used for dust control where necessary.
    c. Petroleum-based products and other dust abatement chemicals will not be used.
    d. During base flow periods, water withdrawal will be considered a last resort, and will not exceed 10% of available streamflow.
    e. During officially declared drought periods, no water will be withdrawn from the stream. In Oregon, drought is declared by the Governor (http://www.oregon.gov/owrd/WR/docs/State_Drought_Process_and_Tools_Final.pdf.).
17. ***Spill prevention, control, and countermeasures***. The use of mechanized machinery increases the risk for accidental spills of fuel, lubricants, hydraulic fluid, or other contaminants into the riparian zone or directly into the water. Additionally, uncured concrete and form materials adjacent to the active stream channel may result in accidental discharge into the water. These contaminants can degrade habitat, and injure or kill aquatic food organisms and ESA-listed species. SNF will specify the following measures for its contractors and subcontractors:
    a. A description of hazardous materials that will be used, including inventory, storage, and handling procedures will be available on-site.
    b. Written procedures for notifying environmental response agencies will be posted at the work site.
    c. Spill containment kits (including instructions for cleanup and disposal) adequate for the types and quantity of hazardous materials used at the site will be available at the work site.
    d. Workers will be trained in spill containment procedures and will be informed of the location of spill containment kits.
    e. Any waste liquids generated at the staging areas will be temporarily stored under an impervious cover, such as a tarpaulin, until they can be properly transported to and disposed of at a facility that is approved for receipt of materials.
    f. No uncured concrete will come in contact with the water.
18. ***Invasive species control***. The following measures will be used to avoid introduction of invasive plants and noxious weeds into project areas:

a. Each time equipment enters a site after being at another site, all vehicles and equipment will be power washed, allowed to fully dry and inspected to make sure no plants, soil, or other organic material adheres to the surface.
b. Each time after entering a site after being at another site watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species.

19. ***Work area isolation and fish salvage***. This conservation measure applies to projects implemented in cooperation with the state department of fish and wildlife. State department of fish and wildlife agency personnel or other qualified biologists will implement the following measures in accordance with their existing permits.
    a. Any work area within the wetted channel will be isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is less than 300 feet upstream from active spawning habitats.
    b. When work area isolation is required by permit conditions, engineering design plans will clearly denote that work area isolation is required and must comply with all permit conditions. Fish release areas will be determined in consultation with the ODFW and will be located in the field during the pre-construction meeting. Engineering design plans will specify that when a pump is used to dewater the isolation area and fish are present, a fish screen that meets NMFS' most recent fish screen criteria is required.
    c. Work area isolation and fish capture activities will occur during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize mortality for the species present.
    d. Salvage operations shall follow the ordering, methodologies, and conservation measures specified below in Steps 1 through 6. Steps 1 and 2 will be implemented for all projects where work area isolation is necessary according to condition 15(a) above. Electrofishing (Step 3) may be implemented to ensure all fish have been removed following Steps 1 and 2, or when other means of fish capture may not be feasible or effective. Dewatering and re-watering (Steps 4 and 5) will be implemented unless wetted in-stream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species. Dewatering will not be conducted in areas occupied by lamprey, unless lampreys are salvaged using guidance set forth in "USFWS Best Management Practices to Minimize Adverse Effects to Pacific Lamprey".
        i. Step 1: Isolate
            1) Block nets will be installed at up and downstream locations and maintained in a secured position to exclude fish from entering the project area.
            2) Nets will be secured to the stream channel bed and banks until fish capture and transport activities are complete.
            3) If block nets or traps remain in place more than one day, the nets and traps will be monitored at least daily to ensure they are secured to the banks and free of organic accumulation, and to minimize fish predation in the trap.

4) Nets and traps will be monitored hourly anytime there is in-stream disturbance.

ii. Step 2: Salvage – as described below, fish trapped within the isolated work area will be captured to minimize the risk of injury, then released at a safe site:

1) Fish will be collected by hand or dip nets, as the area is slowly dewatered.
2) Seines with a mesh size to ensure entrapment of the residing ESA-listed fish will be used.
3) If used, minnow traps will be left in place overnight and used in conjunction with seining.
4) If buckets are used to transport fish:
   a) The time fish are in a transport bucket will be limited, and will be released as quickly as possible.
   b) The number of fish within a bucket will be limited based on size, and fish will be of relatively comparable size to minimize predation.
   c) Aerators for buckets will be used or the bucket water will be frequently changed with cold clear water at 15-minute or more frequent intervals.
   d) Buckets will be kept in shaded areas or will be covered by a canopy in exposed areas.
   e) Dead fish will not be stored in transport buckets, but will be left on the streambank to avoid mortality counting errors.
5) As rapidly as possible (especially for temperature-sensitive bull trout), fish will be released in an area that provides adequate cover and flow refuge. Upstream release is preferred, but fish released downstream will be sufficiently outside of the influence of construction.
6) Salvage will be supervised by a qualified fisheries biologist experience in work area isolation and competent to ensure the safe handling of all fish.

iii. Step 3: Electrofishing—Electrofishing will be used only after other salvage methods have been employed or when other means of fish capture may not be feasible or effective. If electrofishing will be used to capture fish for salvage, the salvage operation will be led by an experienced fisheries biologist and the following guidelines will be followed:

1) The NMFS' electrofishing guidelines (NMFS 2000 or most recent) will be used.
2) Only direct current (DC) or pulsed direct current will be used.
   a) If conductivity is less than 100 microseconds (µs), voltage ranges from 900 to 1100 volts (v.) will be used;
   b) For conductivity ranges between 100 to 300 µs, voltage ranges will be 500 to 800 v.;

c) For conductivity greater than 300 µs, voltage will be less than 400 v.

3) Electrofishing will begin with a minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized.
4) The anode will not intentionally contact fish while the current is being emitted.
5) If mortality or obvious injury (defined as dark bands on the body, spinal deformations, de-scaling of 25% or more of body, and torpidity or inability to maintain upright attitude after sufficient recovery time) occurs during electrofishing, operations will be immediately discontinued, machine settings, water temperature and conductivity checked, and procedures adjusted or postponed to reduce mortality.

iv. Step 4: Dewater—Dewatering, when necessary, will be conducted over a sufficient period of time to allow species to naturally migrate out of the work area.

1) Diversion around the construction site may be accomplished with a coffer dam and an associated pump, a by-pass culvert or pipe, or a non-erodible or lined diversion ditch.
2) All pumps will have fish screens to avoid juvenile fish entrainment, and will be operated in accordance with current NMFS fish screen criteria (NMFS 2011, or most recent version). If the pumping rate exceeds 3 cubic feet per second (cfs), a NMFS engineering review will be necessary.
3) Dissipation of flow energy at the bypass outflow will be provided to prevent damage to riparian vegetation or stream channel.
4) Safe reentry of fish into the stream channel will be provided, preferably into pool habitat with cover, if the diversion allows for downstream fish passage.
5) Seepage water will be pumped to a temporary storage and treatment site or into upland areas to allow water to percolate through soil or to filter through vegetation prior to reentering the stream channel.

v. Step 5: Re-watering—Upon project completion, the construction site will be slowly re-watered to prevent loss of surface flow downstream and to prevent a sudden increase in stream turbidity. During re-watering, the site will be monitored to prevent stranding of aquatic organisms below the construction site.

vi. Step 6: Salvage Notice—Once salvage operations are completed, a salvage report will document procedures used, any fish injury or mortality (including numbers of fish affected), and a description of the causes for mortality, as required on the reporting form.

20. ***Fish passage***. Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during construction, unless passage did not exist before construction or the stream is naturally impassable at the time of construction. After

construction, fish passage will be provided that meets NMFS' fish passage criteria (NMFS 2011 or most recent version).

21. ***Construction and discharger water***.
    a. Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
    b. During base flow periods, water withdrawal will be considered a last resort, and will not exceed 10% of available streamflow.
    c. During officially declared drought periods, no water will be withdrawn from the stream. In Oregon, drought is declared by the Governor (http://www.oregon.gov/owrd/WR/docs/State_Drought_Process_and_Tools_Final.pdf.).
    d. All construction discharge water will be collected and treated using the best available technology applicable to site conditions.
    e. Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present will be provided.
    f. Treat all construction discharge water using the BMPs applicable to site conditions to remove debris, sediment, petroleum products, and any other pollutants likely to be present, (e.g., green concrete, contaminated water, silt, welding slag, sandblasting abrasive, grout cured less than 24 hours, drilling fluids) to ensure that no pollutants are discharged from the construction site. Pump seepage water from the de-watered work area to a temporary storage and treatment site or into upland areas and allow water to filter through vegetation prior to reentering the stream channel. Treat water used to cure concrete until pH stabilizes to background levels.
    g. Any surface water diverted for construction needs (e.g., with pumps) will be screened to avoid juvenile fish entrainment, and will be done in accordance with current NMFS fish screen criteria (NMFS 2011 or most recent version). If the pumping rate exceeds 3 cfs, a NMFS engineering review will be necessary.
22. ***Minimize time and extent of disturbance***. Earthwork (including drilling, excavation, dredging, filling and compacting) in which mechanized equipment is in stream channels, riparian areas, and wetlands will be completed as quickly as possible. Mechanized equipment will be used in streams only when project specialists believe that such actions are the only reasonable alternative for implementation, or would result in less sediment in the stream channel or damage (short- or long-term) to the overall aquatic and riparian ecosystem relative to other alternatives. To the extent feasible, mechanized equipment will work from the top of the bank, unless work from another location would result in less habitat disturbance.
23. ***Cessation of work***. Project operations will cease under the following conditions:
    a. High flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage.
    b. When allowable water quality impacts, as defined by the 401 water quality certification, have been exceeded.
24. ***Site restoration***. When construction is complete:
    a. All streambanks, soils, and vegetation will be cleaned up and restored as necessary using stockpiled large wood, topsoil, and native channel material.
    b. All project related-waste will be removed.

c. All disturbed areas will be rehabilitated in a manner that results in similar or improved conditions relative to pre-project conditions. This will be achieved through redistribution of stockpiled materials, seeding, and/or planting with adapted, non-invasive seed mixes or plants. Local and native plant materials will be used.

25. ***Revegetation following construction activities***. Long-term soil stabilization of the disturbed site will be accomplished with re-establishment of vegetation using the following criteria:
    a. Planting and seeding will occur prior to or at the beginning of the first growing season after construction.
    b. An appropriate mix of species that will achieve establishment, shade, and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site will be used.
    c. Vegetation, such as willow, sedge and rush mats, will be salvaged from disturbed or abandoned floodplains, stream channels, or wetlands to be replanted during site restoration.
    d. Non-native species will not be used.
    e. Short-term stabilization measures may include the use of non-native seed mix (when native seeds are not available or not expected to provide adequate stabilization), weed-free certified straw, jute matting, and other similar techniques.
    f. Surface fertilizer will not be applied within 50 feet of any stream channel, waterbody, or wetland.
    g. Barriers will be installed as necessary to prevent damage to revegetated sites by livestock or unauthorized persons.
    h. Re-establishment of vegetation in disturbed areas will achieve at least 70% of pre-project conditions within 3 years.
    i. Invasive plants will be removed or controlled until vegetation is well established (typically 3 years post-construction).
26. ***Obliteration of temporary access roads to construction sites***. When the project is completed, the contractor will obliterate all temporary access roads, crossings, and staging areas, and will stabilize the soils and revegetate. When necessary, loosen compacted areas, such as access roads, stream crossings, staging, and stockpile areas to allow for revegetation and improved infiltration.

1.3.1.3 Project Activity Design Criteria

The proposed design criteria are intended to avoid or minimize the effects of the proposed action on aquatic species and habitat including ESA-listed OC coho salmon and their designated critical habitat, UWR steelhead and their designated critical habitat, and EFH for Chinook and coho salmon and are listed below.

27. ***Tree felling, snag creation, and fell and leave***. The purpose of the following PDCs is to: 1) ensure changes in live canopy cover associated with SNF restoration efforts are within ecological reference ranges; 2) to ensure restoration efforts do not substantially contribute

to an overall warming trend of any stream; and 3) do not create detrimental increases in the potential for surface water flow and potential associated sedimentation runoff.

a. Any project including tree felling or snag creation within the riparian restoration zones (Table 9) must be developed by or reviewed and approved by a fisheries biologist and must be consistent with the Aquatic Conservation Strategy Objectives in the NWFP amendments. This requirement is in addition to any other requirements.
b. No tree felling/tipping, fell and leave, and/or snag creation treatment(s) within the riparian restoration zones (Table 9) of a stand will reduce the live canopy cover below 40%.
c. The combined amount of felling/tipping, fell and leave, and/or snag creation treatment(s) within the riparian restoration zones and within the upland areas (areas outside of riparian reserves) will not exceed the acre values presented in Table 1.
d. No tree felling/tipping, fell and leave, and/or snag creation treatment(s) within all riparian restoration zones will create a gap or expand an existing gap to greater than 0.25 acre.
e. Trees for removal must be felled away or parallel to the stream. Trees that are inadvertently felled into the stream, fall and leave trees, or trees felled to create yarding corridors or non-system roads within the stream buffer, must be left on site.

28. ***Tree tipping***. The primary points of analysis when considering the aquatic resources and ESA-listed salmon recovery in association with the activity of tree tipping (beyond the reduction of live canopy cover addressed in PDC 27 above) is associated with the uplifting of part of the trees' root wad. The purpose of the PDCs below are to minimize the potential for soil movement and sedimentation runoff into associated water bodies as a result of tree tipping.
    a. All criteria in PDC 27 apply to tree tipping activities.
    b. No tree tipping will lead to the destabilization of a stream bank or slope.
    c. All tree tipping will minimize the potential for slope instability and/or the potential for soil movement that would potentially lead to sedimentation runoff into a stream or other waterbodies by:
        i. Avoid areas at high risk of soil movement, such as:
        1) headwalls
        2) steep, narrow valleys
        3) existing landslide areas, using LiDAR and DOGAMI surveys as a reference
29. ***Tree yarding***. Tree yarding is the act of moving felled trees (PDC 27) from their downed location to another location. For most felled trees outside the inner riparian restoration zone, the yarding destination is typically to a landing, or a collection point where further, fully suspended over-the-road transportation may occur. The four methods utilized for tree yarding on the SNF include, ground-based, skyline, tethered, and helicopter yarding. The purpose of the PDCs below is to ensure tree yarding associated with SNF restoration efforts minimizes potential increases in soil movement and potential sedimentation runoff into associated water bodies.

a. No yarding across class 1 streams. Yarding corridors are allowed only within the outer riparian restoration zone on class 1 streams. (Table 2). Tailhold trees may be allowed across streams. No clearing is required for tailhold tree use.
b. The establishment of yarding corridors through riparian restoration zones excluding class 1 streams will also meet all of PDC in #27 above.
c. Full suspension is required when cable yarding over class 2 and 3 stream riparian restoration zones.
d. Full suspension over class 4 streams inner riparian restoration zone will occur whenever feasible. If full suspension cannot be achieved, bump logs within the channel will be utilized.
e. Yarding operations are required to maintain a minimum of one-end suspension except where it is not possible, such as at landing approaches.
f. Ground-based yarding equipment is prohibited within the no-equipment zones of Class 1 to 3 streams.
g. Skid trails (ground-based systems) will not cross class 1, 2, and 3 streams and will not enter no-equipment zones. Skid trails will not be designated through wetlands or other wet areas, including any needed buffers as determined by a hydrologist or fisheries biologist.
h. If skid trails cannot avoid crossing class 4 streams, they may only do so when:
    i. All phases of operations can be completed, and the stream channel/bank restored to prior condition during dry stream conditions.
    ii. Crossings (placement and design) are reviewed and approved by a fisheries biologist or hydrologist prior to and upon completion of operations.
    iii. Crossings are perpendicular to the stream channel.
i. Ground-based equipment (including, but not limited to; harvesters, forwarders, and skidders) is prohibited on slopes exceeding 35% (except for short pitches (< 250 feet) on less than 45%).
j. All ground-based equipment must stay on designated skid trails.
k. Whenever reasonable, ground-based equipment should drive on top of slash to minimize soil impacts.

30. ***Tree removal***. Changes in the number (and size) of trees in a riparian and/or the upland environment naturally occurs across the SNF over time. The purpose of the following PDCs is to ensure changes in the number of trees associated with SNF restoration efforts are within reference ranges while considering existing and future forest and aquatic landscape conditions. Consideration of restoration strategies may include systems depleted of wood resources due to past management activities. It is important to understand how current restoration efforts, directly and indirectly, affect the SNF's ability to contribute towards the Aquatic Conservation Strategy Objective and ESA-listed salmon recovery. The purpose of the PDCs below are to ensure the proposed action do not reduce the rate of natural introduction of wood into streams below reference baseline conditions or preclude our ability to supplement natural wood introductions with in-stream wood placement restoration efforts within the context of current conditions that may include depleted structures historically present.
    a. Any tree removal within the inner riparian restoration zone must be developed by or reviewed and approved by a fisheries biologist and must be consistent with the

Aquatic Conservation Strategy Objectives in the NWFP amendments. This requirement is in addition to any other requirements.

b. All criteria in the preceding PDCs 27 and 28 apply to tree removal activities.

31. ***Tree planting, tree culturing, and invasive plant removal***. The primary purpose of these activities is to establish uncommon native species that have benefits to local and landscape structure and habitats. The removal of invasive plants is also common and serves a similar purpose of allowing the re-establishment of native plants that have important benefits to the diversity of local and landscape structure and habitats in aquatic, riparian, and/or upland areas. Tree planting, tree culturing, and invasive plant removal are associated with some relatively small and localized soil disturbance, the reduction of brush biomass, and the potential for introduction of pollutants into associated waterbodies. The purpose of the PDCs below is to ensure tree planting, tree culturing, and invasive plant removal restoration efforts minimize increases in the potential for soil movement and potential sedimentation or pollutant runoff into associated water bodies.
    a. Herbicide application methods would be consistent with the following consultation documents: The Invasive Plants FEIS (USDA 2005) and ARBO II (USDA and USDC 2013), to minimize adverse effects to fish, aquatic invertebrates, aquatic plants, and algae. Herbicide buffer distances for perennial streams, intermittent streams, roadside ditches with flowing or standing water present, dry intermittent streams and dry roadside ditches varies according to application method and herbicide and would follow the PDCs in ARBO II (USDA and USDC 2013).
    b. The only herbicides proposed for use are aquatic-labeled glyphosate and aquatic-labeled imazapyr in accordance with project design criteria for herbicides in ARBO II PDC 33e, Non-native Invasive Plant Control (Chemical Methods):
        i. 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.
            1) 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.
            2) Carefully consider herbicide impacts to fish, wildlife, non-target native plants, and other resources when making herbicide choices.
            3) 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.
            4) Herbicide application rates will follow label direction, unless site specific analysis determines a lower maximum rate is needed to reduce non-target impacts.

5) An 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.
6) Pesticide applicator reports must be completed within 24 hours of application.

ii. Herbicide active ingredients - 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 US government):[1]
1) Aminopyralid (e.g., terrestrial: Milestone VM)
2) chlorsulfuron (e.g., terrestrial: Telar, Glean, Corsair)
3) clopyralid (e.g., terrestrial: Transline)
4) dicamba (e.g., terrestrial: Vanquish, Banvel)
5) diflufenzopyr + dicamba (e.g., terrestrial: Overdrive)
6) glyphosate (e.g., aquatic: Aquamaster, AquaPro, Rodeo, Accord)
7) imazapic (e.g., terrestrial: Plateau)
8) imazapyr (e.g., aquatic: Habitat; terrestrial: Arsenal, Chopper)
9) metsulfuron methyl (e.g., terrestrial: Escort)
10) picloram (e.g., terrestrial: Tordon, Outpost 22K)
11) sethoxydim (e.g., terrestrial: Poast, Vantage)
12) sulfometuron methyl (e.g., terrestrial: Oust, Oust XP)
13) triclopyr (e.g., aquatic: Garlon 3A, Tahoe 3A, Renovate 3, Element 3A; terrestrial: Garlon 4A, Tahoe 4E, Pathfinder II)
14) 2 ,4-D (e.g., aquatic: 2,4-D Amine, Clean Amine; terrestrial: Weedone, Hi-Dep)

iii. Herbicide adjuvants - 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.

iv. Herbicide carriers - Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.

v. Herbicide mixing – 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.

[1] The use of trade, firm, or corporation names in this opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

vi. Herbicide application methods – Liquid forms of herbicides will be applied as follows:
    1) Broadcast spraying using booms mounted on ground-based vehicles (this consultation does not include aerial applications).
    2) Spot spraying with hand held nozzles attached to backpack tanks or vehicles and hand-pumped sprayers to apply herbicide directly onto small patches or individual plants.
    3) Hand/selective through wicking and wiping, basal bark, frill ("hack and squirt"), stem injection, or cut-stump.
    4) Dyes or colorants, (e.g., Hi-Light, Dynamark) will be used to assist in treatment assurance and minimize over-spraying within 100 feet of live water.

vii. Minimize herbicide drift and leaching - Minimization of herbicide drift and leaching – Herbicide drift and leaching will be minimized as follows:
    1) Do not spray when wind speeds exceed 10 miles per hour (mph) 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.
    2) Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.
    3) Keep boom or spray as low as possible to reduce wind effects.
    4) Avoid or minimize drift by utilizing appropriate equipment and settings (e.g., nozzle selection, adjusting pressure, drift reduction agents). 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]).
    5) Follow herbicide label directions for maximum daytime temperature permitted (some types of herbicides volatilize in hot temperatures).
    6) 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.
    7) 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 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.

viii. Herbicide buffer distances - The following no-application buffers, which are measured in feet and are based on herbicide formula, stream type, and application method, will be observed during herbicide applications (Table 4). 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 4. No-application buffer widths in feet for herbicide application, by stream types and application methods.

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

32. ***Road maintenance, reconstruction, and construction***. Forest and watershed restoration activities on the SNF use the transportation system (roads) for access and haul of material. Maintenance, reconstruction, and at times, construction of new system roads and special use roads is required to safely implement restoration projects and minimize water quality impacts from forest roads. Road maintenance and reconstruction is necessary to ensure that roads are prepared and maintained during haul so that they do not cause resource damage or present safety hazards. Road construction is sometimes required to re-route forest system roads to provide for resource protection, hydrologic stability, and safe travel during haul. Road construction refers to new permanent template roads that are not already existing on the landscape; however, the proposed action will not cause a net increase in miles of permanent road templates in riparian reserves on the SNF. The purpose of the PDCs below are to ensure that road maintenance, construction and reconstruction associated with restoration efforts on the SNF minimize increases in the potential for soil movement and potential sedimentation runoff into associated water bodies.
    a. Road maintenance and reconstruction activities will be implemented during the dry season (generally June 1 - October 31) unless the road segment has no direct hydrologic connection to streams or if work is approved by a fisheries biologist or hydrologist during dry periods throughout the wet season (generally November 1 – May 31). Addition of gravel (including blading and compacting) for wet season haul, brushing, sign installation, gate installation and unforeseen slide removal is allowed during the wet season.
    b. Require all waste material generated from road maintenance (ditch cleaning, blading, etc.) to be placed in an area outside of the inner riparian restoration zones for all streams.
    c. When removing vegetation from ditch lines where ditches have a direct hydrological connection to class 1, 2, or 3 streams, install an effective sediment trap to prevent ditch erosion from entering streams (e.g. wattles, straw bales, rock dams, or leave 100-feet of vegetated ditch line) until vegetation is re-established.
    d. All new replacement of culverts will be designed to pass, at minimum, a 100-year flood streamflow.
    e. Dust abatement is limited to the application of water or lignosulfonate only. If lignosulfonate is used for dust abatement:
        i. One application will occur during the dry season (June 1 – October 31) at a dilution rate of 50% lignosulfonate and 50% water.
        ii. Lignosulfonate will be contained to the road surface and not go over road edge.
        iii. During blading, small berms may be created or wattles used at stream crossings to assist with keeping palliatives on the road surface.
        iv. A one-foot no-application buffer on the edge of gravel shall be used if road width allows.
        v. Lignosulfonate will not be applied during rain or when forecasted; a 3-day forecast of clear weather from time of application is required.
    f. Surface water may be drafted to meet dust abatement, road maintenance or road construction needs. All surface water drafting within LFH must be approved by a fisheries biologist.

i. Within LFH, diversions may not exceed 10% of the available flow and fish screen(s) will be installed, operated, and maintained according to NMFS's fish screen criteria (NMFS 2011 or most recent version).
ii. No more than a 50% reduction in flow may occur in non-ESA streams and fish screens will be used when in fish-bearing streams (class 1 and 2 streams).

g. Culvert and bridge replacements - Culvert and bridge replacements occurring on fish-bearing streams shall adhere to the criteria in PDC 39 below (*Fish passage restoration*), which includes total removal of culverts or bridges, or replacing culverts or bridges with properly sized culverts and bridges, replacing a damaged culvert or bridge, and resetting an existing culvert that was improperly installed or damaged; stabilizing and providing passage over headcuts; removing, constructing (including relocations), repairing, or maintaining fish ladders; and constructing or replacing fish screens for irrigation diversions. Such projects will take place where fish passage has been partially or completely eliminated through road construction, stream degradation, creation of small dams and weirs, and irrigation diversions. Equipment such as excavators, bull dozers, dump trucks, front-end loaders, and similar equipment may be used to implement projects.
h. Require an approved dewatering plan for all perennial, stream-crossing culvert replacements that maintains downstream flow.
i. Require the complete excavation of fill material over the culvert at each replacement site prior to extracting the existing culvert.
j. Replacement of bridges, including temporary bridges, must consist of a single span with the abutments located outside of bankfull width. Abutment work areas must be isolated from any flowing water.
k. Fresh concrete (cured less than 72-hours), concrete contaminated wastewater, welding slag and grindings, concrete saw cutting by-products, and sandblasting abrasives shall be contained and not come in contact with water bodies or wetlands. Prepare concrete at least 150 feet from all water bodies.
l. Within LFH on new constructed roads, adequate cross-drainage will be installed near streams so that there is less than 200-feet of ditchline (on each side of crossing) draining directly to any stream.
m. All new system road construction shall be designed in accordance with Forest Service Handbook 7709.56 Chapter 40.
n. Roadside hazard tree treatment is only allowed within 2 SPTHs uphill of the road prism and 1 SPTH downhill of the road prism.

33. ***Temporary roads and landings construction***. Temporary (non-system) road and landing construction, including re-opening existing templates is often required to gain access to units for treatment. Landings are used as collection points where trees are loaded onto trucks for further transportation. Roads are classified as either system roads or non-system roads. System roads are permanent roads used for multiple access needs on national forest lands and are part of the Forest Service inventory of assets. Temporary roads are non-system roads and are used to temporarily access areas that cannot be reached by system roads. Sometimes temporary roads are "legacy roads" that still have existing templates on the ground. Temporary roads are decommissioned, and hydrological function is restored to the area once they are no longer needed for project

activities, which typically occurs from one to five years following the road's construction. The below PDCs will ensure that landing and temporary road construction associated with restoration efforts do not create detrimental increases in the potential for soil movement and sediment runoff into adjacent waterbodies.

a. Temporary road construction must not increase the drainage potential or rate of drainage of the hydrological network into streams. New roads will be built with one or more of the following PDCs (depending on appropriateness for the landscape): road located on ridgetop, road is out-sloped, or the outflow of new ditch relief drainage structures will drain to shallow sloped, well vegetated areas, no new ditch lines will be constructed.
b. Prohibit temporary roads within: 100-feet of class 1, 75-feet of class 2, 30-feet of class 3, and 15 feet from class 4 streams unless needed to cross streams. Temporary roads will not cross class 1 streams. If temporary road construction is required to cross streams (class 2, 3, and 4 streams) the following will apply:
    i. Crossings to be placed as perpendicular as possible to the stream channel as site conditions allow.
    ii. Stream crossings will be installed and removed when forecast or actual conditions are as follows:
    1) During in-stream work window or when the stream is dry.
    2) If it is not feasible to remove stream crossings prior to adverse weather conditions, the road must be hydrologically stabilized (installing waterbars) with concurrence by a forest hydrologist or fisheries biologist.
c. All temporary roads will be decommissioned promptly upon completion of project activities, which includes:
    i. Decommissioning shall be performed after completion of use and during the dry season (generally June 1 to October 31). If weather permits decommissioning can occur after October 31 and shall be done on a case by case basis.
    ii. Removing of all stream crossings installed by purchaser, unless determined they are needed.
    iii. When determined necessary by a hydrologist temporary road template shall be decompacted to a minimum 18-inch depth. Mineral soils will be lifted and mixed with the rock and brought to the ground surface and seeded with native grass and forbs.
    iv. As necessary to attain stabilization of roadbed and fill slopes out-sloping, drainage dips, and water spreading ditches will be employed.
    v. Barricade entrance to effectively block vehicular traffic within first 50-feet utilizing earthen berm, stumps and logging slash or other approved method.
d. Landing locations are not permitted within the inner riparian restoration zone and the no equipment zone.
e. Temporary roads will be adequately surfaced with rock sized to support season of haul.

34. ***Road decommissioning and closure***. The SNF travel analysis report (SNF 2014) is used to identify the minimum road system needed for administrative and public access. This report directs the SNF to evaluate whether roads are needed and gives recommendations

for management including road closure or decommissioning. The purpose of the PDCs below is to ensure that road decommissioning and closure associated with restoration efforts on the SNF do not create detrimental increases in the potential for soil movement and potential sedimentation runoff into associated water bodies.

a. Decommissioning will include the removal of all stream culverts/structures and installation of water bars. Stream structures may be left in place if road is being converted into a trail and has minimal failure risks. It may also include the removal of ditch relief culverts, side cast pullback, decompaction and recontouring the slope. Decommissioning will include the action of administrative removal of the road from the road system.
b. Closed roads will be hydrologically stabilized. This can include removing all stream culverts and water-barring. Sometimes deep fill stream crossings will also be stabilized by reducing the fill material over culverts left in place or other measures to hydrologically stabilize the road as determined by a hydrologist. Closed roads with stream culverts left in place will receive a level of maintenance to ensure culverts are not plugged (level 1 maintenance) or have other conservation features installed like; water bars, reduced fill material over culvert, or other measures to hydrologically stabilize the road.
c. Road decommissioning and closure will follow PDCs in the ARBO II programmatic. Culvert removal on fish-bearing streams shall adhere to the measures described in PDC 32(g) above. Project design criteria for road decommissioning is as follows:
    i. For road decommissioning and hydrologic closure projects within riparian areas, recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
    ii. When obliterating or removing road segments adjacent to a stream, use sediment control barriers between the road and stream if space is available.
    iii. Dispose of slide and waste material in stable sites out of the flood-prone area. Native material may be used to restore natural or near-natural contours.
    iv. Drainage features used for storm proofing and treatment projects should be spaced as to hydrologically disconnect road surface runoff from stream channels. If grading and resurfacing is required, use gravel, bark, or other permeable materials for resurfacing.
    v. Minimize disturbance of existing vegetation in ditches and at stream crossings.
    vi. Conduct activities during dry-field conditions (generally May 15 to October 15) when the soil is more resistant to compaction and soil moisture is low.
    vii. When removing a culvert from a first or second order, non-fish-bearing stream, project specialists shall determine if culvert removal should include stream isolation and rerouting in project design. Culvert removal on fish-bearing streams shall adhere to the measures described in PDC 32(g) above.

viii. For culvert removal projects, restore natural drainage patterns and channel morphology. Evaluate channel incision risk and construct in-channel grade control structures when necessary.

d. Road relocation

   i. When a road is decommissioned in a floodplain and future vehicle access through the area is still required, relocate the road as far as practical away from the stream.

   ii. The relocation will not increase the drainage network and will be constructed to hydrologically disconnect it from the stream network to the extent practical. New cross-drains shall discharge to stable areas where the outflow will quickly infiltrate the soil and not develop a channel to a stream.

e. Culvert removal sites will be dewatered while the culvert is being removed if streamflow is sufficient for dewatering to be possible. On class 1 and 2 streams, maintaining continuous stream flow is required.

f. Excavations to remove stream culverts will be matched to the approximate bed elevation and bank-full stream width of the existing streambed. At a minimum, the bottom of the fill will be excavated to 1.5 times the width of the culvert being removed and fill removal slopes must be at least 1.5:1 slope or match natural bank slopes. For all fish-bearing streams fill removal slopes should be 2:1 and the bottom of fill removals should be equal to or greater than bank full width. Any variation of standards will be approved by a forest fisheries biologist or forest hydrologist.

g. At culvert removal sites, the road must have water bars or other drainage features constructed to route surface water away from the newly excavated slopes, unless determined that these actions would create other instability issues.

35. ***Road use***. Forest and watershed restoration activities on the SNF use the transportation system for access and haul material. The purpose of the PDCs below is to ensure that road use associated with restoration efforts on the SNF do not create detrimental increases in the potential for soil movement and sediment runoff into adjacent waterbodies. The most current SNF road rules shall be followed.

   a. Require system roads used to meet minimum design standards to ensure safe haul without road failure. Prohibit haul on roads that are failing or likely to fail; be especially cautious where a failure would cause direct sediment impacts to streams.

   b. Timber haul operations will be stopped immediately if road use is causing deep rutting of the road surface, there is ponding of water on the road, there is a failure of any drainage structure, or any other situation occurs which may result in sediment delivery to a stream. Any such roads must be repaired before haul can continue.

   c. There are no seasonal restrictions on haul over paved roads that meet design standards, are maintained to standards, and where no known issues exist that would lead to direct sediment impacts to streams.

   d. Prohibit timber haul on native surfaced roads and landings during the wet season (generally November 1 – May 31).

e. Timber transport on rock surfaced and native surfaced roads is only allowed during the dry season (generally June 1 – October 15), except on rock surfaced roads where conditions of 35(f) are met.
f. Timber transport is only allowed during the wet season (generally November 1 – May 31) on rock surfaced roads if all the following criteria are met:
    i. Roads must meet design standards to support wet weather haul (road shall have sufficient structural strength to support haul during wet weather conditions and shall have a minimum 6-inch depth of compacted rock) as determined by forest engineering prior to haul. Haul shall be suspended if any road distress/damage happens until signs and causes of distress are remedied.
    ii. Haul routes must be inspected weekly, or more frequently if weather conditions warrant. Inspections will focus on road surface condition, drainage maintenance, and potential sources of sediment delivery to streams.
    iii. Road segments that have the potential to deliver sediment to any stream channel, will have erosion control measures implemented to prevent off-site movement of soil. This work will occur prior to any wet weather haul (generally November 1 – May 31).
    iv. The approach and crossing of each listed fish habitat stream (class 1 stream) is paved or has a high quality, well drained, and recently maintained rock surface.
    v. Timber or other material transport will be stopped by the sale administrator or other responsible personnel when road sediment can be observed moving into streams.
    vi. Seasonal haul restrictions within the timber contract require contractors to monitor respective weather stations and restrict haul for 24-hours in the event of precipitation accumulations of 1-inch in a 24-hour window.

36. ***Rock quarry operations***. Rock quarries were developed as source areas for rock and gravel used for surfacing forest roads. Development of new rock quarries are uncommon but are sometimes required to meet the rock needs for associated restoration work over roads. Activities associated with the development of a rock quarry include vegetation and soil removal, excavation, drilling and blasting, and construction of access roads and a work area. Activities associated with quarry use include drilling and blasting, crushing, sorting and piling of rock materials, and loading trucks. These activities require the use of a variety of heavy equipment such as excavators, dozers, backhoes, rock crushers, and trucks. Quarries no longer needed to supply rock for roads, may be used as waste areas for material removed from roads and ditches during road maintenance operations. The purpose of the PDCs below is to ensure that rock quarry development and use associated with restoration efforts do not create detrimental increases in the potential for soil movement and potential sediment runoff into adjacent waterbodies.
    a. New rock quarries shall not be developed within the riparian restoration zones.
    b. Conduct activities for existing quarries 300 feet from class 1 and class 2 streams and 100 feet from class 3 streams with the potential to introduce sediment into streams or if work is approved by a fisheries biologist or hydrologist during dry periods during the wet season.

i. Circumstances require such activities to occur during a wet period (or occur at any time adjacent to listed fish spawning or rearing habitat), erosion control measures will be implemented to prevent off-site soil movement, to prevent damage to water quality and fish habitat. Erosion control measures include the use of filter materials (such as straw bales or silt fencing) and other conservation measures.

c. For all quarries within 300 feet of class 1, class 2, and 100 feet from class 3 and 4 streams, prepare and implement BMPs commensurate with the scope of activity at the quarry that includes the following information:
   i. The name, phone number, and address of the official responsible for implementing BMPs.
   ii. BMPs to confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion and sedimentation associated with the action.
   iii. BMPs to confine, remove, and dispose of hazardous materials generated, used, or stored at the work site.
   iv. Procedures to contain and control a spill of any hazardous material generated, used or stored at the work site, including notification of proper authorities.

d. For blasting, follow setback criteria from ESA-listed fish habitat based on the following Table 5:

Table 5. Setback distances for blasting activities based on charge weight.

Charge Weight (lbs.)	Setback Distance (ft.)	Setback Distance (mi)
10	282	0.053
20	397	0.075
40	564	0.107
60	689	0.13
80	797	0.151
100	889	0.168
140	1053	0.199
150	1089	0.206
200	1260	0.239
500	1991	0.377
1,000	2815	0.533
5,000	6299	1.193
10,000	8907	1.687
15,000	10909	2.066

37. ***Fuels treatments***. Fuels treatments may be necessary within units to remove residual slash to reduce fire hazard. Logging slash on pre-existing landings and up to 100 feet from open roads will be treated to reduce the potential risk of wildfire. Treatment methods include construction and burning of hand piles within 100 feet of open roads and burning any machine piles on landings, and understory prescribed fire of units. Hand-piling involves the manual placement of smaller pieces of slash into piles for future burning, typically during the fall and winter. Mechanical or tractor piling is used when the slope is less than 35% and is done during periods of low soil moisture (dry season) to reduce impacts to soils caused by using heavy equipment. Mechanical or hand piles are typically 8 by 8-feet, 6-feet high and at least 20-feet apart. Piles are placed away from residual trees to prevent damage and are burned in the fall or winter after significant rain to prevent the spread of fire. Typically, a mosaic patchwork of the understory vegetation, leaf litter, and duff are consumed through understory prescribed fire. The following PDCs apply to fuels treatments:
    a. Fuels treatment of any kind is prohibited within the inner riparian restoration zone, with the exception that fire backing into the inner riparian restoration zone during understory prescribed fire may occur but will be kept to the minimal extent possible.
    b. At points where a road, unit, and stream are in close proximity, piles could be constructed within the outer riparian restoration zone for each stream class (slash is usually collected within a 10-foot radius of each pile).
    c. Mechanical fuels treatments are subject to the same slope standards as ground-based yarding equipment (<35% slope).
    d. Water (if needed) used for fuels treatment will be drawn from sources near the units treated. A fisheries biologist or hydrologist will be consulted prior to utilizing any water sources.
    e. Within class 1 and class 2 streams, diversions may not exceed 10% of the available flow and fish screen(s) will be installed, operated, and maintained according to NMFS' fish screen criteria (NMFS 2011 or most recent version).
    f. No more than a 50% reduction in flow may occur in perennial streams (class 3 streams – non-fish-bearing streams).
    g. Understory prescribed fire will be conducted during spring like conditions (March – June) or when fuel moistures are high (in some years fall burning) to reduce the risk of loss of overstory trees. No more than 10% mortality of overstory trees should occur during understory prescribed fire operations and no less than 30% of the duff layer shall be retained.
    h. Prohibit the construction of hand-built fire lines in the inner riparian restoration zone and/or where water could be channeled into areas of instability, headwalls, or streams. Construct water bars on fire line to reduce soil erosion. Mechanical fire lines are prohibited within the riparian restoration zones.
38. ***Large wood placement***. Much of the SNF's habitat restoration and enhancement consists of large wood placement. Large wood placement will occur in stream channels and adjacent floodplains to increase channel stability, rearing habitat, key beaver habitat, pool formation, spawning gravel deposition, channel complexity, hiding cover, low velocity areas, and floodplain function. Equipment such as helicopters, excavators, dump trucks,

front-end loaders, full-suspension yarders, tether set-ups, and similar equipment may be used to implement projects.

a. Large wood structure types shall simulate disturbance events and are not limited to log jams, debris flows, wind throw, and tree breakage.
b. No limits are to be placed on the size or shape of log structures if structures are in the range of natural variability of the channel and do not block fish passage.
c. Large wood includes whole conifer and hardwood trees, logs and rootwads. Large wood size (diameter and length) should account for bankfull width and stream discharge rates. When available, trees with rootwads should be a minimum of 1.5 times bankfull width, while logs without rootwads should be a minimum of 2.0 times bankfull width.
d. Structures may partially or completely span stream channels or be positioned along stream banks.
e. Stabilizing or key pieces of large wood must be intact, hard, with little decay, and if possible, have rootwads (untrimmed) to provide functional refugia habitat for fish. Consider orienting key pieces such that the hydraulic forces upon the large wood increases stability.
f. All PDC's for large wood placement projects will be used in compliance with ARBO II, which are as follows:
    i. Place large wood in areas where they would naturally occur and in a manner, that closely mimics natural accumulations for that particular stream type.
    ii. Structure types shall simulate disturbance events to the greatest degree possible and include, but are not limited to, log jams, debris flows, wind-throw, and tree breakage.
    iii. Projects can include grade control and bank stabilization structures, while size and configuration of such structures will be commensurate with scale of project site and hydraulic factors.
    iv. The partial burial of large wood is permitted and may constitute the dominant means of placement. This applies to all stream systems but more so for larger stream systems where use of adjacent riparian trees or channel features is not feasible or does not provide the full stability desired.
    v. Anchoring large wood – Anchoring alternatives may be used in preferential order:
    a. use of adequate sized wood sufficient for stability
    b. orient and place wood in such a way that movement is limited
    c. ballast (gravel or rock) to increase the mass of the structure to resist movement
    d. use of large boulders as anchor points for large wood
    e. Pin large wood with rebar to large rock to increase its weight. For streams that are entrenched (Rosgen F, G, A, and potentially B; Rosgen 1994) or for other streams with very low width to depth ratios (<12) an additional 60% ballast weight may be necessary due to greater flow depths and higher velocities.

39. ***Fish passage restoration***. As part of the restoration program, the SNF routinely removes and/or replaces damaged or undersized culverts or bridges, fish passage barrier culverts and resets existing culverts that were improperly installed or damaged. Projects will take place where fish passage has been eliminated (partially or completely) through road construction and during road maintenance activities. Equipment such as excavators, bulldozers, dump trucks, front-end loaders, and similar equipment may be used to implement these projects. All PDCs for fish passage restoration will be used in compliance with:

    a. Stream simulation culvert and bridge projects - All road-stream crossing structures shall simulate stream channel conditions per *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road Stream Crossings* (USDA Forest Service 2008), located at: http://stream.fs.fed.us/fishxing/aop_pdfs.html

        i. Culvert criteria – Within the considerations of stream simulation, the structure shall, at a minimum, accommodate a bankfull wide channel plus constructed banks to provide for passage of all life stages of native fish species (for more information, reference Chapter 6, page 35 of the USFS Stream Simulation Guide). The following crossing-width guidance applies to specific ranges of entrenchment ratios as defined by Rosgen 1996:

        1) Non-entrenched streams: If a stream is not fully entrenched (entrenchment ratio of greater than 1.4), the minimum culvert width shall be at least 1.3 times the bankfull channel width. This is consistent with Anadromous Salmonid Passage Facility Design (section 7.4.2 "Stream Simulation Design") (NMFS 2011 or most recent version). However, if the appropriate structure width is determined to be less than 1.3 times the bankfull channel width.

        2) Entrenched streams: If a stream is entrenched (entrenchment ratio of less than 1.4), the culvert width must be greater than bankfull channel width, allow sufficient vertical clearance to allow ease of construction and maintenance activities, and provide adequate room for the construction of natural channel banks. Consideration should be given to accommodate the floodprone width. Floodprone width is the width measured at twice the maximum bankfull depth (Rosgen 1996).

    b. Bridge design

        i. Bridges with vertical abutments, including concrete box culverts, which are constructed as bridges, shall have channel widths that are designed using the culvert criteria (above). This opinion does not cover bridges that require pile driving within a wetted stream channel.

        ii. Primary structural elements must be concrete, metal, fiberglass, or untreated timber. Concrete must be sufficiently cured or dried[2] before coming into contact with stream flow.

        iii. Riprap must not be placed within the bankfull width of the stream. Riprap may only be placed below bankfull height when necessary for

[2] NMFS recommends 48 to 72 hours, depending on temperature.

protection of abutments and pilings. However, the amount and placement of riprap should not constrict the bankfull flow.

c. Crossing design
    i. Crossings shall be designed using an interdisciplinary design team consisting of an experienced engineer, fisheries biologist, and hydrologist/geomorphologist.
    ii. SNF crossing structures wider than 20 feet or with costs that exceed $100,000 shall be reviewed by the USDA-Forest Service, Region 6, Aquatic Organism Passage Design Assistance Team.
    iii. A least one member of the design team shall be trained in a weeklong Aquatic Organism Passage course based *Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings* (USDA Forest Service 2008).
    iv. Bankfull width shall be based on the upper end of the distribution of bankfull width measurements as measured in the reference reach to account for channel variability and dynamics.
d. NMFS fish passage review and approval - If the structure width is determined to be less than the established width criteria as defined above, a minor project modification must be requested from NMFS for consistency with criteria in NMFS 2011, or most recent version.
e. Headcuts - Headcuts often occur in meadow areas, typically on Rosgen “C” and “E” channel types. Headcuts develop and migrate during bankfull and larger floods, when the sinuous path of Rosgen E type streams may become unstable in erosive, alluvial sediments, causing avulsions, meander cut-offs, bank failure, and development of an entrenched Rosgen G gully channel (Rosgen 1994).
    i. Stabilize headcuts
    1) In streams with current or historic fish presence, provide fish passage over stabilized headcut through constructed riffles for pool/riffle streams or a series of log or rock structures for step/pool channels.
    2) Armor headcut with sufficiently sized and amounts of material to prevent continued up-stream migration of the headcut. Materials can include both rock and organic materials which are native to the area. Material shall not contain gabion baskets, sheet pile, concrete, articulated concrete block, and cable anchors.
    3) Focus stabilization efforts in the plunge pool, the headcut, as well as a short distance of stream above the headcut.
    4) Minimize lateral migration of channel around headcut (“flanking”) by placing rocks and organic material at a lower elevation in the center of the channel cross section to direct flows to the middle of channel.
    5) Short-term headcut stabilization (including emergency stabilization projects) may occur without associated fish passage measures. However, fish passage must be incorporated into the final headcut stabilization action and be completed during the first subsequent in-water work period.
    6) In streams without current or historic fish presence, it is recommended to construct a series of downstream log or rock structures as described in part ii below to expedite channel aggradation.

f. Grade stabilization to promote fish passage associated with headcut stabilization

   i. NMFS fish passage review and approval – If a grade stabilization structure spans the channel and creates one or more discrete longitudinal drops > 6 inches, the Action Agencies will ensure that the action is individually reviewed and approved by NMFS for consistency with criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011, or most recent version).
   ii. Provide fish passage over stabilized headcut through constructed riffles for pool/riffle streams or a series of log or rock structures for step/pool channels.
   iii. Construct structures in a 'V' or 'U' shape, oriented with the apex upstream, and lower in the center to direct flows to the middle of channel.
   iv. Key structures into the streambed to minimize structure undermining due to scour, preferably at least 2.5x their exposure height. The structures should also be keyed into both banks—if feasible greater than 8 feet.
   v. If several structures will be used in series, space them at the appropriate distances to promote fish passage of all life stages of native fish. Incorporate NMFS fish passage criteria (jump height, pool depth, etc.) in the design of step structures. Recommended spacing should be no closer than the net drop divided by the channel slope (for example, a 1 foot high step structure in a stream with a 2% gradient will have a minimum spacing of 50-feet [1/0.02]).
   vi. Include gradated (cobble to fine) material in the rock structure material mix to help seal the structure/channel bed, thereby preventing subsurface flow and ensuring fish passage immediately following construction if natural flows are sufficient.
   vii. If a project involves the removal of multiple barriers on one stream or in one watershed over the course of a work season, remove the most upstream barrier first, if possible.

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, each Federal agency must ensure that its 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 provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The USFS determined the proposed action is not likely to adversely affect critical habitat for Southern Resident killer whales. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12).

2.1 Analytical Approach

This opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This 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 as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced 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 PCEs, PBFs, or essential features. In this opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly 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, or (2) directly or

indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

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' "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 function of the essential PBFs that help to form that conservation value.

One factor affecting the status of ESA-listed species 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 and distribution of ESA-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. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote *et al.* 2014, Mote *et al* 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague *et al.* 2013, Mote *et al.* 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou *et al.* 2014, Kunkel *et al.* 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote *et al.* 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote *et al*. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007, Mote *et al.* 2013). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007, Mote *et al.* 2013). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez *et al.* 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote *et al.* 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua *et al.* 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua *et al.* 2010, Isaak *et al*. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier *et al.* 2011, Tillmann and Siemann 2011, Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al.* 1999, Winder and Schindler 2004, Raymondi *et al.* 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier *et al.* 2008, Wainwright and Weitkamp 2013, Raymondi *et al.* 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode *et al.* 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989, Lawson *et al.* 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest because of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote *et al.* 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7°C by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder *et al*. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely *et al.* 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder *et al.* 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick *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, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005, Zabel *et al.* 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder *et al*. 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these evolutionarily significant units (ESUs) (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney *et al.* 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential PBFs of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-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).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the 5^{th} field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, 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. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

OC coho salmon critical habitat

Critical habitat encompasses 13 sub-basins in Oregon. The long-term decline in OC coho salmon productivity reflects deteriorating conditions in freshwater habitat as well as extensive loss of access to habitats in estuaries and tidal freshwater. Many of the habitat changes resulting from land use practices over the last 150 years that contributed to the ESA-listing of OC coho salmon continue to hinder recovery of the populations; changes in the watersheds due to land use practices have weakened natural watershed processes and functions including loss of connectivity to historical floodplains, wetlands, and side channels; reduced riparian area functions (stream temperature, regulation, wood recruitment, sediment and nutrient retention); and altered flow and sediment regimes (NMFS 2016). Several historical and ongoing land uses have reduced stream capacity and complexity in Oregon coastal streams and lakes through disturbance, road building, splash damming, stream cleaning, and other activities. Beaver removal, combined with loss of large wood in streams, has also led to degraded stream habitat conditions for coho salmon (Stout *et al.* 2012).

The critical habitat unit is defined at the 5th field watershed scale. For this proposed action, there are 23 critical habitat units (Table 8) analyzed in this opinion that are used by OC coho salmon for spawning, rearing, and migration. The CHART rated six of the critical habitat units as medium for conservation value and 19 critical habitat units as high for conservation value to OC coho salmon. The conservation value is the relative importance of the watershed to conservation of the ESU. Activities that have reduced the quality and function of PBFs in the action area critical habitat units include agriculture, forestry, grazing, and urbanization. The PBFs identified for the critical habitat units in the action area are water quality, water quantity, substrate, floodplain connectivity, forage, natural cover, and free of artificial obstruction.

Upper Willamette River steelhead critical habitat

Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.

The critical habitat unit is defined at the fifth-field watershed scale. For this proposed action, there are two critical habitat units (Table 8) analyzed in this opinion that are used by UWR steelhead. The CHART rated the Upper South Yamhill River and Willamina Creek critical habitat units fair to good and fair to poor for conservation value to UWR steelhead. The conservation value is the relative importance of the watershed to conservation of the ESU. Activities that have reduced the quality and function of PBFs in the action area critical habitat units include forestry, agriculture, grazing and urbanization. The PBFs identified for the critical habitat units in the action area are water quality, water quantity, substrate, floodplain connectivity, forage, natural cover, and free of artificial obstruction.

2.2.2 Status of Species

Oregon Coast coho salmon

OC coho salmon were listed as threatened under the ESA on June 6, 2011, and critical habitat designated and protective regulations issues on February 11, 2008 (73 FR 7816). The recovery plan was completed in 2016 (NMFS 2016) and the most recent status review completed in 2015 (NWFSC 2015).

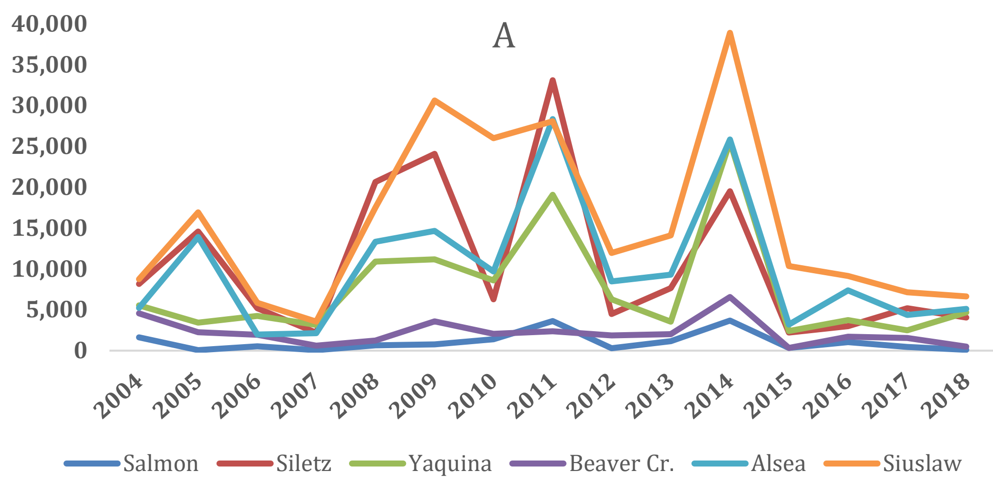
This ESU comprises 56 populations including 21 independent and 35 dependent populations. The last status review (NWFSC 2015) indicates a moderate risk of extinctions. Significant improvements in hatchery and harvest practices have been made for this ESU. Most recently, spatial structure conditions have improved in terms of spawner and juvenile distribution in watersheds; none of the geographic area or strata within the ESU appear to have considerably lower abundance or productivity. The ability of the ESU to survive another prolonged period of poor marine survival remains in question.

Limiting factors for OC coho salmon include:

- Reduced amount and complexity of habitat including connected floodplain habitat
- Degraded water quality
- Blocked/impaired fish passage
- Inadequate long-term habitat protection
- Changes in ocean conditions

The proposed action will affect four dependent populations that include Sand Lake, Rock Creek, Yachats River, and Tenmile Creek. Dependent populations are those that rely on emigrants from nearby independent populations for abundance and productivity. The remaining populations the proposed action will affect are independent populations.

Estimates of returning adult OC coho salmon spawners show considerable variability in the annual abundance from year to year (Figure 1) over the last 15 years. Even with considerable variability in adult return estimates from year-to year, abundance in the affected populations is low, compared to historical levels.



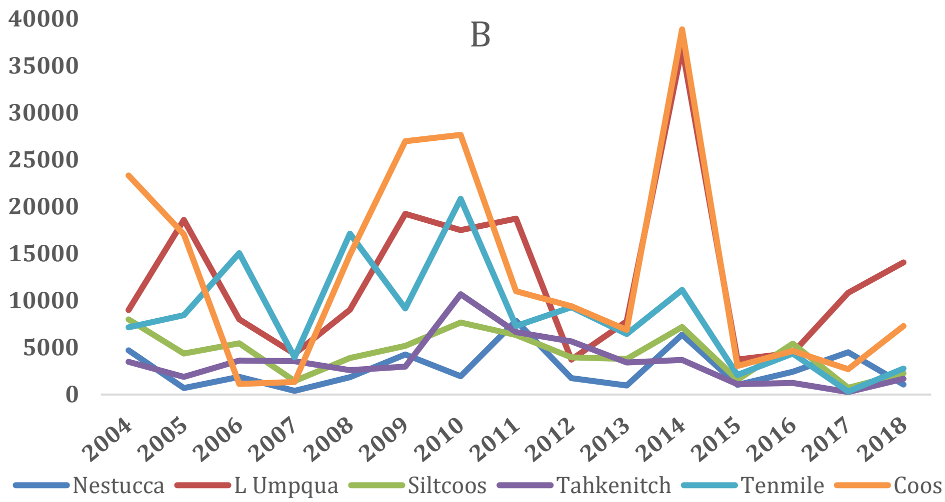


Figure 1. Estimated wild OC coho salmon spawner abundance in the affected populations: (A) Populations in the Mid-Coast stratum, and (B) Populations in the North-Coast (Nestucca), Umpqua (Lower Umpqua), Lakes (lakes populations), and Mid-South Coast (Coos) strata (http://oregonstate.edu/dept/ODFW/spawn/cohoabund.htm).

The OC coho salmon recovery plan discussed the last status review (NWFSC 2015) and the decision support system (DSS) (Lewis 2015) used to evaluate biological recovery criteria for the ESU at two levels, persistence and sustainability. The persistence analysis evaluates the ability of the ESU to persist over a 100-year period without artificial support, including the ability to survive prolonged periods of adverse environmental conditions. The sustainability analysis evaluates the ability of the ESU to maintain its genetic legacy and long-term adaptive potential for the foreseeable future based on habitat availability and other conditions necessary for the full expression of the population's (or ESU's) life history diversity. The DSS uses scores for each independent population to determine the persistence and sustainability of the ESU overall. Table 6 shows the persistence and sustainability scores and the levels of certainty for persistence and sustainability for the independent populations affected by the proposed action analyzed in this opinion.

Table 6. Decision support system persistence and sustainability scores and certainty levels for populations of OC coho salmon covered in this opinion. DSS scores range from -1.00 (high certainty that the population, at its current level, is not persistent or sustainable) to 1.00 (high certainty that a population is persistent or sustainable).

Population	Persistence Score	Persistence Certainty	Sustainability Score	Sustainability Certainty
Nestucca	0.62	High	0.45	Moderate to High
Salmon	-1.00	High	-1.00	High
Siletz	0.81	High	0.58	Moderate to High
Yaquina	0.85	High	0.73	High
Beaver	0.82	High	0.56	Moderate to High
Alsea	0.81	High	0.64	High
Siuslaw	0.85	High	0.85	High

Population	Persistence Score	Persistence Certainty	Sustainability Score	Sustainability Certainty
Siltcoos Lake	0.95	High	0.85	High
Tahkenitch Lake	0.82	High	0.70	High
Tenmile Lakes	0.90	High	0.88	High
Lower Umpqua	0.81	High	1.00	High
Coos	0.89	High	1.00	High

The common factors limiting production and abundance of OC coho salmon in these populations include stream complexity and water quality. Uncommon population specific limiting factors include spawning gravel for Beaver Creek and non-native fish species for the Lakes populations.

Upper Willamette River steelhead

UWR steelhead were listed as threatened on January 5, 2006 (71 FR 834). A recovery plan is available for this species (ODFW and NMFS 2011).

Spatial Structure and Diversity. This distinct population segment (DPS) includes all naturally-spawned anadromous winter-run steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to and including the Calapooia River (USDC 2014). Four demographically independent populations (DIPs) of UWR steelhead occur within the DPS (Table 7). Historical observations, hatchery records, and genetics suggest that the presence of UWR steelhead in many tributaries on the west side of the upper basin is the result of recent introductions. Nevertheless, the Willamette/Lower Columbia Technical Recovery Team (WLC-TRT) recognized that although west side UWR steelhead does not represent a historical population, those tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. Hatchery summer-run steelhead that are released in the subbasins are from an out-of-basin stock, and are not part of the DPS, nor are stocked summer steelhead that have become established in the McKenzie River (ODFW and NMFS 2011).

Table 7. Scores for the key elements (A&P, diversity, and spatial structure) used to determine current overall viability risk for UWR steelhead (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

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

The UWR steelhead affected by this program are from the west-side tributaries population area, which is not a demographically independent population. Winter steelhead have been reported spawning in the west-side tributaries to the Willamette River upstream of Willamette Falls and ODFW recognizes the Tualatin, Yamhill, Rickreall, and Luckiamute west-side sub-basins as part of the Willamette Winter Steelhead special management unit. In the WLC-TRT assessment, these tributaries were not considered to have constituted independent populations historically. Rather, these tributaries may have functioned and continue to function as a population sink with the DPS metapopulation structure (Myers *et al.* 2006). Conversely, under current condition or future conditions, steelhead production from west-side sub-basins may help buffer or compensate for independent populations that are not meeting recovery goals.

There has been no significant change in the UWR steelhead hatchery programs since the previous ESA status review (Jones 2015). The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity because there is some overlap in the spawn timing for summer- and late-winter steelhead. Genetic analysis suggests that there is some level introgression among native late-winter steelhead and summer-run steelhead (Van Doornik *et al.* 2015), and up to approximately 10% of the juvenile steelhead at Willamette Falls and in the Santiam Basin may be hybrids (Johnson *et al.* 2013). While winter-run steelhead have largely maintained their genetic distinctiveness over time (Van Doornik *et al.* 2015), there are still concerns that hybridization will decrease the overall productivity of the native population. In addition, releases of large numbers of hatchery-origin summer steelhead may temporarily exceed rearing capacities and displace winter-run juvenile steelhead (NWFSC 2015).

Abundance and Productivity. For the UWR steelhead DPS, the declines in abundance noted during the previous review (Ford *et al.* 2011) continued through the period 2010-2015, and accessibility to historical spawning habitat remains limited, especially in the North Santiam River. Although the recent magnitude of these declines is relatively moderate, the NWFSC (2015) notes that continued declines would be a cause for concern. 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. Habitat restoration projects completed in upper Willamette River tributaries are expected to eventually provide benefit to the UWR steelhead DPS, however, the scale of improvements needed is greater than the scale of habitat actions implemented to date (NMFS 2016). Harvest rates on UWR steelhead have remained stable and relatively low since the last status review, and research impacts remain low. Pinniped predation on UWR steelhead appears to be increasing, for example in 2014 when 11-18% of the total winter steelhead run entering the Willamette River was consumed by pinnipeds at Willamette Falls (Wright *et al.* 2014). However, we currently are unable to quantify the resulting change in extinction risk due to predation. The impacts that hatcheries and climate change pose to long-term recovery also remain a concern. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford *et al.* 2011), and collective risk to persistence of the DPS has not changed significantly (NWFSC 2015, NMFS 2016).

Recent estimates of escapement in the Molalla River indicate abundance is stable but at a depressed level, and the lack of migration barriers indicates this limitation is likely due to habitat degradation (NWFSC 2015). In the North Santiam, recent radio-tagging studies and counts at Bennett Dam between 2010 and 2014 estimate the average abundance of returning winter-run adults is following a long-term negative trend (Jepson *et al.* 2013, 2014, and 2015). In the South Santiam live counts at Foster Dam indicate a negative trend in abundance from 2010-2014, and redd survey data indicate consistent low numbers of spawners in tributaries (NWFSC 2015). Radio-tagging studies in the Calapooia from 2012-2014 suggest that recent abundances have been depressed but fairly stable, however, long-term trends in redd counts conducted since 1985 are generally negative (Jepson *et al.* 2013, 2014, and 2015).

The underlying cause(s) of these declines is not well understood. Returning winter steelhead do not experience the same deleterious water temperatures as the spring-run Chinook salmon. Improvements to Bennett Dam fish passage and operational temperature control at Detroit Dam may be providing some stability in abundance in the North Santiam River DIP. It is unclear if sufficient high quality habitat is available below Detroit Dam to support the population reaching its viable salmonid population (VSP) recovery goal, or if some form of access to the upper watershed is necessary to sustain a "recovered" population. Similarly, the South Santiam Basin may not be able to achieve its recovery goal status without access to historical spawning and rearing habitat above Green Peter Dam (Quartzville Creek and Middle Santiam River) and/or improved juvenile downstream passage at Foster Dam. Overall, none of the populations in the DPS are meeting their recovery goals.

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

- Degraded freshwater habitat, including floodplain connectivity and function, channel structure and complexity, incubation gravels, riparian areas, and gravel 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 due to migration barriers and impaired fish passage at dams
- Altered food web due to changes in inputs of microdetritus
- Predation by native and non-native species, including hatchery fish and pinnipeds
- Competition related to introduced races of salmon and steelhead
- Altered population traits due to natural origin fish interbreeding with hatchery origin fish

2.3 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). This assessment addresses actions on the 630,000-acre Siuslaw National Forest that are located within "Late Successional Reserve" (LSR), "Adaptive Management Areas (AMA's), and "Matrix" land allocations (Table 8) and any projects on private land paid for by the Siuslaw National Forest (in full or in part).

Table 8. Distribution of land management allocations in the SNF by 5th field watersheds that are within listed fish habitat.

Watershed Name [1] (5th field)/ HUC Number	Adaptive Management (AMAs)	Late-Successional Reserve (LSR)	Matrix	Total Acres
Willamina-1709000801	1,066	0	0	1066
Agency Creek - Yamhill River 1709000802	5,397	0	0	5,397
Little Nestucca - 1710020301	16,324	2,707	0	19,031
Nestucca River - 1710020302	66,529	2,853	0	69,382
Sand Lake - 1710020309	14,889	699	0	15,588
Big Elk Creek - 1710020402	0	11,122	5,029	16,151
Lower Yaquina River - 1710020403	0	3,375	0	3,375
Lower Siletz River - 1710020407	6,468	16,081	0	22,549
Salmon River - 1710020408	11,125	191	0	11,316
Rock Creek - 1710020409	2,034	0	0	2,034
Five Rivers - 1710020502	0	29,275	17,500	46,775
Drift Creek - 1710020503	0	22,405	524	22,929
Lower Alsea River - 1710020504	0	32,471	9,214	41,685
Beaver Creek Frontal -1710020505	0	15,690	1,873	17,563
Yachats River - 1710020506	0	20,965	152	21,117
Tenmile – 1710020507	2,964	36,632	1,862	41,458
Deadwood Creek - 1710050604	0	23,821	5,028	28,849
Indian Creek - 1710020605	0	19,762	5,619	25,381
Lake Creek - 1710020606	0	2,357	1,886	4,243
North Fork Siuslaw -1710020607	0	26,274	5,634	31,908
Siltcoos River -1710020701	17,077	13,754	4,499	35,330
Lower Smith River -1710030307	185	40,930	616	41,731
Lower Umpqua River -1710030308	0	12,844	24	12,868
Coos Bay Frontal - 1710030403	3,471	0	0	3,471
Tenmile Frontal - 1710030404	8,685	0	0	8,685
Total	156,214	334,208	59,460	549,882

The proposed action would result in wide-ranging effects across multiple watersheds and, therefore, the action area is defined at the sub-basin scale. The action area includes seven sub-basins occupied by OC coho salmon including the Wilson/Trask/Nestucca, Siletz/Yaquina, Alsea/Yachats, Siuslaw, Coastal Lakes – Pacific/Siltcoos, and Umpqua. For this consultation, the action area consists of upland, riparian, and aquatic areas affected by vegetation and aquatic restoration treatments, roadwork and use, quarry operations, and fuels treatment at each project site. Site-specific action areas are located near non-fish-bearing streams, riparian areas, and uplands that have a direct link to the proposed action. The action area is comprised of Federal forest service lands and private lands where the SNF conducts restoration work or contributes funding for restoration work on private lands.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The climate change effects on the environmental baseline are described in Section 2.2, above. Climate change is likely to play an increasingly important role in determining the abundance of OC coho salmon and UWR steelhead and the conservation value of designated critical habitats.

During the last five years, NMFS has engaged in Section 7 consultation on Federal projects affecting these populations and their habitats in the action area and those impacts have been taken into account in this opinion. These consultations include the North Fork Siuslaw Riparian Thinning project, the Bureau of Land Management Resource Management Plan for Western Oregon opinion, many restoration projects implemented under the ARBO II programmatic biological opinion, and routine maintenance actions under the RAMBO programmatic biological opinion.

2.4.1 Critical Habitat in the Action Area

Designated critical habitat in these population sub-basins includes that which supports OC coho salmon and UWR steelhead migration, rearing, and spawning. The PBFs of critical habitat that are essential to support conservation of OC coho salmon and UWR steelhead in the action area include passage free of artificial obstruction, water quality, water quantity, forage, natural cover, floodplain connectivity, and substrate.

Key management activities that have reduced the quality and function of OC coho salmon and UWR steelhead critical habitat in the action area include agriculture, forestry, grazing, and urbanization. Each of these activities has contributed to a myriad of interrelated factors for the decline in quality and function of critical habitat PBFs essential for the conservation of OC coho salmon and UWR steelhead. Among the most important changes to critical habitat are altered stream channel morphology, degradation of spawning substrates, reduced in-stream roughness and cover, loss and degradation of riparian areas, water quality degradation (e.g., temperature, sediment, and dissolved oxygen), blocked fish passage, and loss of habitat refugia (off-channel habitat and floodplain connectivity).

Although we identify a myriad of factors for the reduced quality and function of critical habitat in the action area, federal lands managed under the NWFP amendment over the last 20 years show an overall improvement in aquatic ecosystems (Reeves *et al.* 2016). The aquatic conservation strategy (ACS) was developed to guide management of aquatic ecosystems on federal lands in the NWFP area that would meet potential ESA-listed fish requirements. The ACS was expected to make significant contributions to the recovery of the ESA-listed fish by increasing the quantity and quality of freshwater habitat for Pacific salmon and protecting and enhancing habitats of other species (FEMAT 1993). Specifically, the ACS objectives address diversity and complexity of watershed features; spatial and temporal connectivity within and between watersheds; physical integrity; water quality; sediment input, storage, and transport; in-stream flows (e.g., both peak and low-flows); floodplain inundation; riparian plant species composition and structural diversity; and habitat to support well-distributed populations of native plant, invertebrate, and vertebrate aquatic - and riparian-dependent species.

The AREMP was developed to implement the ACS monitoring strategy (Reeves *et al.* 2004). Monitoring was to assess trends in ACS goals to restore and maintain ecological processes that create and maintain aquatic ecosystems for a suite of aquatic and riparian-dependent organisms, including fish that would potentially be listed under the ESA, and for clean water and other ecological services (USDA and USDI 1994). The program's intent has been to characterize the condition of watersheds by assessing in-channel, riparian and upslope conditions.

From these recent analyses that address the entire data set from AREMP inception through the 20-year post-NWFP amendment implementation, results suggest that the overall distribution of watershed conditions has remained relatively stable (Miller *et al.* 2017). Yet on a per-watershed scale, changes were apparent. Areas that were most heavily managed (e.g., intensive timber production and high road densities) before the NWFP amendment showed the largest improvements in overall condition, primarily because of increased size of trees in riparian areas and reductions in roads through decommissioning.

2.4.2 Species in the Action Area

The action area is occupied by OC coho salmon and UWR steelhead. The independent populations of OC coho salmon that occupy the action area include the Nestucca, Salmon, Siletz, Yaquina, Alsea, Siltcoos, Siuslaw, Lower Umpqua and Coos Rivers; and Beaver, Tahkenitch, and Tenmile (Lakes) Creeks. OC coho salmon from the Sand Lake, Rock and Tenmile Creeks, and Yachats River dependent populations also occupy the action area. Adults from these populations typically migrate into spawning tributaries from October to January with peak spawning occurring in November and December. Coho salmon smolts migrate to the ocean beginning in March ending in June with peak migration occurring in April and May. Coho salmon fry emerge from spawning gravels in the spring and over-summer as juvenile parr in tributaries and streams that provide cold-water refuge and have a high degree of habitat complexity including complex pools, large wood structures, undercut banks, and off-channel habitat.

UWR steelhead that are present in the action area are part of the west-side tributaries population area, which is not a demographically independent population. Specifically, UWR steelhead occupy Kitten, Agency, and Pierce Creeks, which are tributaries to the South Yamhill River. Run timing of UWR steelhead is a legacy of the fact that, before construction of a fish ladder at Willamette Falls in the early 1900s, flow conditions allowed steelhead to ascend Willamette Falls only during the late winter and spring. Thus, the majority of the UWR steelhead adults return to freshwater in January through April, pass Willamette Falls, from mid-February to mid-May, and spawn in March through June, with peak spawning in late April and early May. Juvenile steelhead rear in headwater tributaries and upper portions of the sub-basins for one to four years (most often two years), then as smoltification proceeds in April through May, migrate quickly downstream through the mainstem Willamette River and Columbia River estuary and into the ocean.

Factors limiting the recovery of OC coho salmon and UWR steelhead considered in this opinion vary with the overall condition of aquatic habitats on private, state, and federal lands. The environmental baseline in the action area is also degraded by key management activities including agriculture, grazing, forestry, and urbanization. These activities and the changes to critical habitat described above have adversely affected OC coho salmon and UWR steelhead individuals in the action area and have contributed to their decline. Construction and operations related to the key management activities have resulted in direct take and adverse behavioral modification of OC coho salmon and UWR steelhead that have caused reduced growth, survival, and fitness of individuals.

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

The BA included an evaluation of the effects of forest management actions and their associated activities on OC coho salmon, UWR steelhead, and their designated critical habitat in the action area. The assessment in the BA was adapted from the "Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish within the Northwest Forest Plan Area," November 2004 (AP) (USDA, USDC, and USDI 2004). The action as proposed in the BA does not provide site specific details on any aspect of the individual management actions. Instead, the BA describes the expected effects of each major project element (i.e., timber felling, timber yarding, timber hauling, road and landing work including rock quarry operations, and fuels treatment, with each element being modified using the proposed PDCs) on habitat indicators adapted from the AP. The habitat indicators considered here are as follows:

1. Stream temperature
2. Suspended Sediment and Substrate Embeddedness
3. Chemicals and Nutrients
4. Physical Barriers
5. Woody Material
6. Pool Frequency and Quality
7. Changes in Peak/Base Flows
8. Drainage Network Increase
9. Road Density and Location
10. Disturbance History and Disturbance Regime
11. Riparian Reserves

Because specific project information is not available at this time, we will analyze the effects of the proposed action by considering how the SNF would implement each project element using the PDCs presented in Section 1.3 (*Proposed Federal Action*) to determine which effects species and critical habitat would be exposed to and how species and critical habitats would respond to those exposures and the risks associated with those exposures and responses.

NMFS has evaluated the initiation package and determined that it provides a comprehensive assessment of the effects of the proposed action. The assessment is based on the best available scientific and commercial information. Based on our assessment of the BA we agree with the assessment of most of the indicators assessed in the Effects of the Proposed Action section (e.g., Section 3.1) of the BA and adopt them here and briefly summarize them below (50 CFR 402.14(h)(3)).

- ***Physical barriers***. Road maintenance, construction, and reconstruction; road decommissioning and closure; and fish passage restoration would include the installation, replacement or removal of undersized or failing road stream crossing structures. The PDCs related to road activities or road stream crossings will result in removal or improvements to road stream crossings such that fish passage, sediment and wood transport, and flow would be improved throughout the action area.
- ***Peak and base flows***. While it is likely that the proposed action would affect peak and base flows, implementation of the PDCs would only result in minor changes to peak and base flows. Vegetation changes resulting from tree falling/tipping, fall and leave, snag creation, yarding corridors, and roadside hazard tree removal will result in short-term reduced evapotranspiration, increasing soil water, and therefore increasing yield. Other work would reduce soil water infiltration affecting storage, delivery and timing of flow to stream channels. However, the limited spatial extent or intensity of the planned work would likely result in minor changes in peak and base flows that would not meaningfully change peak and base flows in the action area.
- ***Road density and location***. Implementation of the proposed action would commonly result in short-term negative effects to this indicator, but the effects would be minor and not likely result in measurable effects to LFH or ESA-listed fish to the PDCs implemented by the SNF (no hydrologic connection of roads to the stream network through surface flows).
- ***Riparian Reserves***. The proposed action would cause an adverse effect to this watershed condition indicator. The magnitude of effect can be assessed by referring to the likely effects on related individual habitat indicators (e.g., temperature, wood recruitment). However, the proposed thinning would only affect a small proportion of the riparian reserves and, most impacts of the proposed thinning would be minimized before they can reach the stream. This is because the riparian restoration zones and PDCs would minimize the effects of shade loss and in-stream wood recruitment, and these functions will continue to be provided by the unlogged areas. In addition, the majority of sediment and nutrients would be intercepted and immobilized by the undisturbed soil and vegetation on the forest floor within the riparian zones. No clearcutting (or regeneration cutting) would occur and existing plantations would be thinned to maintain a minimum 40% canopy cover.
- ***Disturbance History and disturbance regime***. The proposed action will disturb stands and riparian features, and thereby affect the history and disturbance regime indicators. These are watershed condition analysis indicators associated with spawning, rearing, and migration. The effects of the proposed action on disturbance history and disturbance

regime indicators will be minor because: 1) The SNF will only treat managed plantation stands and not natural stands; 2) includes meaningful PDCs to reduce the effects of management on stream and riparian function; 3) uses road reconstruction to reduce the adverse impacts of previously constructed roads; and 4) the new road construction will be either temporary and will have no hydrological connections to the stream network through surface flow. Moreover, to the extent that the proposed action, including fuels treatment, is successful in promoting tree growth to develop more late-seral characteristics and a more natural fire disturbance regime, it will also contribute to an overall pattern of disturbance where the frequency and extent of change due to processes such as fire and insects will be more similar to historic forest conditions than the current environmental baseline.

For stream temperature, suspended sediment and substrate character and embeddedness, chemical contaminants and nutrients, woody debris, pool frequency and quality, large pools, off-channel habitat, refugia, width to depth ratio, streambank condition, and floodplain connectivity we do not disagree with the conclusions of the BA; however, NMFS has evaluated these sections of the BA and after our independent, science-based evaluation, we determined the following information is needed to meet our regulatory and scientific standards.

Stream temperature

Removing trees in riparian areas reduces the amount of shade which exposes streams to increased thermal loading (Moore and Wondzell 2005). In clearcuts, small effects on shade were observed in studies that examined no-cut buffers 46 m (150 feet) wide (Anderson *et al*. 2007, Leinenbach *et al*. 2013, 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 more than 46 m (150 feet) during most of the day in the summer (Leinenbach 2011). Although clearcuts were used in these studies, the results demonstrate that vegetation that is 46 m (150 feet) away from streams contributes shade to streams in some situations.

The relationship between the width of no-cut buffers on thinning versus clearcut prescriptions and stream shade is difficult to generalize because of the limited number studies that have specifically evaluated no-cut buffers in thinning prescriptions. As is seen in no-cut buffer widths with clearcut prescriptions, the wider no-cut buffers resulted in lower reductions of stream shade (Anderson *et al.* 2007, Science Team Review 2008, Park *et al*. 2008). In addition, the canopy density of the no-cut buffer appeared to have an ameliorating effect on thinning activities outside of the buffer, with higher protection associated with greater canopy densities in the no-cut buffer (Leinenbach *et al.* 2013). Finally, higher residual vegetation densities outside of the no-cut buffers were shown to result in less shade loss (Leinenbach *et al.* 2013).

Although 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. Silvicultural prescriptions used by the SNF to retain variable amounts of shade are intended to minimize the importance of those site-specific differences, and result in less stream exposure to thermal loading. 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).

Tree feeling/tipping, snag creation, and fall and leave (reduction in canopy cover). The SNF proposed an average of 3,000 acres of upland vegetation restoration thinning (range 1,500 to 10,000 acres) and up to 3,000 acres of vegetation/aquatic riparian reserve thinning (range 1,000 to 3,000 acres) annually. Vegetation and aquatic riparian reserve thinning would only occur in managed plantation stands and not natural stands. The SNF will minimize loss of stream shade by providing inner and outer riparian restoration zones on all streams (Table 9).

Table 9. Riparian restoration zones by stream class within riparian reserves. SPTH = 200 feet.

Stream Class/Definition	Riparian Restoration Zones		
	Outer Zone	**Inner Zone**	**No Equipment Zone**
Class 1 - A waterbody containing species listed under the Endangered Species Act (ESA), or municipal water source	100 feet – two SPTH vegetation and aquatic restoration activities	0-100 feet aquatic restoration only	50 feet
Class 2 – Fish-bearing streams and ponds	75 feet – two SPTH vegetation and Aquatic	0-75 feet Aquatic restoration	50 feet
Class 3 - Non-fish-bearing streams and ponds that flow perennially	30 – one SPTH Vegetation and aquatic restoration activities	0-30 feet Aquatic restoration only	30 feet
Class 4 - Non-fish-bearing streams and ponds that flow intermittently	15 – one SPTH Vegetation and aquatic restoration activities	0-15 feet Aquatic restoration only	15 feet

Within inner riparian restoration zones, only aquatic restoration thinning would occur (fall and leave, tree falling/tipping). The inner riparian restoration zone would be the widest on units adjacent to streams that are LFH and get smaller on streams that are not LFH. Common practice would be for SNF not to remove fallen or tipped trees from the inner riparian zone. The outer riparian restoration zone would include aquatic and vegetation restoration thinning. No thinning treatments within the riparian restoration zones of a stand will reduce live canopy cover below 40%.

The units on LFH will have 100-foot inner riparian zone where only aquatic restoration thinning would occur to no lower than 40% canopy cover, which would increase solar radiation to the stream (Anderson *et al.* 2007, Leinenbach *et al.* 2013, Groom *et al.* 2011a, Groom *et al.* 2011b). The units with 30-foot to 75-foot inner riparian zones thinned to no lower than 40% canopy cover would allow more radiation to reach the streams, and could increase stream temperature; however, the size of the streams would be smaller, and these buffers would likely provide the majority of shade needed to minimize an increase in stream temperature (Anderson *et al.* 2007, Leinenbach *et al*. 2013, Groom *et al.* 2011a, Groom *et al.* 2011b). For these streams with the smaller buffers that are in close proximity to LFH, it is likely that the increases in stream temperature will transfer downstream to LFH. The effects will continue for decades until the vegetation recovers. The SNF will minimize increases in stream temperature from tree falling/tipping, fall and leave, and snag creation by implementing PDCs 27 and 28. The PDCs will minimize the loss of shade associated with thinning and the increase in solar radiation to adjacent streams.

Again, the relationship between the width of no-cut buffers on thinning versus clearcut prescriptions and stream shade is difficult to generalize because of the limited number studies that have specifically evaluated no-cut buffers in thinning prescriptions. Thus, quantifying the stream shade loss and subsequent stream temperature increase is difficult. Nonetheless, the best available scientific information supports a direct relationship between the loss of shade resulting from tree harvest in riparian areas with stream buffers and localized increases in stream temperatures. Resulting increases in stream temperature are variable depending on the intensity of harvest and other factors described above (stream size, substrate type, stream discharge, topography, channel aspect, and forest structure and species composition) and could range from not measureable (low intensity thinning) to significant increases that render aquatic habitats unusable during certain seasons (clearcutting). Because the SNF's program consists of thinning in the outer riparian zone (100 to 2 SPTH) and a small amount of tree tipping in the inner riparian zone (0 to 100 feet), it is reasonably certain the program will result in a small amount of shade loss and subsequently, a localized and temporal increase in stream temperature that would cause minor adverse effects to aquatic habitat.

Tree yarding. The SNF proposed to use yarding corridors that will also require removal of some trees in the upland and the riparian reserves. 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 (12-15 feet wide) when compared to the size of a typical timber harvest unit. The effects will continue for decades until the vegetation recovers. The SNF will minimize changes to stream temperature by implementing PDC 29.

Tree removal. The SNF proposed to conduct tree removal from treatment units following falling. Tree removal refers specifically to removal of trees after they have been fallen by the SNF to achieve specific restoration objectives. Tree removal may occur near streams, or stream reaches, occupied by or that provide habitat for ESA-listed salmonids, where the forest is a densely stocked monoculture of Douglas fir. Since the removal of trees has no mechanism to affect stream temperature, tree removal will not have effects on stream temperatures.

Road maintenance, reconstruction, construction and landings. The SNF proposed to conduct road maintenance on up to 400 miles (range 50 to 400 miles) of road construction and reconstruction and construction of up to 100 miles (range 20 to 100 miles) of permanent and temporary roads annually. Removing trees associated with roadwork and landings in riparian areas reduces the amount of shade, which exposes the stream to increased thermal loads (Moore and Wondzell 2005). Road maintenance, reconstruction, and construction and road hazard tree removal in the riparian reserves would remove trees and cause a decrease in shade and a subsequent increase in stream temperature; however, on a much smaller magnitude than commercial timber harvest. To minimize the changes to stream temperature from road construction, reconstruction, and maintenance, the SNF will implement PDCs 32 and 33.

As part of road construction, reconstruction, and maintenance, the SNF proposed to install road stream crossings (culverts and bridges). The SNF proposed to conduct up to eight aquatic restoration projects per year, but did not provide an estimate of how many culverts and bridges would be installed annually on temporary roads. At crossings where overstory vegetation would be required, the SNF would remove only a small amount. In addition, there will be a spatial and temporal separation of temporary stream crossing installations and removals across the action area, which will prevent an aggregation of increases in stream temperature.

As described above, the effects of removing trees in the riparian reserves could cause a slight increase in stream temperature. Depending on the location of the roads, and stream crossings, the increased stream temperature could affect LFH.

Water withdrawal from road work can affect water quantity, and thus could cause a temporary increase in stream temperature. Stream flows may be temporarily reduced downstream from the withdrawal point. The amount of flow decrease from water withdrawals would depend on the amount of stream flow, how much water is withdrawn, and the duration of water drafting. Water trucks commonly hold 500 gallons of water, with a withdrawal rate of up to approximately 7.5 gallons per second. This means the maximum withdrawal would last at least 67 sec, and the maximum withdrawal period commonly is less than 5 minutes at lower rates of withdrawal. Water withdrawals are likely to occur during summer low-flow periods. While discharge to LFH will likely be reduced (less than 10% change) for a short period of time (less than 5 minutes), the magnitude of flow reductions is not likely to increase stream temperatures. This is because the periods of withdrawal will be short and will not affect inflow from tributary streams and hyporheic flow downstream from the point of withdrawal.

Road decommissioning and closure. The SNF proposed to decommission and close temporary roads after a thinning restoration project is complete. Decommissioning may include removal of all stream culverts, water barring, re-establishment of natural drainage patterns, subsoiling, slope pullback, recontouring, and blocking vehicle access with berms or large rock. If there are no stream crossings, and vegetative recovery has occurred, a road can be decommissioned through closure to vehicle access and administratively removing the road from the system. Road closure may include water bars, removing of culverts, out-sloping road surface, fill slope pullback, decompaction of roadway, modification of culvert fill depths, upsizing culverts, drainage maintenance and other similar type work. Roads may be closed/blocked to public and still used for limited access (utility line access, private property access, administrative use, etc.). The SNF will ensure that after culvert removal, the site will match the approximate bed elevation and bank-full stream width of the existing streambed. The SNF would minimize the effects of road decommissioning and closure by implementing PDC 34.

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 PDCs required by the SNF, specifically matching the natural bank profile, and re-establishing 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 re-establishment of overstory vegetation. Once the overstory vegetation is re-established, there will be a recovery of stream shade, and a subsequent decrease in stream temperature. There will be long-term beneficial effects from removing roads adjacent to streams. Removal of roads and decompacting the road bed will allow establishment of overstory vegetation, increase stream shade, and decrease stream temperature. The positive impacts of road decommissioning on stream temperature will outweigh the temporary minor negative effects on stream temperature for removing culverts.

Road use. Timber hauling will not cause any vegetation removal. Since there is no causal mechanism to affect stream shade, timber hauling will not have an effect on stream temperature.

Rock quarry operations. Rock quarry development and operation will include vegetation and soil removal, excavation, drilling and blasting, crushing, sorting, and piling of rock materials. The SNF will not develop any new rock quarries in riparian reserves. Since there is no causal mechanism to affect stream shade, rock quarry operations will not have an effect on stream temperature.

Fuels treatment. Treatment methods include construction and burning of hand piles within 100 feet of open roads and burning any machine piles on landings, and understory prescribed fire of units. Piles would be mechanical or hand-built and 8 feet by 8 feet by 6 feet high and at least 20 feet apart. Understory prescribed fire of units involves igniting the understory and preventing the spread of fire outside the unit boundary during times of higher moisture content. Typically, a mosaic patchwork of the understory vegetation, leaf litter, and duff are consumed through understory prescribed fire. The implementation of the PDCs described above will likely prevent any damage to trees that could remove stream shade. Thus, fuels treatment is not likely to affect stream temperature by reducing shade.

Surface water may be diverted for fuels treatment. The SNF will follow the same PDCs described in the Water Withdrawal for Road Work section, and the effects on stream temperature will be as described in this section.

Suspended sediment and substrate character and embeddedness

Forest activities can increase sediment supply to streams via increased mass wasting (primarily landslides) (Swanson and Dyrness 1975, Swanston and Swanson 1976, Furniss *et al.* 1991, McClelland *et al*. 1997, Robison *et al.* 1999) or surface erosion (most commonly from road surfaces (Haupt 1959, Swanson and Dyrness 1975, Swanston and Swanson 1976, Beschta 1978, Megahan 1987).

Timber falling/tipping, fall and leave, and snag creation. 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., more than 70% concave, more than 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, thinning will greatly reduce the number of living trees within the treated stands. As the roots of harvested trees die and decompose, their effectiveness in stabilizing soils will decrease over time. However, 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.

Timber felling and yarding disturbs soils and increases their potential for transport to area stream channels. Logging alone does not appear to increase surface erosion significantly (Likens *et al*. 1970, Megahan *et al.* 1995), although use of heavy machinery to transport cut logs causes soil compaction, leading to increased surface erosion and increased fine sediment delivery to streams (Williamson and Neilson 2000). For all types of surface erosion, sediment delivery to streams is through direct surface water connections such as ditches, rills, or gullies (Bilby *et al*. 1989, Croke and Mocker 2001).

Streamside buffer strips are generally not as effective in preventing channelized flow, but are effective where sheet erosion occurs; however, the effectiveness of buffer strips for preventing sediment movement within the buffer increases with the presence of herbaceous vegetation and slash (Belt *et al.* 1992). 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 SNF proposed to conduct only aquatic restoration treatments in the 15-foot to 100-foot inner riparian zones for streams adjacent to thinning units in the action area, depending on stream class. Within the inner riparian zones disturbance to the forest floor, shrubs, and herbaceous ground cover would be minimal from fall and leave and tree tipping; such that it is unlikely to cause a meaningful change in suspended sediment or substrate character or embeddedness.

Tree yarding. Yarding would occur in areas immediately adjacent to streams in the action area. Sediment delivery from timber yarding may be increased via several mechanisms: loss of vegetative cover may increase splash erosion and decrease slope stability, yarding can cause extensive soil disturbance and compaction which may cause increased splash erosion and channelized runoff (Spence *et al.* 1996). The potential for surface erosion is directly related to the amount of bare compacted soil exposed to rainfall and runoff; hence, landings, skid trails and disturbed clearcut areas may contribute large quantities of fine sediment to streams (Swanston and Swanson 1976).

The four methods utilized for tree yarding on the SNF include, ground-based, skyline, tethered, and helicopter yarding. Ground-based yarding systems utilize hand felling or heavy-equipment (i.e. feller-bunchers) to fell trees and then move trees through a designated skid trail network by carrying trees (on forwarders or other equipment) or partially suspending trees and skidding them over the ground (with skidders). In skyline systems, trees are carried by full or partial suspension of trees on the cable system. Typically, only intact treetops are touching the ground as they yard them over the ground to the landing through designated corridors. Tethered systems are for slopes over 40%, which allows equipment to tie off to an anchor point and lower itself down. The unit has an arm and cut-to-length processing head that reaches into the stand to harvest designated trees. Helicopter yarding systems lift and fly individual trees or small groups of trees from their downed locations within the forest to landings or to stream locations (in the case of in-stream wood placement).

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 reduces soil impacts because logs are fully suspended above the ground.

To minimize the effects of yarding on suspended sediment and substrate character and embeddedness in LFH, the SNF would implement an equipment exclusion zone ranging from 15 feet to 50 feet, depending on stream class, and PDC 29.

The no equipment zones and yarding PDCs required by the SNF will ensure that most fine sediment generated by yarding will not reach streams. This is because the PDCs and size of the no equipment exclusion zones on streams adjacent to and upstream of LFH will prevent most sediment from entering stream (Burroughs and King 1989, Corbett and Lynch 1985, Gomi *et al.* 2005). Thinning units with 15-foot to 30-foot no equipment zones, while providing some protection will allow small amounts of sediment to enter streams; however, these are on small, perennial, and intermittent streams, and are further away from LFH. In addition, the PDCs required for tree yarding will limit ground-based yarding to slopes less than 35%, excluding ground-based machinery from the equipment exclusion zones, and limiting operations to periods of low soil moisture content, minimizing the amount of sediment generated from yarding.

Because of the widths of the inner riparian restoration zones and that only aquatic restoration activities will occur there, the ground cover and existing root systems along with the surface soil litter and residual slash will help stabilize streambanks and prevent the transport of soils to streams (Belt *et al.* 1992). For these reasons, restriction of the inner riparian zone to aquatic restoration activities and the PDCs are likely to ensure that the effects of suspended sediment due to yarding will only cause a small increase, if any, in suspended sediment and substrate character and embeddedness within LFH.

Tree removal. The SNF proposed to conduct tree removal from treatment units following tree falling. Tree removal refers specifically to removal of trees after they have been fallen by the SNF to achieve specific restoration objectives. Tree removal may occur near streams, or stream reaches, occupied by or that provide habitat for ESA-listed salmonids, where the forest is a densely stocked monoculture of Douglas fir.

The effects of tree removal on sediment transport depends on a number of local site conditions including climate, vegetation, topography, soil type, the type and extent of disturbance and the proximity of the disturbance to the stream channel. The removal of trees does not change the infiltration capacity of forest soils sufficiently to cause infiltration limited surface erosion. While the absence of trees does not increase surface erosion, the manner in which they were removed, and the site-preparation techniques used after harvest may increase its risk. The SNF proposed inner riparian zones where only fall and leave or tree tipping would occur. In these inner zones, tree removal would not be common and, therefore, would occur infrequently. Based on this and the SNF's implementation of PDCs to minimize sedimentation to streams, it is unlikely that tree removal will change suspended sediment and substrate character and embeddedness in the action area.

Tree planting, tree culturing, and invasive plant treatment. The SNF will conduct tree planting, tree culturing, and invasive plant treatments on an average of 500 acres (range 100 to 1,000) of the action area annually. Tree planting, tree culturing and invasive plant treatment may occur in areas immediately adjacent to streams with OC coho salmon or their designated critical habitat as well as in areas that may be several miles upstream from these streams or reaches.

Tree planting and culturing activities, such as brush release, pruning, and protection measures such as tubing are common activities in the SNF's restoration program, as is removal of invasive plants. Tree planting, tree culturing, and invasive plant removal are associated with some relatively small and localized soil disturbance. In a few areas, invasive weed treatments will change understory and ground vegetation; however, it is unlikely sediment release to streams will occur because very little ground disturbance will take place. Thus, tree planting, culturing, and invasive plant treatment is unlikely to change suspended sediment and substrate character and embeddedness in the action area.

Road maintenance, reconstruction, and construction and landings; temporary roads and landings; road decommissioning and closure, and rock quarry operations. The link between unpaved forest roads and increased fine sediment delivery into streams has been well-established over the past three decades (e.g., Johnson and Bestcha 1980, Reid *et al*. 1981, Montgomery 1994, Croke and Mockler 2001, Madej 2001). The effects of roads range from chronic and long-term contributions of fine sediment into streams to catastrophic mass failures of roads cuts and fills during large storms (Gucinski *et al*. 2001). Road surface erosion rates are primarily a function of storm intensity, surfacing material, road slope, and traffic level (Reid *et al.* 1981, Bilby *et al.* 1989, MacDonald *et al.* 2001, Ziegler *et al.* 2001). The direct effects of roads, such as increased sedimentation and increased risk of slides and debris flows, are much affected by road design and placement on the landscape (Gucinski *et al.* 2001). For all types of surface erosion, sediment to streams is through direct surface water connections such as ditches, rills, or gullies (Bilby *et al.* 1989, Croke and Mockler 2001).

Extensive research has demonstrated that improved design, building, and maintenance of roads can reduce road-related surface erosion at the scale of individual road segments. Key factors are road location, particularly layout relative to stream systems (Swift 1988, USDA Forest Service 1999), road drainage (Haupt 1959), surfacing (Burroughs and King 1989, Kochenderfer and Helvey 1987, Swift 1984), and cut slope and fill slope treatments (Burroughs and King 1989, Swift 1988). Many studies show that surfacing materials and vegetation measures can be used to reduce the yield of fine sediment from road surfaces (Beschta 1978, Burroughs *et al.* 1984, Kochenderfer and Helvey 1987, Swift 1984). Studies show that the placement of aggregate surface on roads reduced sediment production by 70-97% (Swift 1984, Burroughs *et al.* 1985), as cited by Burroughs and King (1989).

The SNF proposed to conduct road maintenance on up to 400 miles (range 50 to 400) of road and reconstruction and construction of up to 100 miles (range 20 to 100) of temporary roads annually. Road construction, reconstruction and maintenance includes adding spot rock, shaping/blading road surfaces, snow plowing, compacting the road surface, use and/or development of pump chance/water sources, cleaning ditches, cleaning culvert inlets/outlets/structures and associated drainage features, use and/or development of material disposal sites, installing signs, installing gates, brushing roadsides, clearing and grubbing of vegetation in roadway, removal/repair of slides or slumps (may include blasting of large rocks), roadside hazard tree felling, cleaning out cattle guards, dust abatement, cutting/filling/blasting of material, adding and compacting lifts of rock, paving, constructing ditches to design standards and, replacing/installing culverts, bridges or other drainage structures, pavement milling/conversion, and other similar type work activities.

The SNF will also decommission and close roads and use rock quarries for roadwork. Road decommissioning will include removal of all stream culverts, water barring, re-establishment of natural drainage patterns, decompacting the roadbed, recontouring cuts and fill slopes to their original contour, and blocking vehicle access. Rock quarry development and operation will include vegetation and soil removal, excavation, drilling and blasting, crushing, sorting, and piling of rock materials.

There is a high probability that roadwork 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 reconstruction and maintenance on road segments draining to LFH; (3) stream culvert/bridge installation, replacement, and removal in close proximity to LFH; and (4) existing rock quarry operations in riparian reserves. To minimize the amount of sediment generated from roadwork that is discharged to streams, the SNF will implement all applicable PDCs from Section 1.3.1 including:

- Section 1.3.1.2 *General Criteria Common to All Activities*
- Section 1.3.1.3 *Project Activity Design Criteria*
    - No. 32 *Road maintenance, reconstruction, and construction*
    - No. 33 *Temporary roads and landings construction*
    - No. 34 *Road decommissioning and closure*
    - No. 36 *Rock quarry operations*

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 PDCs required by the SNF, in particular, the construction and spacing of cross-drains and ditches (Luce and Black 1999), adding aggregate surface to roads (Copstead and Johansen 1998), and conducting in-water work during the ODFW in-water work window, will minimize the amount of fine sediment from roads reaching streams. The SNF will also minimize the amount of sediment reaching streams by installing effective sediment traps to prevent ditch erosion from entering streams (e.g. wattles, straw bales, rock dams, or leave 100-feet of vegetated ditch line) until vegetation is re-established. 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. Installing sediment traps after vegetation removal 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 roadwork 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 roadwork on suspended sediment and substrate character and embeddedness will also be spatially and temporally separated, and will help ameliorate some of these effects. Based on this discussion road maintenance, construction, and reconstruction; temporary roads and landings, road decommissioning and closure, and rock quarry operations will adversely affect suspended sediment and substrate character and embeddedness in the action area. However, because of the PDCs, increases in suspended sediments are likely to be localized to the site or source within the action area. Similarly, substrate character and embeddedness would be changed from road related activities, but the effects would be minor resulting in only minor changes to this indicator.

Road use. 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 (Reid *et al.* 1981, Bilby *et al.* 1989, MacDonald *et al.* 2001, Ziegler *et al.* 2001). Measures of the effects of roads are closely related to the length of roads connected by direct surface-flow paths to streams, rather than road density (Gucinski *et al.* 2001). Raw ditch lines and roadbeds are continuing sources of sediment (Miller *et al.* 1985), usually because of lack of maintenance, inadequate maintenance for the amount of road use, excessive ditch line disturbance, or poorly timed maintenance relative to storm patterns (Swift 1984 and 1988). Luce and Black (1999) noted that blading of aggregate-surfaced roads with well-vegetated ditches yielded no increase in sediment production at the outlet. Reid and Dunne (1984) found that most sediment coming from roads appears to be trapped in ditches.

The SNF proposed to authorize contractors to haul timber on roads. On the SNF, there are approximately 564 miles of roads within 200 feet of class 1 streams with LFH (Table 10), of which 430 miles could contribute sediment to class 1 streams. The SNF will authorize wet season hauling on up to 500 miles (range 100 to 500) of roads. This mileage consists of paved and aggregate surface types and is not limited to just aggregate roads. The SNF will not conduct wet season haul on naturally surfaced roads. To minimize the effects of road use on suspended sediment and substrate character and embeddedness, the SNF will implement PDC 35. There is a high probability that the use of hauling roads for transport of timber would 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 would mobilize during the first freshets in the fall. Hauling during the wet season would mobilize sediment that could potentially be delivered to streams.

The PDCs required by the SNF and the appropriate use of PDCs described in the road work section, including maintaining vegetated ditches, or other sediment barriers (Reid and Dunne (1984), 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 SNF will prohibit wet season haul on roads that are failing or likely to fail, suspend commercial road use where the road surface is deteriorating due to vehicular rutting or ponding water, or where turbid runoff is likely to reach stream channels. Roads that are adjacent to LFH will have higher likelihood of adverse effects and, subsequently, changes to suspended sediment and substrate character and embeddedness. 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).

Table 10. Miles of SNF system roads by surface type that are within 200 feet of class 1 streams.

5th Field Watershed name/ HUC Number	System Road Surface Type			
	Asphalt	Crushed Aggregate or Gravel	Native Material	Total Miles
Willamina 1709000801	0.0	0.0	0.0	0.0
Agency Creek/Yamhill River 1709000802	0.0	0.03	0.0	0.03
Little Nestucca 1710020301	0.0	49.37	0.0	49.37
Nestucca River 1710020302	11.58	76.05	0.0	87.63
Sand Lake 1710020309	1.07	15.87	0.0	16.94
Big Elk Creek 1710020402	3.85	28.22	0.0	32.07
Lower Yaquina River 1710020403	0.0	4.54	0.0	4.54
Lower Siletz River - 1710020407	5.34	15.84	0.0	21.17
Salmon River 1710020408	1.74	5.33	0.0	7.07
Rock Creek 1710020409	0.0	5.01	0.0	5.01
Five Rivers 1710020502	12.88	23.70	1.40	37.98
Drift Creek 1710020503	4.48	13.32	0.0	17.79

5th Field Watershed name/ HUC Number	System Road Surface Type			
	Asphalt	Crushed Aggregate or Gravel	Native Material	Total Miles
Lower Alsea River 1710020504	29.86	24.86	0.06	54.78
Beaver Creek Frontal 1710020505	8.79	5.7	0.0	14.48
Yachats River 1710020506	6.26	17.62	.047	24.35
Tenmile 1710020507	4.17	34.37	0.0	38.55
Deadwood Creek 1710050604	.052	21.27	0.53	22.31
Indian Creek 1710020605	4.48	20.18	1.39	26.05
Lake Creek 1710020606	1.64	1.88	0.0	3.53
North Fork Siuslaw 1710020607	0.0	39.16	0.0	39.16
Siltcoos River 1710020701	5.08	0.98	.052	6.58
Lower Smith River 1710030307	14.05	20.13	0.0	3.42
Lower Umpqua River 1710030308	0.0	2.50	0.0	2.50
Coos Bay Frontal 1710030403	0.0	0.0	0.0	0.0
Tenmile Frontal 1710030404	0.0	0.0	0.0	0.0
Total	**115.78**	**425.92**	**4.36**	**564.06**

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 PDCs 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 action area, and will occur on up to 500 miles (range 100 to 500) of roads within the action area. This will ameliorate some of the effects of increased suspended sediment and substrate embeddedness in LFH. Nonetheless, road use will adversely affect suspended sediments and result in minor effects on substrate character and embeddedness.

Fuels treatment. The SNF proposed to conduct fuels treatment on an average of 300 acres (range 50 to 1,000 acres) of forest in the action area annually. The SNF will use slash piling and burning, and prescribed under burning. The SNF pile slash using machines and hand piling. The SNF would minimize the effects of fuels treatment by implementing PDC 37. The SNF would not conduct fuels treatment of any kind within the inner riparian restoration zones with the exception that fire backing into the inner riparian restoration zone during understory prescribed fire may occur infrequently and would be kept to the minimal extent possible. Pile burning and prescribed broadcast burning would occur during high moisture conditions in the fall, or spring-like conditions that are favorable for controlling the flame. The placement of piles outside the inner riparian zones, and burning in high moisture conditions would prevent any sediment from reaching the stream. Therefore, there would not be an increase in suspended sediment or change in substrate character or embeddedness in LFH.

Large wood placement. The SNF proposed large wood placement in 15 miles of stream annually. Large wood placement can occur using excavators, cable systems, or helicopters. Large wood placement in streams associated with some relatively small and localized soil disturbance into associated waterbodies depending if rootwads are attached. Additionally, the placement of wood in a stream can cause localized and short-term increases in suspended sediment by disturbing the streambed and stream banks. To minimize short-term increases in suspended sediment, the SNF would implement the applicable PDCs in Section 1.3.1.2 *General Criteria Common to All Activities* and PDC 38 (*Large wood placement*). Given the limited scale of wood placement across the action area and the implementation of the PDCs, large wood placement would not meaningfully increase suspended sediment in the action area.

Large wood in streams functions to regulate sediment and flow routing, reduce streambed mobility, filter fine sediment from coarse streambed materials, and attenuate and stabilize the flow of energy and materials through stream networks. Increasing the amount of large wood in streams would improve stream processes relative to sediment regulation and transport, thus improving the quality of sediment of streams for aquatic organisms. These improvements would have the greatest impact in bedrock streams where large wood would help to build the streambed load and improve habitat for aquatic invertebrates and spawning fish while also contributing to improved water quality. Other streams would also benefit from large wood placement. Therefore, the SNF's proposed large wood placement would improve substrate character and embeddedness in an average of 15 miles (range 5 to 50 miles) of streams in the action area annually.

Chemical contaminants and nutrients

Timber falling/tipping, snag creation, fall and leave, yarding, road use, road and landing work, and fuels treatment have the potential to affect the chemicals and nutrients habitat indicator due to the operation of machinery near streams. The proposed action does not include introduction of contaminants or excess nutrients into any stream channel. Furthermore, the BMPs to be implemented by the SNF, including 150-foot setbacks for refueling, will help to minimize the aquatic contamination risk. These measures reduce, but do not eliminate the risk of contaminants being released into streams during fueling or from spills.

Deforestation can cause a release of carbon, nitrogen, phosphorus, and sulfur through timber harvest, burning of slash, accelerated decomposition, decreased production of wood and roots, and erosion (Vitousek 1983). Riparian forests have been found to be effective filters for nutrients from agriculture runoff, including nitrogen, phosphorus, and sulfur. Stream buffers as small as 62 feet have shown a decrease of nutrients from 48% to 95% (Lowrance *et al.* 1984, Jordan *et al.* 1993, Snyder *et al.* 1995).

For thinning, the SNF will retain trees resulting in at least 40% canopy cover, which will minimize the amount of nutrients entering streams. Nonetheless, some chemical contaminants and nutrients would be released into streams in the action area. Therefore, there will be a small increase in nutrients to the stream from timber falling/tipping, fall and leave, snag creation, yarding, road use, road and landing work, and fuels treatment.

The SNF proposed to use herbicides for invasive plant control. The use of herbicides can affect aquatic habitats through a combination of pathways including disturbance, chemical toxicity, dissolve oxygen and nutrients, water temperature, sediment, in-stream habitat structure, forage, and riparian and emergent vegetation. These impacts are addressed in detail in our biological opinion for Aquatic Restoration Activities in the States of Oregon and Washington (NMFS No.: NWR-2013-9664) (NMFS 2013), and summarized here. Herbicides can enter stream networks through spray and vapor drift, surface water runoff after application, and direct application into waterbodies. Direct application in this proposed action is unlikely because the SNF will implement PDCs for herbicide application. Implementation of PDC 31 by the SNF will minimize the effects of herbicide applications to the chemical contaminants and nutrients. Nonetheless, herbicide application will result in a small increase in chemical contaminants and nutrients into the stream network in the action area.

Woody Debris

Large wood provides important habitat for a range of 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 2013).

Coarse 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.

Removal of wood mass within 1 SPTH of a stream has the greatest potential of affecting recruitment of woody material (FEMAT 1993). For near-stream riparian inputs, empirical and modeling studies suggest that stream wood input rates decline exponentially with distance from the stream and vary by stand type and age (Figure 2) (McDade *et al.* 1990, Van Sickle and Gregory 1990, Gregory *et al.* 2003).

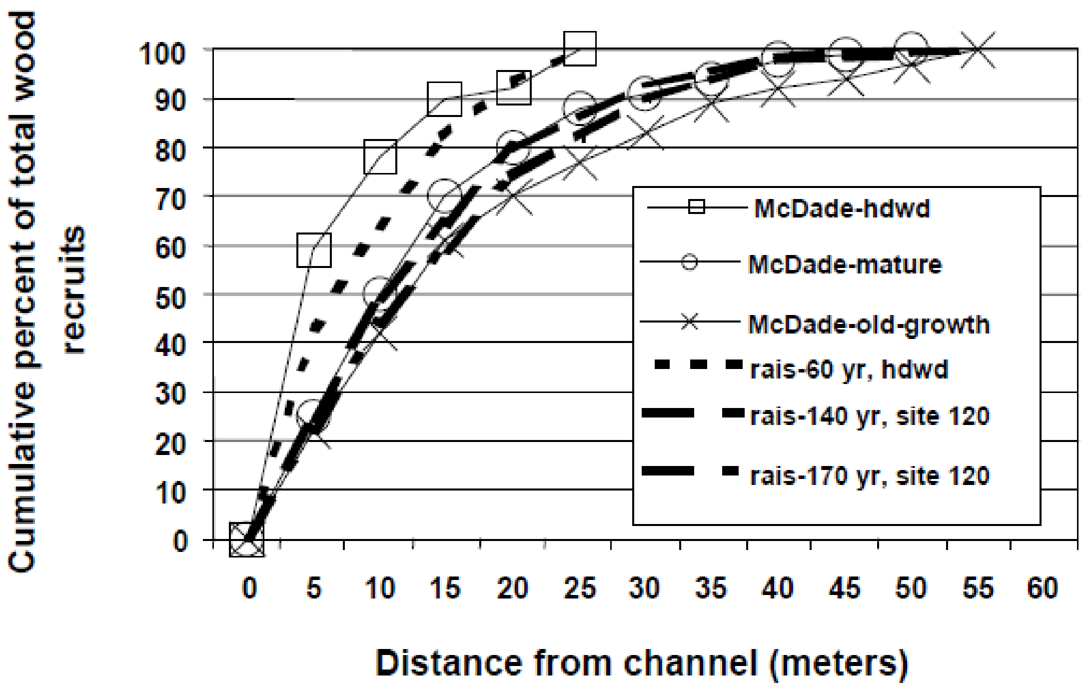


Figure 2. Comparison of predictions of total wood accumulation with distance from channel using the Organon forest growth model and RAIS in-stream wood recruitment model verses the observations of McDade *et al.* (1990) for streams in the Cascade Mountains of Oregon and Washington. (From Spies *et al*. 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.

Timber falling/tipping, fall and leave, snag creation. Thinning can accelerate the development of very large diameter trees (greater than 40") by 1-20 years, depending on thinning intensity and initial stand conditions; however, can reduce the amount of wood recruited to streams (Spies *et al.* 2013). Empirical studies indicate that 95% of total in-stream wood from near-stream sources comes from distances of 82 to 148 feet (Figure 2, above). Shorter distances occur in young, shorter stands and longer distances occur in older and taller stands (Spies *et al*. 2013). Additional wood can be recruited to fish-bearing streams from upslope and upstream areas through landslides and debris flows (McGarry 1994, Reeves *et al.* 1995). In some areas, wood transported in this manner may constitute up to 50% of the wood recruited to downstream reaches (McGarry1994).

The SNF proposed to conduct an average of 3,000 acres (1,500 to 10,000) of upland thinning for vegetation restoration and retain 40% canopy cover. Since upland thinning for vegetation restoration will occur outside the riparian reserves (2 SPTH), it will not cause an effect on in-stream wood recruitment. The SNF also proposed up to 3,000 acres (range 1,000 to 3,000) of riparian reserve thinning annually. On perennial streams with ESA-listed fish and LFH, the SNF will only conduct aquatic restoration thinning (tree felling and tipping into streams) in the 100-foot inner riparian zone in managed plantation stands. On fish-bearing perennial streams that are not LFH, the inner riparian zone would be 75 feet where only aquatic restoration thinning would occur. On non-fish-bearing perennial streams and intermittent streams, the SNF will observe 30- and 15-foot inner riparian zones. In the outer riparian zones on each stream type, which is from the end of the inner riparian zone width to two SPTHs, the SNF will conduct vegetation and aquatic restoration thinning. The SNF proposed to retain 40% canopy cover in the inner and outer riparian restoration zones.

According to the Organon forest growth model (Spies *et al.* 2013), and the RAIS in-stream wood recruitment models (McDade *et al.* 1990), thinning with 120-foot no-cut buffers adjacent to LFH would capture approximately 90-95% of existing wood recruitment. Thinning with 100-foot no-cut buffers would capture approximately 82-90% of existing wood recruitment, and 75-foot no-cut buffers would capture approximately 70-80% of the existing wood recruitment (McDade *et al.* 1990, Spies *et al.* 2013). Thinning with 30-foot no-cut buffers would capture approximately 40-50% of the existing wood recruitment (McDade *et al.* 1990, Spies *et al.* 2013). Thinning with 15-foot no-cut buffers would capture approximately 25% of wood recruitment. Within the 15 to 100-foot inner riparian zones, the SNF will conduct only aquatic restoration thinning and vegetation and aquatic restoration thinning in the outer riparian zones while retaining 40% canopy cover in both the inner and outer zones. Additionally, in the inner riparian zone, most of the trees would be fallen or tipped into the streams resulting in immediate wood recruitment. The SNF did not provide information on the how many trees per acre they would remove or retain after thinning, but due to their proposed retaining of 40% canopy cover it is likely they would remove a majority of trees in a stand. However, aquatic restoration thinning in the inner and outer riparian zones would consist of tree falling and tipping trees into streams, which would immediately increase the amount of large wood in those streams.

Site-scale reductions in stream channel wood loads due to riparian reserve thinning are reasonably likely to result from the units with the SNF's proposed activities in the outer riparian zones. The wood reduction would primarily occur on streams with LFH and streams in close proximity to LFH, particularly on those streams that have the potential to deliver wood to LFH. These effects will continue for decades until the vegetation recovers. Aquatic and vegetation restoration thinning would be spatially and temporally separated throughout the action area, and will be up to 3,000 acres (range 1,000 to 3,000)in riparian reserves annually. This will ameliorate some of the effects of reduction of in-stream wood recruitment in LFH.

Tree yarding. Yarding corridors will result in the removal of trees in the upland and the riparian reserves. Yarding corridors will be prohibited through the inner riparian zone on class 1 streams with LFH. On all other streams, the SNF will limit yarding corridors through the riparian zones to 12- to 15-foot widths. Yarding corridors within the riparian restoration zones can decrease the number of trees available for in-stream wood recruitment; however, on a much smaller magnitude than thinning. This is because yarding corridors are relatively narrow (12-15 feet wide) when compared to the size of a typical thinning unit. This would result in site scale reductions of wood in perennial streams that are in proximity to LFH, but are not LFH. The effects will continue for decades until the vegetation recovers.

Tree removal. Tree removal refers to the removal of trees after they have been fallen. Tree removal would occur after vegetation restoration thinning in the outer riparian zone, occasionally in the inner riparian zone (not common), and from roadside hazard tree removal. Nonetheless, when it infrequently occurs, tree removal would affect the availability and likelihood of wood to fall or move into streams. Thus, tree removal would result in a reduction of wood available to the stream network. The effects of tree removal to woody debris would continue for decades until the vegetation recovers.

Tree planting and culturing and invasive plant removal. Tree planting and culturing and invasive plant removal would occur on an average of 500 (range 400 to 2,000) acres of the SNF annually. Since these activities would not reduce the available wood to the stream network, they will not affect woody debris in the action area.

Road maintenance, reconstruction, and construction; temporary roads and landings construction; road decommissioning and closure; road use; rock quarry operations; and fish passage restoration. The SNF would construct and reconstruct up to 100 miles (range 20 to 100) of road, maintain up to 400 miles (range 50 to 400) of road, and decommission and close 80 miles of road annually. The SNF would also conduct wet season haul on up to 500 miles (range 100 to 500) of road and conduct an average of 3 (range 1 to 8) fish passage restoration projects annually. The SNF did not provide the number of quarries that would be constructed or maintained annually or their locations. To minimize the effects of these road activities on woody debris in the action area, the SNF would implement PDCs 32, 33, 34, 35, 36, and 39.

As described above in the tree removal section and restoration thinning sections, the effects of removing trees in the riparian reserves could cause a decrease in in-stream wood recruitment. Depending on the location of the roads, and stream crossings, the decreases of in-stream wood recruitment 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 and landings until the vegetation recovers.

As part of road construction, reconstruction and maintenance; temporary roads and landings construction, the SNF proposes to install and replace bridges and culverts. The SNF did not provide a number of culverts or bridges they would install or replace for these road activities; however, it would only require the removal of a small amount of overstory vegetation at each site. Stream crossing installation and bridge and culvert replacement, would cause a minor reduction of overstory vegetation (a few trees); however, is it unlikely that there will be a reduction of in-stream wood recruitment from the loss of a few trees.

The SNF proposed to decommission and close an average of 80 miles (range 30 to 200) of roads each year, which includes culvert removal. The effects of culvert removal on wood recruitment are similar to those described for culvert replacement or installation above. The PDCs required by the SNF, specifically matching the natural bank profile, and re-establishing the natural channel width and floodplain would provide a long-term benefit to in-stream wood recruitment. This is because restoring the stream and bank back to natural conditions would allow for the re-establishment of overstory vegetation. Once the overstory vegetation is re-established, there will be a recovery of in-stream wood recruitment. There will be a long-term beneficial effect from removing roads adjacent to streams. Removal of roads and decompacting the roadbed will allow establishment of overstory vegetation, and a subsequent increase of in-stream wood recruitment. These long-term benefits of road decommissioning on in-stream wood recruitment will outweigh the temporary effects on in-stream wood recruitment for removing culverts.

Rock quarry development and operation will include vegetation and soil removal, excavation, drilling and blasting, crushing, sorting, and piling of rock materials. The SNF will not develop any new rock quarries in riparian reserves. Since no trees will be removed in the riparian reserves, there will not be an effect on in-stream wood recruitment from rock quarry operations.

Road use for timber hauling would occur in the action area with wet season haul on up to 500 miles (range 100 to 500) annually. Timber hauling will occur on roads adjacent to LFH. However, there is no vegetation that will be removed due to hauling. Thus, road use will not affect in-stream wood recruitment.

As part of fish passage restoration, the SNF proposed to conduct 3 (range 1 to 8) fish passage restoration projects annually. Typically, these are culvert or bridge replacements similar to those described above. Culvert and bridge replacement would cause a minor reduction of overstory vegetation (a few trees). Culvert replacement would cause a minor reduction of overstory vegetation (a few trees); however, it is unlikely that there will be a reduction of in-stream wood recruitment from the loss of a few trees.

Fuels treatment. The SNF proposes to use slash piling and burning, and prescribed underburning. The SNF would not conduct fuels treatment of any kind within the inner riparian restoration zones with the exception that fire backing into the inner riparian restoration zone during understory prescribed fire may occur infrequently and would be kept to the minimal extent possible. Pile burning and prescribed broadcast burning would occur during high moisture conditions in the fall, or spring-like conditions that are favorable for controlling the flame. The placement of piles outside the inner riparian zones, and burning in high moisture conditions would prevent any damage to trees. Therefore, fuels treatment is not likely to affect in-stream wood recruitment.

Pool frequency and quality, large pools, off-channel habitat, width to depth ratio, streambanks, floodplain connectivity, and refugia

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 proposed action is small, mainly caused by timber harvest, and new road construction.

Pool quality and width to depth ratio are habitat features related to suspended sediment. Because there will be a negative effect in the form of increased sediment, as described in the roadwork section, 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 the PDCs required by the SNF. In addition, actions that cause an increase in suspended sediment will be spatially and temporally separated, which will help ameliorate some of these effects.

Drainage network increase

Tree falling/tipping, fall and leave, snag creation and tree removal; tree planting, tree culturing, and invasive plant control; fuels treatment, large wood placement, and fish passage restoration to affect an increase in the drainage network.

Tree Yarding. Yarding can affect the rate that water is discharged and routed to a stream, thus causing an increase in drainage network. The SNF proposed that no yarding would be allowed within 100 feet of class 1 streams, requiring full suspension in the riparian reserves when yarding across class 2 and 3 streams, implementing equipment exclusion zones, and limits of ground-based yarding to slopes less than 35% will minimize the likelihood of runoff reaching streams. The SNF will also require that, whenever possible, ground based yarding equipment would run on slash to minimize soil compaction. Wear *et al.* 2013 showed that adding slash, mulch, and grass seed to harvested areas prevented runoff to streams. The inner riparian zones are well-vegetated with ground cover and this would help stabilize streambanks, and prevent runoff to streams (Belt *et al.* 1992).

Road construction, reconstruction, and maintenance; temporary roads and landings; road decommissioning and closure; and rock quarry operations. 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 SNF will minimize the effects of roadwork on the drainage network increase by implementing PDCs 32, 33, 34, and 36.

As previously described in the roadwork effects on suspended sediment section, the proposed action includes implementing PDCs that are applied on project-specific basis to protect water quality. These PDCs include actions managing runoff by using ditch maintenance techniques, road design, and using drainage management techniques. 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).

Design criteria proposed by the SNF, in particular, the construction and spacing of cross-drains and ditches (Luce and Black 1999) would reduce 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 SNF would require PDCs that would direct runoff from cross-drains to vegetated slopes. This would minimize the likelihood of the last 200 feet of runoff from the ditch line 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. All temporary roads and landings would be decommissioned after completion of project activities, which includes removing stream crossings, decompacting the road surface, and blocking vehicle access. Roads and landings that receive full decommissioning (decompacting the road surface) 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.

The SNF proposed to conduct yarding and construct up to 100 miles (range 20 to 100) of road construction and reconstruction, maintenance on up to 400 miles (range 50 to 400) of road, and decommissioning and closure of an average of 80 miles (range 30 to 200) of road annually. The effects of roadwork and yarding are likely to increase the drainage network after temporary roads and landings construction. The effects would be localized to the specific watersheds where the SNF is conducting forest management activities and would be temporally and spatially separated in the action area. The SNF will decommission temporary roads and landings following completion of a project, which would improve the effects of increases in peak flows to streams caused by road construction. Additionally, the SNF will implement PDCs to minimize the effects of roadwork and yarding on the drainage network. Thus, it is unlikely that the proposed action would meaningfully change the drainage network in the action area.

2.5.1 Effects on Critical Habitat

Designated critical habitat within the action area for OC coho salmon and UWR steelhead considered in this opinion consists of freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors and their essential PBFs as listed below. The effects of the proposed action on these features are summarized as a subset of the habitat-related effects of the action that were discussed more fully above.

Substrate. Substrate embeddedness downstream of sediment generating activities described in the previous section is likely to 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. Thus, the proposed action will cause a small reduction in spawning habitat quality that will last for 5 to 10 years.

Roads contribute a large percentage of the forestry related sediment. Proposed design criteria related to road maintenance, construction, and reconstruction; temporary roads and landings; road use; road decommissioning and closure; and rock quarry operations (PDC No. 32, 33, 34, 35, and 36) would minimize sediment discharge to the stream by installing sediment traps, maintaining vegetation in ditches, installing cross-drains, prohibiting temporary roads and landings construction in the inner riparian restoration zones, decommissioning of roads, and limiting timber transport during the wet season.

Sediment from timber harvest and timber yarding would be greatly reduced through the inner riparian zones of 100 feet on LFH, 30-75 feet on other perennial streams, and 50 feet on intermittent streams. Additionally, the SNF would retain 40% canopy cover from any thinning in the riparian reserves and trees fallen or tipped in the inner riparian zones would be left on-site. These riparian restoration zones would 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 are at greatest risk. These areas are located throughout the action area where thinning would occur. Sediment would be greatest near road runoff, and would pulse through the stream reach with each storm event. Although sediment would reach stream reaches, and the overall accumulation may impact spawning grounds and associated bedloads; the effects of sediments would be spatially and temporally separated with the annual construction and decommissioning of temporary roads and landings and any reduction of spawning for ESA-listed salmonids in the action area would not appreciably 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 ESA-listed fish within the action area.

Water quality. Water quality would be temporarily and locally degraded by increases in suspended sediment from roadwork and thinning. Increased suspended sediments in streams can temporarily degrade aquatic habitat that supports OC coho salmon and UWR steelhead. Increases in suspended sediments associated with the proposed action would occur periodically during the rainy season and would be temporally and spatially separated throughout the action area. We described the sediment effects on the substrate section above.

The proposed action will also cause an increase in stream temperature from aquatic and vegetation restoration thinning, typically in July and August. The SNF proposed to conduct thinning in the inner and outer riparian zones of the riparian reserves to a minimum of 40% canopy cover. Riparian reserve thinning would occur on up to 3,000 acres annually (range 1,000 to 3,000 acres). The magnitude of temperature increase is difficult to predict because the scientific literature evaluating timber harvest effects on riparian shade and stream temperature focuses on no-cut buffers adjacent to streams that shade streams from clearcuts.

Although 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. Chan *et al.* (2006) studied canopy closure after thinning of 30 to 33-year-old conifer stands in coastal Oregon. They found that the canopy began to close rapidly after 3 years and that the rate of canopy cover averaged 2% per year for the first 8 years. The percentage of skylight in thinned stands decreased because of increases in tree height (bole area), crown length, and crown width. The PDCs for tree falling/tipping, fall and leave, and snag creation would minimize shade loss and increases of solar radiation to streams, thus, temperature increases in LFH would likely be small and would last for decades until vegetation and shade recover. Small temperature increases in the action area would also be temporally and spatially separated throughout the action area resulting in localized reach scale effects. Therefore, the proposed action would cause small and localized and short-term changes to the quality and function of the water quality PBF throughout the action area.

Water quantity. Effects are limited to increased peak flow in the winter due to timber harvest and roadwork. 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). The proposed PDCs would limit timber harvest and road construction to avoid increases in peak flow as described in Change in Peak/Base Flows discussions above. Therefore, only a very small and localized effect is expected near harvest areas above snow elevation and 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 water quantity PBF to support OC coho salmon and UWR steelhead in the action area. The proposed action would cause a slight, temporary decrease in water quantity from water withdrawal for road construction, and timber hauling; however, water withdrawal will occur during the summer low-flow periods and will not overlap with the timing of spawning in the fall.

Floodplain connectivity. The proposed action will affect floodplain connectivity with the construction of new roads, maintenance of existing roads, and road decommissioning. Any adverse effects will be limited because the SNF will decommission temporary roads and landings following project completion. The SNF will prohibit non-system roads within the inner riparian zones of all streams, unless needed to cross streams. If non-system road construction is required to cross streams, crossings would be placed as perpendicular as possible to the stream channel as site conditions allow.

The SNF also proposed to fall and tip trees into streams and placement of large wood to increase the amount of wood in a stream. Large wood in streams functions to increase habitat complexity, aggrade streambeds, and slow water flow. Falling and tipping trees into streams and large wood placement would improve floodplain connectivity and floodplain function in reaches where these activities occur.

The overall affect to floodplain connectivity with the SNF forest management activities would not significantly reduce the quality and function of the floodplain connectivity to support OC coho salmon or UWR steelhead.

Forage. Increases in suspended sediment from roadwork and road use will cause small reductions in the production and abundance of macroinvertebrates. Suspended sediment fills in interstitial spaces in the streambed that is habitat for macroinvertebrates, reducing the habitat for the coho salmon and steelhead prey organisms. The proposed action will result in a localized reach scale reduction (small) in prey organism abundance for OC coho salmon and UWR steelhead for 5 to 10 years. Small reach scale reductions in prey organism abundance will be spread out across the landscape. In some cases, increase in solar radiation to the stream, and concurrent increase in understory vegetation, may cause in increase in the insect populations at that site, and balance forage abundance for juvenile OC coho salmon and UWR steelhead. Thus, the overall effect on forage is small, but will slightly reduce the quality and function of the forage PBF to support OC coho salmon and UWR steelhead in the action area.

Natural cover. Woody debris falling into the stream due to natural mortality in the riparian area contributes to many natural stream processes that improve habitat complexity. Aquatic habitat features that contribute to habitat complexity include large deep pools, pools with complex woody debris, off channel habitat (i.e., side channels, backwater pools, and alcoves), vegetated streambanks with coarse woody debris, and connected floodplains. These habitats provide high flow velocity refuge, cover for predator avoidance, and foraging habitat for juvenile OC coho salmon and UWR steelhead.

Reductions in wood recruitment potential are expected to occur from timber harvest, and new road construction. Decreases of in-stream wood recruitment will be minimized through retaining trees to provide 40% canopy cover in the inner and outer riparian zones and directly falling and tipping trees into the stream. These inner and outer zones and falling and tipping trees in streams will provide the majority of available wood recruitment to streams. Additionally, the SNF will conduct wood placement in streams throughout the action area as other project activities would be occurring. PDCs required by the SNF would not increase the overall amount of system roads in the action area; however, small increases in roads is still expected to occur periodically on a small scale and the SNF will decommission these temporary roads and landings after project completion. Overall, the effect from wood loss from the proposed action is minimal and will not significantly reduce wood recruitment and its contribution to the creation of complex habitat in the action area. Therefore, the proposed action would not meaningfully reduce the quality and function of the natural cover PBF to support OC coho salmon and UWR steelhead in the action area.

Fish passage free of 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. The SNF will meet stream simulation passage criteria when constructing bridges or culvert where OC coho salmon and UWR steelhead are present. This will improve fish passage at those locations for several decades and access to important refuge, rearing, and spawning habitats for OC coho salmon and UWR steelhead. Therefore, the proposed action will incrementally improve the quality and function of the fish passage free of obstruction PBF in the affected sub-basin and the overall action area.

2.5.2 Effects on Listed Species

The proposed action would likely have adverse effects on OC coho salmon and UWR steelhead because of increased suspended sediments, stream temperatures, reduced forage, and capture and handling during fish salvage. Responses due to exposure of OC coho salmon and UWR steelhead individuals to these effects include reduced growth, survival, and fitness; behavioral modification; and injury or death.

Increases in suspended sediments associated with the proposed action would occur periodically during the rainy season and would be temporally and spatially separated throughout the action area. An increase in turbidity from suspension of fine sediments can adversely affect fish and filter-feeding macro-invertebrates downstream from the project site. At moderate levels, turbidity has the potential to reduce primary and secondary productivity; at higher levels, turbidity may interfere with feeding and may injure and even kill both juvenile and adult fish (Berg and Northcote 1985, Spence *et al.* 1996). However, Bjornn and Reiser (1991) found that adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that may be experienced during storm and snowmelt runoff episodes.

Exposure duration is a critical determinant of the occurrence and magnitude of physical or behavioral effects caused by turbidity (Newcombe and Jensen 1996). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such seasonal high pulse exposures. However, research indicates that chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Servizi and Martens 1991). In a review of 80 published reports of fish responses to suspended sediment in streams and estuaries, Newcombe and Jensen (1996) documented increasing severity of ill effects with increases in dose (concentration multiplied by exposure duration).

Migrating and spawning adult OC coho salmon and UWR steelhead, and rearing and migrating juveniles could be exposed to increased suspended sediment. Effects from suspended sediment are likely to be small on incubating eggs and pre-emergent fry. This is because PDCs for tree falling/tipping, fall and leave, and snag creation; timber hauling; and roadwork will minimize the amount of sediment reaching streams.

Growth and survival of rearing and migrating juveniles will likely be adversely affected; however, as habitat for these life stages overlaps with the effects from suspended sediment. These negative effects would be limited in duration, lasting several months during the wet season, which overlaps with spawning, and egg incubation. Although increased suspended sediment would cause interruption of essential behavior, it would not likely reach levels sufficient to kill or permanently injure juvenile and adult OC coho salmon and UWR steelhead.

Juvenile OC coho salmon and UWR steelhead will be exposed to small increases in stream temperatures, typically in July and August. The increases in stream temperature will increase the risk of reduced growth, reduced competitive success of juveniles in relation to non-salmonid fish, increased disease virulence, and reduced disease resistance (Reeves *et al.* 1987, McCullough *et al.* 2001, Marine 1992, Marine and Cech 2004). A small percentage of the juveniles in each affected stream will suffer a reduction in size upon out-migration, which makes fish more vulnerable to predation, or a reduction in fitness, which reduces the likelihood of long-term survival of individual fish.

Most direct, lethal effects of the proposed action would likely be caused by the isolation of in-water work areas, though lethal and sublethal effects would be greater without isolation. Any individual fish present in the work isolation area would be captured and released. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. Stress and death from handling occur because of differences in water temperature and dissolved oxygen between the river and transfer buckets, as well as physical trauma and the amount of time that fish are held out of the water. Stress on salmon and steelhead increases rapidly from handling if the water temperature exceeds 64ºF, or if dissolved oxygen is below saturation. Debris buildup and predation within minnow traps can also kill or injure listed fish if they are not monitored and cleared on a regular basis. Design criteria related to the capture and release of fish during work area isolation will avoid most of these consequences, and ensure that most of the resulting stress is short-lived.

An estimate of the maximum effect that capture and release operations for projects authorized or completed under this opinion would have on the abundance of adult salmon and steelhead in each recovery domain was obtained as follows: A = n(pct), where:

A = number of adult equivalents "killed" each year
n = number of projects likely to occur in a recovery domain each year
p = 31, *i.e.*, number of juveniles to be captured per project, based on Oregon Department of Transportation's (ODOT's) data for site isolation[3]
c = 0.05, *i.e.*, rate of juvenile injury or death caused by electrofishing during capture and release, primarily steelhead and coho salmon. Consistent with observations by Cannon (2008 and 2012) and data reported in McMichael *et al*. (1998).
t = 0.02, *i.e.*, an estimated average smolt to adult survival ratio, see Smoker *et al*. (2004) and Scheuerell and Williams (2005). This is very conservative because many juveniles are likely to be captured as fry or parr, life history stages that have a survival rate to adulthood that is exponentially smaller than for smolts.

NMFS anticipates that up to 31 individuals per project (up to 248 for 8 projects) juvenile OC coho salmon or UWR steelhead per year would be pursued or captured, and that five individuals (up to 13 for 8 projects) would be killed because of work necessary to isolate in-water work areas under the Road Work category, specifically for culvert installation and replacement. This estimate is based on the following assumption: Each site requiring in-water work area isolation is likely to capture as many as 31 individuals per project (up to 248 for 8 projects) listed juvenile salmon or steelhead. Because the SNF proposed three (range 1 to 8) of these culvert projects per year in LFH, 31 individuals per project (up to 248 for 8 projects) individuals would be affected. Of these, approximately 5% of juveniles captured would be killed, totaling five (up to 13 for 8 projects) fish per year. Capture and release of adult fish is not reasonably certain to occur as part of the proposed isolation of in-water work areas. OC coho salmon and UWR steelhead are from

[3] In 2007, ODOT completed 36 work area isolation operations involving capture and release using nets and electrofishing; 12 of those operations resulted in capture of 0 Chinook salmon, 345 coho salmon, and 22 steelhead; with an average mortality of 5% Cannon (2008). Cannon (2012) reported a mortality rate of 4.4% for 455 listed salmon and steelhead captures during 30 fish capture and release operations in 2012. No sturgeon or eulachon have been captured because of ODOT fish capture and operations.

different species that are separated geographically and do not overlap in presence and distribution. Thus, in a year, this take could be wholly assigned to either species or could be split between the two species depending on where the LFH stream crossing replacements occur that year. Thus, the effects of work area isolation on the abundance of OC coho salmon or UWR steelhead in any population is likely to be small, resulting in no more than one adult-equivalent per year.

In summary, the proposed action will result in reduced growth, survival, and fitness and injury or death to some OC coho salmon and/or UWR steelhead annually from increased suspended sediments, increased stream temperatures, and work area isolation and fish salvage. The amount of individuals injured or killed by the proposed action would be spatially separated throughout the action area and small such that the abundance or productivity of any single population of coho salmon or steelhead would not be meaningfully affected. Adverse effect of the proposed action would be localized and greatest immediately following project implementation. After which, restorative actions taken by the SNF and natural processes will begin improving the ecological functions temporarily affected by the proposed action. Additionally, the proposed action is intended to improve natural stream and forest function and overall habitat quality for OC coho salmon and UWR steelhead over the long-term. Improving habitat quality will likely improve abundance and production potential of OC coho salmon and UWR steelhead populations affected by the proposed action.

2.6 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 and 402.17(a)). 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. In addition to Federal lands, the action area also includes private lands where the SNF might conduct restoration work to improve aquatic or riparian habitats degraded from agriculture, roadbuilding, or other land management activities.

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 *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

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 Critical Habitats and Environmental Baseline sections, above. Among those activities were agriculture, forestry, road construction, urbanization, water development, and river restoration. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of population centers in the action area, and the efforts of social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

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, in-stream roughness and cover, estuarine rearing habitats, wetlands, riparian areas, water quality (e.g., temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PBFs that are necessary for successful spawning, production of offspring, and migratory access necessary for adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. Without those features, the species cannot successfully spawn and produce offspring. As noted above, however, the declining level of resource-based industrial activity and rapidly rising industry standards for resource protection would likely reduce the intensity and severity of those impacts in the future.

The economic and environmental significance of natural resource-based economy is currently 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 program-action area for the indefinite future. However, over time those industries have adopted management practices that avoid or reduce many of their most harmful impacts, as is evidenced by the extensive conservation measures included with the proposed action, but which were unknown or in uncommon use until even a few years ago.

While natural resource extraction within northwest Federal lands may be declining, general resource demands are increasing with growth in the size and standard of living of the local and regional human population (Metro 2010 and 2011). Population growth is a good proxy for multiple, dispersed activities and provides the best estimate of general resource demands because as local human populations grow, so does the overall consumption of local and regional natural resources. Between 2010 and July 2019, Oregon's population grew from approximately 3.83 million to 4.23 million and increased by 10.6%. Most of the major population areas in Oregon occur west of the Cascade Mountains. The NMFS assumes that future private, state, and federal actions will continue within the action areas, increasing as population rises.

The most common activity likely to occur in the action areas addressed by this consultation is dispersed recreation. Although land managers intensively manage developed recreational activities (i.e., campgrounds, trailheads, off-road-vehicle trails, public access), a considerable amount of dispersed recreation occurs (camping, hunting, mushroom collection, etc.). Expected impacts to salmon and steelhead from this type of recreation include minor releases of suspended sediment, impacts to water quality, short-term barriers to fish movement, minor changes to habitat structures, and poaching. Streambanks, riparian vegetation, and spawning redds can be disturbed wherever human use is concentrated. Recreational fishing within the action area is expected to continue to be subject to ODFW regulations. The level of take of ESA-listed salmon and steelhead within the action area from angling is unknown, but is expected to remain at current levels.

When considered together, these cumulative effects are likely to have a small negative effect on salmon and steelhead population abundance, productivity, and some short-term negative effects on spatial structure (short-term blockages of fish passage). Similarly, the condition of critical habitat PBFs will be slightly degraded by the cumulative effects.

2.7 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 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), 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) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1 Critical Habitat

OC coho salmon critical habitat

There are 23 critical habitat units (5^{th} field watersheds) in the action area, which support OC coho salmon. The CHART described the conservation value of a critical habitat unit as depending on the importance of the populations associated with a critical habitat unit to the ESU conservation and the contribution of that critical habitat unit to the conservation of the population either through demonstrated or potential productivity of the area. Of those critical habitat units, the CHART rated 16 as having a high conservation value. A high conservation value means that the critical habitat unit is essential for the conservation of the population of OC coho salmon that it supports. The remaining seven critical habitat units were rated as having a medium conservation value.

Climate change is likely to adversely affect the overall conservation value of OC coho salmon designated critical habitats. The adverse effects are likely to include, but are not limited to, depletion of cold-water habitat and other variations in quality and quantity of tributary spawning, rearing, and migration habitats. The magnitude and severity of these effects will vary from year to year. The effects of the proposed action will last for years to decades and will overlap with the effects of climate change listed above. However, the proposed action's effects would unlikely exacerbate the effects of climate change in the action area because of PDCs proposed by the SNF to minimize the effects of the proposed action to the stream reach scale; the proposed actions' effects will be temporally and spatially separated throughout the action area such that there is little to no overlap of effects from different projects in the action area; and the proposed actions' intent is to improve ecological processes that will improve overall habitat quality in the action area.

The environmental baseline is degraded by past management activities including agriculture, forestry, urbanization, water development, road construction, and river restoration. Each of these activities has contributed to a myriad of interrelated factors for the decline in quality and function of critical habitat PBFs essential for the conservation of OC coho salmon. Limiting factors for populations of OC coho salmon affected by the proposed action include reduced habitat complexity and water quality. Although we identify a myriad of factors for the reduced quality and function of critical habitat in the action area, Federal lands managed under the NWFP amendment over the last 20 years show an overall improvement in aquatic ecosystems (Reeves *et al.* 2016).

Effects from the proposed vegetation management activities consultation include increases in suspended sediment, increased temperature, decreased in-stream wood recruitment, increased peak flow, and decreased base flow from tree falling and road related activities. We do not expect any significant effects of activities occurring under this proposed action because effects would be spatially and temporally separated such that there is little to no spatial overlap of effects from different projects in the action area. This is because the SNF's vegetation management program includes detailed projections and assumptions about the aggregate numbers and limits of treated acres (especially limits in riparian reserves), inner and outer riparian zones for tree fallings and PDCs for tree falling, and PDCs for timber yarding. Additionally, the SNF proposed limits for roadwork, the effects would be minimized from the required PDCs, including no new construction of system roads, restrictions of construction of temporary roads near LFH, and decommissioning all temporary roads to ensure no increase of road densities. Effects from road use would be minimized from required PDCs, including limits on wet season hauling, a strict inspection program during the wet season, and placement and maintenance of ditches and cross-drains. In addition to annual limits on vegetation management activities, we do not expect any significant aggregate or synergistic effects of activities occurring under this program because of the projected spatial separation of timber harvest across multiple 5th field watersheds at any one time (provided by the action agency and reflecting historical practice).

Adverse effects to the quality and function of critical habitat PBFs affected by this action will be minor to moderate intensity due to the small to moderate magnitude of suspended and depositional sediment, increase in stream temperature, and decrease of in-stream woody material likely to occur. As stated above, the effects would be spatially and temporally separated throughout the action area such that there is little to no spatial overlap of effects from different projects in the action area. In addition, monitoring under the NWFP is showing an overall improvement in habitat conditions in the action area. Because of this, the effects of the proposed action would not reduce the quality and function of the critical habitat features and their ability to conserve OC coho salmon in the action area.

Cumulative adverse effects on OC coho salmon critical habitat would continue from ongoing forestry, agriculture, road construction, urbanization and river restoration along with dispersed recreation. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. The NMFS assumes that future private, state, and federal actions would continue within the action areas, increasing as population rises. Because of this, the condition of critical habitat PBFs would continue to slowly degrade from these cumulative effects.

The effects of the proposed action, when added to the environmental baseline, cumulative effects, and status of OC coho salmon critical habitat will not appreciably reduce the quality and function of critical habitat in the action area. Therefore, the action will not impair the ability of this critical habitat to play its intended conservation role of supporting populations of OC coho salmon in the action area.

UWR steelhead critical habitat

For this proposed action, there are two critical habitat units analyzed in this opinion that are used by UWR steelhead. The CHART rated the Upper South Yamhill River and Willamina Creek critical habitat units fair to good and fair to poor for conservation value to UWR steelhead. The conservation value is the relative importance of the watershed to conservation of the ESU.

Climate change is likely to adversely affect the overall conservation value of UWR steelhead designated critical habitats. The adverse effects are likely to include, but are not limited to, depletion of cold-water habitat and other variations in quality and quantity of tributary spawning, rearing and migration habitats. The magnitude and severity of these effects will vary from year to year. The effects of the proposed action will last for years to decades and will overlap with the effects of climate change listed above. However, the proposed action would unlikely exacerbate the effects of climate change in the action area because of PDCs proposed by the SNF to minimize the effects of the proposed action to the stream reach scale; the proposed actions' effects will be temporally and spatially separated throughout the action area such that there is little to no overlap of effects from different projects in the action area; and the proposed actions' intent is to improve ecological processes that will improve overall habitat quality in the action area.

The environmental baseline is degraded by past management activities including agriculture, forestry, urbanization, water development, road construction, and river restoration. Each of these activities has contributed to a myriad of interrelated factors for the decline in quality and function of critical habitat PBFs essential for the conservation of UWR steelhead. Limiting factors for populations of UWR steelhead affected by the proposed action include reduced habitat complexity and water quality. Although we identify a myriad of factors for the reduced quality and function of critical habitat in the action area, Federal lands managed under the NWFP amendment over the last 20 years show an overall improvement in aquatic ecosystems (Reeves *et al.* 2016).

Effects from the proposed vegetation management activities consultation include increases in suspended sediment, increased temperature, decreased in-stream wood recruitment, increased peak flow, and decreased base flow from tree falling and road related activities. We do not expect any significant effects of activities occurring under this proposed action program because effects of the proposed action would be spatially and temporally separated such that there would be little to no overlap of effects from different projects in the action area. This is because the SNF's vegetation management program includes detailed projections and assumptions about the aggregate numbers and limits of treated acres (especially limits in riparian reserves), inner and outer riparian zones for tree fallings and PDCs for tree falling, and PDCs for timber yarding. Additionally, the SNF proposed limits for roadwork, the effects would be minimized from the required PDCs, including no new construction of system roads, restrictions of construction of temporary roads near LFH, and decommissioning all temporary roads to ensure no increase of road densities. Effects from road use would be minimized from required PDCs, including limits on wet season hauling, a strict inspection program during the wet season, and placement and maintenance of ditches and cross-drains. In addition to annual limits on vegetation management activities, we do not expect any significant aggregate or synergistic effects of activities occurring under this timber program because of the projected spatial separation of timber harvest across multiple 5th field watersheds at any one time (provided by the action agency and reflecting historical practice).

Adverse effects to the quality and function of critical habitat PBFs affected by this action would be minor to moderate intensity due to the small to moderate magnitude of suspended and depositional sediment, increase in stream temperature, and decrease of in-stream woody material likely to occur. As stated above, the effects would be spatially and temporally separated throughout the action area such that there is little to no spatial overlap of effects from different projects in the action area. In addition, monitoring under the NWFP amendment is showing an overall improvement in habitat conditions in the action area. Because of this, the effects of the proposed action would not reduce the quality and function of the critical habitat features and their ability to conserve UWR steelhead in the action area.

Cumulative adverse effects on UWR steelhead critical habitat would continue from ongoing forestry, agriculture, road construction, urbanization and river restoration along with unmanaged recreation. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. The NMFS assumes that future private, state, and federal actions would continue within the action areas, increasing as population rises. Because of this, the condition of critical habitat PBFs would continue to slowly degrade from these cumulative effects.

The effects of the proposed action, when added to the environmental baseline, cumulative effects, and status of UWR steelhead critical habitat will not appreciably reduce the quality and function of critical habitat in the action area. Therefore, the action will not impair the ability of this critical habitat to play its intended conservation role of supporting populations of UWR steelhead in the action area.

2.7.2 Listed Species

OC coho salmon

The proposed action would affect 12 independent populations of OC coho salmon including the Nestucca, Salmon, Siletz, Yaquina, Alsea, Siuslaw, Siltcoos Lake, Tahkenitch Lake, Lower Umpqua, Tenmile Lakes, and Coos. Each of these populations plays an important role in the persistence and sustainability of their strata and, subsequently, the ESU as a whole. The proposed action would also affect the Sand Lake, Rock Creek, Yachats River, and Tenmile

Creek populations of OC coho salmon, which are dependent populations. The effects on these populations from the proposed action would be the integrated responses of individuals to the predicted environmental changes. Instantaneous measures of population characteristics, such as population size, growth rate, spatial structure, and diversity, are the sums of individual characteristics within a particular area, while measures of population change, such as a population growth rate, are measured as the productivity of individuals over the entire life cycle (McElhany *et al.* 2000). A persistent change in the environmental conditions affecting a population, for better or worse, can lead to changes in each of these population characteristics.

Climate change is likely to adversely affect the survival and recovery of OC coho salmon, though it may have beneficial effects in some circumstances. The adverse effects are likely to include, but are not limited to, depletion of cold-water habitat and other variations in quality and quantity of tributary spawning, rearing and migration habitats. The magnitude and severity of these effects will vary from year to year. The effects of the proposed action will last for years to decades and will overlap with the effects of climate change listed above. However, the proposed action's effects would unlikely exacerbate the effects of climate change in the action area because of PDCs proposed by the SNF to minimize the effects of the proposed action to the stream reach scale; the proposed actions' effects will be temporally and spatially separated throughout the action area such that there is little to no overlap of effects from different projects in the action area; and the proposed actions' intent is to improve ecological processes that will improve overall habitat quality in the action area.

The environmental baseline is degraded by key management activities including agriculture, forestry, urbanization, water development, road construction, and river restoration. Each of these activities has contributed to a myriad of interrelated factors for the decline of OC coho salmon. Limiting factors for populations of OC coho salmon affected by the proposed action include reduced habitat complexity and water quality. Although we identify a myriad of factors for the decline of OC coho salmon, Federal lands managed under the NWFP over the last 20 years show an overall improvement in aquatic ecosystems (Reeves *et al*. 2016).

The proposed action is likely to cause a small decrease in the rate of egg and fry survival, and injury in juveniles and adults because of increased suspended sediment, minor increases in water temperature, and some loss of large wood recruitment and approximately 31 individuals per project captured, injured or killed because of fish salvage and work area isolation (up to 248 individuals for 8 projects). However, these effects are not expected to cause a biologically meaningful effect at the population scale. This is due to narrow limits on the volume of annual vegetation management activities, which would separate the effects in space and time among the 23 5th field watersheds in the action area, and the relatively short duration of the anticipated effects. Because of this, there would likely be only a relatively small number of OC coho salmon affected at any one time, which would not be meaningful at the population level. In addition, monitoring under the NWFP amendment is showing an overall improvement in habitat conditions in the action area (Reeves et al. 2016).

Cumulative adverse effects on OC coho salmon in the action area would continue from ongoing forestry, agriculture, road construction, urbanization and river restoration along with unmanaged recreation. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. The NMFS assumes that future private, state, and federal actions would continue within the action areas, increasing as population rises. Because of this, adverse effects on OC coho salmon would likely continue from these cumulative effects.

The number of OC coho salmon injured or killed by the proposed action is small and would not be meaningful at the population scale. The effects of the proposed action would be spatially and temporally separated throughout the action area. Thus, the effects on individual OC coho salmon would occur in different populations at different times throughout implementation of the proposed action. Additionally, the effects on individuals and populations of OC coho salmon would be minimized by the PDCs implemented by the SNF for vegetation management activities. Therefore, when we add the effects of the proposed action to the populations' status, environmental baseline, cumulative effects, and climate change, we find the proposed action would not appreciably reduce the likelihood of the survival or recovery of OC coho salmon at the population scale. Based on our conclusion that the populations' survival and recovery will not be impeded because of the proposed action, the proposed action will not appreciably reduce the likelihood of the survival or recovery of the OC coho salmon ESU.

UWR steelhead

The UWR steelhead affected by this proposed action are from the west-side tributaries population area, which is not a demographically independent population. Winter steelhead have been reported spawning in the west-side tributaries to the Willamette River upstream of Willamette Falls and ODFW recognizes the Tualatin, Yamhill, Rickreall, and Luckiamute west-side sub-basins as part of the Willamette Winter Steelhead special management unit. In the WLC-TRT assessment, these tributaries were not considered to have constituted independent populations historically. Rather, these tributaries may have functioned and continue to function as a population sink with the DPS metapopulation structure (Myers *et al.* 2006). Conversely, under current condition or future conditions, steelhead production from west-side sub-basins may help buffer or compensate for independent populations that are not meeting recovery goals.

Climate change is likely to adversely affect the survival and recovery of UWR steelhead, though it may have beneficial effects in some circumstances. The adverse effects are likely to include, but are not limited to, depletion of cold-water habitat and other variations in quality and quantity of tributary spawning, rearing and migration habitats. The magnitude and severity of these effects will vary from year to year. The effects of the proposed action will last for years to decades and will overlap with the effects of climate change listed above. However, the proposed action's effects would unlikely exacerbate the effects of climate change in the action area because of PDCs proposed by the SNF to minimize the effects of the proposed action to the stream reach scale; the proposed actions' effects will be temporally and spatially separated throughout the action area such that there is little to no overlap of effects from different projects in the action area; and the proposed actions' intent is to improve ecological processes that will improve overall habitat quality in the action area.

The environmental baseline is degraded by past management activities including agriculture, forestry, urbanization, water development, road construction, and river restoration. Each of these activities has contributed to a myriad of interrelated factors for the decline of UWR steelhead. Limiting factors for populations of UWR steelhead affected by the proposed action include reduced habitat complexity and water quality. Although we identify a myriad of factors for the decline of UWR steelhead, Federal lands managed under the NWFP over the last 20 years show an overall improvement in aquatic ecosystems (Reeves *et al*. 2016).

The proposed action is likely to cause a small decrease in the rate of egg and fry survival, and injury in juveniles and adults because of increased suspended sediment, minor increases in water temperature, and some loss of large wood recruitment and 31 individuals per project captured, injured or killed because of fish salvage and work area isolation (up to 248 individuals for 8 projects). However, these effects are not expected to cause a biologically meaningful effect at the population scale. This is due to narrow limits on the volume of annual vegetation management activities, which would separate the effects in space and time among the two 5th field watersheds in the action area, and the relatively short duration of the anticipated effects. Because of this, there would likely be only a small number of UWR steelhead affected at any one time, which would not be meaningful at the population level. In addition, monitoring under the NWFP amendment is showing an overall improvement in habitat conditions in the action area (Reeves et al. 2016).

Cumulative adverse effects on UWR steelhead in the action area would continue from ongoing forestry, agriculture, road construction, urbanization and river restoration along with unmanaged recreation. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. The NMFS assumes that future private, state, and federal actions would continue within the action areas, increasing as population rises. Because of this, adverse effects on UWR steelhead would likely continue from these cumulative effects.

The number of UWR steelhead injured or killed by the proposed action is small and would not be meaningful at the population scale. The effects of the proposed action would be spatially and temporally separated throughout the action area. Thus, the effects on individual UWR steelhead would occur in different populations at different times throughout implementation of the proposed action. Additionally, the effects on individuals and populations of UWR steelhead would be minimized by the PDCs implemented by the SNF. The affected populations are not expected to play a substantial role in the recovery of UWR steelhead. Therefore, when we add the effects of the proposed action to the populations' status, environmental baseline, cumulative effects, and climate change, we find the proposed action would not appreciably reduce the likelihood of the survival or recovery of UWR steelhead at the population scale. Based on our conclusion that the populations' survival and recovery will not be impeded because of the proposed action, the proposed action will not appreciably reduce the likelihood of the survival or recovery of the UWR steelhead DPS.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of OC coho salmon or destroy or adversely modify its designated critical habitat.

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of UWR steelhead or destroy or adversely modify its designated critical habitat.

2.9 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 ITS.

2.9.1 Amount or Extent of Take

In the opinion, NMFS determined that incidental take of OC coho salmon and UWR steelhead is reasonably certain to occur as follows:

- **Adults** – Harm (death, injury, reduced reproductive success) due to increased water temperature and suspended sediment increases.
- **Juveniles** – Harm (death, injury, and impairment of essential migration and feeding behaviors) because of increases in water temperature and suspended sediment and capture, handling, injury, and death because of work area isolation and fish salvage.
- **Incubating fry** – Harm (deaths, injury) because of increases in water temperature and substrate sediment.

Work area isolation and fish salvages associated with roadwork stream crossings will result in incidental take of OC coho salmon and UWR steelhead. The amount of incidental take from work area isolation and fish salvage will be up to 31 individual juvenile OC coho salmon and/or UWR steelhead per project (up to 248 for 8 projects) per year. This estimate is based on the following assumption: Each site requiring in-water work area isolation is likely to capture as many as 31 listed juvenile OC coho salmon and/or UWR steelhead. Because the SNF proposes three of these culvert projects in LFH per year, 31 individuals would be affected per project (up to 248 individuals annually). Of these, approximately 5% of juveniles captured would be killed, totaling five (up to 13 for 8 projects per year) fish per year. These two species do not overlap in distribution and are separated geographically by their watershed boundaries. Thus, it is reasonable that the total 93 (up to 248 for 8 projects) individuals taken from work area isolation and fish salvage could be from either species or both species in a given year, depending on which domain the projects occur in.

Habitat-related incidental take

The distribution and abundance of fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. Additionally, there is no way to count or observe the number of fish exposed to the effects of the proposed action over the period of time during which these effects will occur (annually). In such circumstances, NMFS cannot provide an amount of take that would be caused by the proposed action and instead uses indicators for the extent of take (Table 11).

Table 11. Extent of take indicators for habitat-related effects on OC coho salmon and UWR steelhead.

Treatment Type	Habitat Effect	Annual
Riparian reserve thinning	Increase in stream temperature	3,000 acres
Road maintenance	Increase in stream temperature and suspended sediment	400 miles
Road construction and reconstruction	Increase in stream temperature and suspended sediment	100 miles
Wet season haul	Increase in suspended sediment	500 miles

Increase in stream temperature – Riparian reserve thinning, road maintenance, and road construction and reconstruction. The indicator for the extent of take includes the estimated annual riparian reserve thinning (3,000 acres), road maintenance (400 miles; range 50 to 400 miles), and road construction and reconstruction (100 miles; 20 to 100 miles). This indicator is proportional to the effects of timber harvest because many thinning units, roadside tree removal areas, and tree removal for temporary roads and landings construction will have removed trees from within 150 feet of streams, reducing stream shade that contributes to increased stream temperatures, which could significantly modify behavior of or injure ESA-listed species covered by this opinion. Although somewhat co-extensive with the proposed action, this is a valid reinitiation trigger because the metric is measured yearly and if the extent of take is exceeded in one year, the SNF can alter plans for future years to reduce the amount of riparian reserve thinning such that, over time, the amount of take would not exceed that considered in our jeopardy analysis. Thus, the extent of take indicator that will be used as the reinitiation triggers for this pathway is the number of acres of riparian reserve thinning annually (up to 3,000 acres; range 1,000 to 3,000), the miles of road maintenance under which roadside hazard tree removal will occur (average 200 miles; range 50 to 400 miles) and the miles of road construction that would remove trees (average 50 miles; range 20 to 100 miles).

Increase in suspended sediments – Road maintenance, road construction and reconstruction, and wet season haul. The indicator for the extent of take relative to suspended sediments includes miles of road maintenance (400 miles; range 50 to 400), road construction and reconstruction (100 miles; range 20 to 100), and wet season haul (500 miles; range 100 to 500). This is proportional to the effects of suspended sediments because even properly designed and maintained roads contribute some amount of fine sediments to streams. Although there is likely not a linear relationship between the amount of roads and increases in fine sediment, we know that in general, the amount of sediment delivered to streams increases as the amount of roads close to streams increases. This is a valid reinitiation trigger because the SNF can restrict additional maintenance, road construction and reconstruction, and wet season haul if yearly estimates indicate that this extent of take has been exceeded.

2.9.2 Effect of the Take

In the 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.

2.9.3 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).

The following measures are necessary and appropriate to minimize the impact of incidental take of listed species due to the proposed action:

The SNF shall:

1. Minimize incidental take due to authorizing or conducting projects by ensuring that all such projects use the PDCs described in the proposed action and analyzed in this opinion as appropriate.
2. Complete notification, monitoring, and reporting to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the SNF or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The SNF 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 ITS (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.

1. To implement RPM #1 (PDCs), the SNF shall administer every action authorized, funded, or carried out under this opinion in a manner consistent with PDCs described in the Proposed Action.

2. To implement RPM #2 (monitoring and reporting), the SNF shall ensure that:
   a. The SNF will submit a monitoring report to NMFS by February 15 each year that describes the SNF's efforts to carry out this opinion. The report will include an assessment of overall program activity by 5th field watershed, and any other data or analyses the SNF deems necessary or helpful to assess habitat trends because of actions completed under this opinion.
   b. The SNF will attend an annual coordination meeting with NMFS by March 31 each year to discuss the annual monitoring report and any actions that will improve conservation under this opinion, or make the program more efficient or more accountable.
   c. The SNF will complete and record the following data on timber sale programmatic activities that occur annually:
      i. Monitor and record fish presence, handling, and injury during all phases of fish capture and submit a fish salvage report to NMFS within 60 days of project completion
      ii. The number of acres of upland thinning.
      iii. The number of acres of riparian reserve thinning.
      iv. The number of miles of road the SNF conducted maintenance.
      v. The number of miles of road the SNF constructed or reconstructed.
      vi. The number of miles of road on which the SNF conducted wet season haul.
      vii. The acres and location of prescribed burning activities.

2.10 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. In riparian reserves, maximize timber hauling in the dry season, as possible, to minimize sediment input to streams.
2. Within the inner riparian zones adjacent to LFH and perennial streams, when conducting thinning activities, minimize stream shade loss and maximize wood recruitment.
3. Increase beaver habitat in riparian areas and seek to increase beaver populations.
4. Consider increasing the inner riparian zone from 100 feet to 120 feet for all perennial streams for future NEPA analyses.
5. Analyze roads in riparian reserves and prioritize removal or relocation to minimize or eliminate sedimentation.
6. Update SNF forest road rules with specific attention to minimizing or eliminating sediment to streams.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Siuslaw Vegetation and Aquatic Restoration Programmatic.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service 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 ITS 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 identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

The SNF requested consultation on Southern Resident killer whales and conferencing on the Southern Resident killer whale proposed critical habitat (pCH). Should the pCH be designated, this conference record shall serve as the consultation for such designation.

On September 19, 2019, we proposed to modify the critical habitat designation for Southern Resident distinct population segment of killer whales (*Orcinus orca*) to expand the geographic area of the designation for prey species (Chinook salmon) of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth (84 FR 49214). The SNF requested consultation on Southern Resident killer whale critical habitat on November 14, 2019. The action area for this proposed action spans SNF managed lands and streams from Coos to Tillamook County. Many streams in the proposed action area support spawning, rearing, and migration of Chinook salmon. Because of similarities in life history and biology, our effects analysis for coho salmon and steelhead is a reasonable surrogate for effects on Chinook salmon.

In our proposal to modify critical habitat (84 FR 49214), we described six coastal areas and the primary essential feature of critical habitat for that area. Chinook salmon populations in the action area that contribute to the prey essential feature of Southern Resident killer whale critical habitat in coastal areas one to three would potentially be affect by the proposed action. Coastal areas one to three include Oregon waters off of Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry counties.

The proposed action may affect forage for Southern Resident killer whales by reducing availability of their primary prey, Chinook salmon. Similar to coho salmon, the proposed activities are not expected to produce a measurable effect on the abundance, distribution, diversity, or productivity of Chinook salmon at either the population or species level. Given the total quantity of prey available to Southern Resident killer whales throughout their range, this reduction in prey is extremely small, and is not anticipated to be different from zero by multiple decimal places (based on NMFS previous analyses of the effects of salmon harvest on Southern

Resident killer whales). Because the reduction is so small, there is also a low probability that any juvenile Chinook salmon killed by the proposed activities would have later (in 3-5 years' time) been intercepted by the Southern Resident killer whales across their vast range in the absence of the proposed activities. The anticipated reduction of salmonids associated with the proposed action would result in an insignificant reduction in adult equivalent prey resources for Southern Resident killer whales and an insignificant effect on proposed Southern Resident killer whale designated critical habitat. Thus, the proposed action would not change the quality and function of the prey designated critical habitat essential feature for Southern resident killer whales. Nor would the loss of juvenile Chinook salmon from the proposed action cause a meaningful effect to any Southern Resident killer whale individuals or the species as a whole. Therefore, the proposed action is not likely to adversely affect Southern Resident killer whales or their proposed critical habitat.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

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 SNF and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plan developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

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 stages of Chinook salmon (*O. tshwytscha*) and coho salmon as identified in the Fishery Management Plan for Pacific coast salmon (PFMC 2014).

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action would adversely affect EFH designated for Chinook and coho salmon. Adverse effects of the proposed action would include sub-lethal effects from exposure to increased suspended sediment, and increased stream temperature.

3.3 Essential Fish Habitat Conservation Recommendations

The following conservation measures are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. All of these conservation recommendations are a subset of the ESA terms and conditions.

1. Minimize adverse effects on EFH from vegetation and aquatic management by implementing term and condition #1 of the accompanying opinion.
2. Ensure completion of a monitoring and reporting program to confirm the proposed action is meeting the objectives of limiting adverse effects on EFH, as stated in term and condition #2, except for 2(c)(i) (reporting for fish salvage).
3. Implement the conservation recommendations presented in section 2.10 of the accompanying opinion.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the SNF 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, minimizing, mitigating, or otherwise 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 SNF 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. The intended users of this opinion are the SNF. Other interested users could include timber contractors, citizens of affected areas, and others interested in the conservation of the affected ESUs/DPS. Individual copies of this opinion were provided to the SNF. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

5.2 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.

5.3 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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