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

Refer to NMFS No:
WCR-2017-7216

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Roylene Rides at the Door
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Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Natural Resources Conservation Service (NRCS) Conservation Programmatic for Oregon and Washington.

Dear Mr. Alvarado and Ms. Rides at the Door:

Thank you for your letter dated June 8, 2017, 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 a conservation programmatic.

We also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)), and 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.

In the biological opinion (opinion), NMFS concludes that the proposed action is not likely to jeopardize the continued existence of ESA-listed Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River (LCR) Chinook salmon, Upper Willamette River (UWR) spring-run Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, Hood Canal (HC) summer chum salmon (*O. keta*), Columbia River (CR) chum salmon, LCR coho salmon (*O. kisutch*), Oregon Coast (OC) coho salmon, Southern Oregon/Northern

California Coast (SONCC) coho salmon, Lake Ozette (LO) sockeye salmon (*O. nerka*), PS steelhead (*O. mykiss*), LCR steelhead, UWR steelhead, Middle Columbia River (MCR) steelhead, UCR steelhead, Snake River Basin (SRB) steelhead, or eulachon (*Thaleichthys pacificus*) or their designated critical habitat. Rationale for our conclusions is provided in the attached opinion. We concur with the Natural Resources Conservation Service (NRCS) that the action is not likely to adversely affect (NLAA) southern green sturgeon (*Acipenser medirostris*) and southern resident killer whale (*Orcinus orca*). We also determined the action is NLAA for SR sockeye salmon. The NRCS determined the action was NLAA Stellar sea lion (*Eumetopias jubatus*). The Stellar sea lion was delisted in December 2013, so consultation was not necessary.

As required by section 7 of the ESA, NMFS provided an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize incidental take associated with the proposed action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the NRCS and any person who performs the action must comply with to carry out the RPMs. Incidental take from the proposed action that meets these terms and conditions will be exempt from the ESA take prohibition.

Our EFH analysis includes one conservation recommendation to avoid, minimize, or otherwise offset potential adverse effects to EFH. If your response is inconsistent with the EFH conservation recommendation, the NRCS must explain why, including the justification for any disagreements over the effects of the action and the recommendation. 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, in your statutory reply to the EFH portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

Please contact Jody Walters of the Columbia Basin Branch at (509) 962-8911 ext. 803, jody.walters@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Michael P. Tehan

for Barry A. Thom
Regional Administrator

Enclosure

cc: [*File*]
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Rachel Maggi, Area Biologist, NRCS, WA; rachel.maggi@wa.usda.gov

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

Natural Resources Conservation Service Conservation Programmatic
for Oregon and Washington

NMFS Consultation Number: WCR-2017-7216

Action Agency: Natural Resources Conservation Service

Affected Species and Determinations:

ESA-Listed Species	ESA Status	Is the action likely to adversely affect this species or its critical habitat?	Is the action likely to jeopardize this species?	Is the action likely to destroy or adversely modify critical habitat for this species?
Southern resident killer whale	T	No	N/A	N/A
Lower Columbia River Chinook salmon	T	Yes	No	No
Puget Sound Chinook salmon	T	Yes	No	No
Upper Willamette River spring-run Chinook salmon	T	Yes	No	No
Upper Columbia River spring-run Chinook salmon	E	Yes	No	No
Snake River spring/summer run Chinook salmon	T	Yes	No	No
Snake River fall-run Chinook salmon	T	Yes	No	No
Columbia River chum salmon	T	Yes	No	No
Lower Columbia River coho salmon	T	Yes	No	No
Oregon Coast coho salmon	T	Yes	No	No
Southern Oregon/Northern California Coast coho salmon	T	Yes	No	No
Puget Sound steelhead	T	Yes	No	No
Hood Canal summer-run chum salmon	T	Yes	No	No
Snake River sockeye salmon	E	No	N/A	N/A
Lake Ozette sockeye salmon	T	Yes	No	No
Lower Columbia River steelhead	T	Yes	No	No
Upper Willamette River steelhead	T	Yes	No	No
Middle Columbia River steelhead	T	Yes	No	No
Upper Columbia River steelhead	T	Yes	No	No
Snake River Basin steelhead	T	Yes	No	No
Southern green sturgeon	T	No	N/A	N/A
Eulachon	T	Yes	No	No

Fishery Management Plan that Describes EFH in the Action Area	Would the action adversely affect EFH?	Are EFH conservation recommendations provided?
Pacific Coast Salmon	Yes	Yes

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

Issued By: Michael P. Tehan
Barry A. Thom
Regional Administrator

Date: 04/27/2018

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ACRONYM GLOSSARY

a.e.	acid equivalent
a.i.	active ingredient
ACEP	Agricultural Conservation Easement Program
A&P	Abundance and Productivity
ARBO	Aquatic Restoration Biological Opinion
BA	Biological Assessment
BDA	Beaver Dam Analogue
BEE	Ester form of triclopyr
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BPA	Bonneville Power Administration
BRT	Biological Review Team
CFR	Code of Federal Regulations
cfs	cubic feet per second
CHART	Critical Habitat Analytical Review Team
CHRT	Critical Habitat Review Team
CPS	Conservation Practice Standards
CR	Columbia River
CSP	Conservation Stewardship Program
CV	Coefficient of Variation
DC	Direct Current
dbh	Diameter at Breast Height
DDT	Dichlorodiphenyltrichloroethane
DIP	Demographically Independent Population
DPS	Distinct Population Segment
DQA	Data Quality Act
EE	Environmental Evaluation
EEC	Expected Environmental Concentration
EFH	Essential Fish Habitat
ELJ	Engineered Log Jam
EOG	Electro-olfactograms
EOW	Edge of Water
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
EWP–FPE	Emergency Watershed Protection Program–Floodplain Easement
FCRPS	Federal Columbia River Power System
fps	feet per second
FR	Federal Register
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems model
HC	Hood Canal
HQ	Hazard Quotient
HUC	Hydrologic Unit Code

HWM	High Water Mark
IC	Interior Columbia
ICTRT	Interior Columbia Basin Technical Recovery Team
ITS	Incidental Take Statement
IWW	In-water Work Windows
JAA	Job Approval Authority
LAA	Likely to Adversely Affect
lb	pound
LC50	lethal concentration required to kill 50 percent of the population
LCR	Lower Columbia River
LO	Lake Ozette
LOEC	Least Observable Effect Concentration
LVAP	Longitudinal Vertical Adjustment Profile
LW	Large Wood
LWD	Large Woody Debris
m^2	meters squared
mm	millimeter
MCR	Middle Columbia River
MPG	Major Population Group
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NAWQA	National Water Quality Assessment
NFH	National Fish Hatchery
NGP	Non-gated Pipe
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOEC	No Observable Effect Concentration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
O&M	Operation and Maintenance
OC	Oregon Coast
OC-TRT	Oregon Coast Technical Recovery Team
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Dpartment of Fish and Wildlife
OMB	Office of Management and Budget
OHWM	Ordinary High Water Mark
opinion	Biological Opinion
PBF	Physical and/or Biological Feature
PCB	Polychlorinated Biphenyls
PCE	Primary Constituent Element
PCF	Project Completion Form
PDC	Pulsed Direct Current
PFMC	Pacific Fishery Management Council
PNF	Project Notification Form
POD	Point of Diversion
POEA	Polyethoxylated tallow amine
PS	Puget Sound

PSTRT	Puget Sound Technical Recovery Team
PVA	Population Viability Analysis
RCW	Revised Code of Washington
RM	River Mile
RPM	Reasonable and Prudent Measure
RUH	Restricted Use Herbicide
SONCC	Southern Oregon Northern California Coast
SERA	Syracuse Environmental Research Associates
SR	Snake River
SRB	Snake River Basin
SRKW	Southern Resident Killer Whale
SRT	Self-regulating Tide Gate
SS/D	Spatial Structure and Diversity
TDG	Total Dissolved Gases
TEA	Triethylamine Salt
TRT	Technical Recovery Team
UCR	Upper Columbia River
UCSRB	Upper Columbia Salmon Recovery Board
URB	Upriver Bright
USACE	U.S Army Corps of Engineers
U.S.C.	United States Code
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WLC	Willamette/Lower Columbia
WLC-TRT	Willamette/Lower Columbia Technical Recovery Team

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 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402.

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). A complete record of this consultation is on file at the NMFS Columbia Basin Branch office.

1.2 Consultation History

We received a request for consultation (dated June 8, 2017) and Biological Assessment (BA) from the Natural Resources Conservation Service (NRCS) on June 19, 2017. The NRCS determined that their conservation projects were "Likely to Adversely Affect" (LAA) the Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River (LCR) Chinook salmon, Upper Willamette River (UWR) spring-run Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, Hood Canal (HC) summer chum salmon (*O. keta*), Columbia River (CR) chum salmon, LCR coho salmon (*O. kisutch*), Oregon Coast (OC) coho salmon, Southern Oregon/Northern California Coast (SONCC) coho salmon, Lake Ozette (LO) sockeye salmon (*O. nerka*), SR sockeye salmon, PS steelhead (*O. mykiss*), LCR steelhead, UWR steelhead, Middle Columbia River (MCR) steelhead, UCR steelhead, Snake River Basin (SRB) steelhead, southern distinct population segment (DPS) eulachon (*Thaleichthys pacificus*), and their designated critical habitats. The NRCS also requested concurrence that the proposed action may affect, but is not likely to adversely affect (NLAA) southern green sturgeon (*Acipenser medirostris*), southern resident killer whale (SRKW) (*Orcinus orca*), and Stellar sea lion (*Eumetopias jubatus*). Stellar sea lion is no longer an ESA-listed species, so will not be considered in this consultation.

We received a consultation initiation package on June 19, 2017. On July 24, 2017 the NRCS requested some changes to the description of the proposed action. On August 11, we requested a 90-day extension of the time for formal consultation, due to the complexity of the consultation and the need to coordinate with co-managers. Our extension request was accepted the same day, moving the deadline to January 19, 2018. However, on October 3, 2017, NMFS met with the NRCS and the United States Fish and Wildlife Service (USFWS) to further discuss clarifications to the proposed action. On October 4, 2017, the NRCS removed forest stand improvement activities from the proposed action. On November 20, 2017, the NRCS provided more information and clarification on the proposed action, in response to some questions and issues identified during a phone conference on November 13, 2017 between NMFS and NRCS. We had additional phone discussions about modifying the proposed action description on October 24, November 22, and November 27, 2017. On December 13, 2017, the NRCS submitted their final edits to the proposed action, and this is the date of initiation of consultation.

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). NRCS conservationists provide technical expertise and conservation planning assistance to farmers, ranchers, non-commercial forest landowners and Tribes to make conservation improvements on non-federal and tribal land. NRCS also administers financial assistance and conservation easement programs under the conservation title of the Farm Bill. Financial assistance programs help private landowners and Tribes to implement activities identified in their conservation plans. All programs are voluntary and offer science-based solutions that benefit both the landowner and the environment.

Washington and Oregon NRCS offices provide federal funding and authorization for thousands of new conservation actions every year via authorities under the Farm Bill. The NRCS is requesting formal programmatic ESA section 7 consultation on programs they are proposing to authorize or fund, which provide for conservation and restoration activities in Oregon and Washington. Those programs include the Environmental Quality Incentives Program (EQIP), the Conservation Stewardship Program (CSP), the Agricultural Conservation Easement Program (ACEP), and the Emergency Watershed Protection Program–Floodplain Easement Option (EWP–FPE) (detailed in Appendix A of the BA). These programs can be broken down into two main categories—financial assistance programs and easement programs. Landowner participation in these programs is voluntary.

Under financial assistance programs, federal funding is provided to landowners in the form of contracts which vary in length from one to ten years. Payments are made after all contract requirements have been met. A contract with a landowner normally includes multiple conservation actions which are planned, designed, and implemented under a variety of conservation practices. In any given year, both Oregon and Washington are contracting, tracking, certifying, and paying for tens of thousands of conservation practices in hundreds of multi-year contracts. In Oregon, NRCS has averaged 594 new financial assistance program contracts per year (3-year average for fiscal years 2013 to 2016.) Washington's 3-year average is 422 new contracts a year.

Under the Wetland Reserve and Floodplain Easement programs, funding is provided to landowners in the form of payments for easement acquisition and reimbursement for restoration and conservation practice implementation. Restoration and conservation implementation could be completed by the landowner, a private contractor, a conservation partner (e.g., U.S. Fish and Wildlife Service [USFWS]) or the NRCS. Easements are acquired from willing sellers for the purposes of restoring and protecting wetland and floodplain functions. NRCS maintains responsibility for management and maintenance of approximately 328 of these conservation easements on nearly 88,000 acres in Oregon and Washington. Approximately two new easements are enrolled in each state each year. The average size of each easement is about 150 acres in Washington and 400 acres in Oregon. In addition to federal funding for acquisition and restoration, NRCS authorizes management actions deemed compatible with the easement program goals and objectives. Issuance of a compatible use authorization ensures the proposed action will meet NRCS practice standards and specifications. Actions included in compatible use authorization may be implemented without the use of federal funding.

The NRCS proposes to fund or authorize projects in the following six categories: Fish Passage Restoration; Tide and Flood Gate Removal, Replacement, or Retrofit; Stream, Floodplain, and Wetland Restoration and Management; Vegetation Management; Road Erosion Control, Maintenance, and Decommissioning; and Irrigation and Water Delivery Management. All activities in all categories will incorporate the applicable General Conservation Measures below. Additional activity-specific conservation measures are described within each activity description below (following the General Conservation Measures section). High-risk activities require NMFS engineering review, as shown in Table 1. Prior to submitting the Project Notification Form (PNF), NRCS will obtain NMFS engineering review and provide written documentation (e.g., an email) from the NMFS engineer that he or she has reviewed the project and that it meets acceptable design specifications. After receiving the PNF, the NMFS Branch Chief will still reserve the right to review the project. Table 2 shows the NRCS' estimates of the number of project activities occurring in each category each year and the extent of habitat affected.

Table 1. Action categories and activities, and NMFS engineering review requirements.

Category	Activities	Requirements for NMFS engineering review prior to submitting the Project Notification Form
Fish Passage Restoration	Structure Removal	Greater than 3 vertical feet of grade control proposed in engineering design
	Irrigation Diversion Improvement	Complete Replacement
		Water operation modification affecting fish passage
		Point of diversion is moved
		Greater than 3 vertical feet of grade control proposed in engineering design
	Headcut and Grade Stabilization	Structures, roughened channels and grade control structures with greater than 3 vertical feet of grade control proposed in engineering design
	Fish Passage at Existing Structure	All projects except maintenance of existing structures
	Bridge and Culvert Removal or Replacement	No review required
	Stream Crossing Improvement	No review required

Category	Activities	Requirements for NMFS engineering review prior to submitting the Project Notification Form
Tide and Flood Gate Removal, Replacement, or Retrofit	Tide and Flood Gate Removal, Replacement, or Retrofit	All projects require review
Stream, Floodplain, and Wetland Restoration and Management	Restore Wetlands and Secondary Channels	No review required
	Setback or Removal of Existing Berms, Dikes, and Levees	No review required
	Bioengineering for Streambank Protection	No review required
	Stream Habitat Improvement with Natural Materials	No review required
	Riparian and Wetland Vegetation Planting	No review required
	Fluvial Channel Reconstruction	All projects require review
	Beaver Dam Analogues	All projects require review
Vegetation Management	Physical Control	No review required
	Herbicide	No review required
	Juniper Tree Removal	No review required
	Prescribed Burning	No review required
Road Maintenance, Erosion Control, and Decommissioning	Road Maintenance and Erosion Control	No review required
	Road Decommissioning	No review required
Irrigation and Water Delivery and Management	Irrigation Efficiency Improvement	No review required
	Water Conveyance Improvement	No review required
	Conversion of Instream Diversions to Groundwater Wells	No review required
	Irrigation Water Siphons	No review required
	Livestock Watering Facilities	No review required
	Fish Screens	Fish screens for surface water diversion by gravity or by pumping at a rate exceeding 3 cubic feet per second (cfs).
	Pump Station Diversions	No review required

Table 2. Estimated annual number and extent of projects.

Category	Activity	Number of Projects/Year	Extent/Year
Fish Passage Restoration	All	20	20 miles opened
Tide and Flood Gate Removal, Replacement, or Retrofit	All	4	4 miles opened
Stream, Floodplain, and Wetland Restoration and Management	Stream Restoration and Management	12	35 miles of stream treated
	Floodplain and Wetland Restoration and Management	85	2800 acres treated
Vegetation Management	All	400	20,000 acres (includes upland)
Road Maintenance, Erosion Control, and Decommissioning	All	8	15 miles within or adjacent to streams

Category	Activity	Number of Projects/Year	Extent/Year
Irrigation and Water Delivery and Management	All	700	6.5 miles

1.3.1 NRCS Planning Process

Regardless of program funding or authorization actions, NRCS first provides technical assistance to clients to identify and solve natural resource concerns (problems) present on their lands. NRCS' conservation planning process, described in the National Planning Procedures Handbook, is used to develop, implement, and evaluate Conservation Plans. Appendix B of the BA outlines the nine-step conservation planning process. An environmental evaluation (EE) is conducted as a concurrent part of the planning process to evaluate potential long-term and short-term impacts of an action on people, their physical and social surroundings, and the environment, and explore alternative courses of action. The EE integrates NRCS' compliance with environmental laws, regulations, and agency environmental policy into the planning process and documents the level of analysis required under the National Environmental Policy Act.

Natural resource concerns, problems, and opportunities are addressed in Conservation Plans by implementing a combination of Conservation Practice Standards (CPSs) as part of a conservation system. Conservation systems can be thought of as conservation or restoration projects intended to address a specific purpose and need. These conservation systems form the basis for Farm Bill program contracts and wetland restoration and management plans.

Every CPS has a set of standards and specifications describing where, when, and for what purposes the practice can be used as well as how the practice must be installed. Each CPS includes a unit of measurement (e.g., acres, feet, number) that quantifies the amount of the CPS planned, designed, and installed. In addition, each CPS implementation funded by NRCS has written Practice Implementation Requirements, which are site-specific. National practice standards are housed in the National Handbook of Conservation Practices. Copies of national practice standards and specifications are available here: https://www.nrcs.usda.gov/wps/portal /nrcs/detailfull/national/technical/cp/ncps/?cid=nrcs143_026849

Appendix C lists the CPS which are commonly used to implement the activities in this consultation.

1.3.2 Quality Assurance

Conservation practices have the potential to affect the environment, natural resources, and public health and safety. Depending on the size, location, and complexity of the work, failure of a CPS could cause environmental damage, unacceptable economic risk, significant property damage, health impairment, and even loss of life.

NRCS' job approval authority (JAA) process ensures the competency of NRCS employees to plan, design, and install CPS that, with proper operation and maintenance (O&M), will perform the intended functions for the projected service life (Appendix C of the BA provides a list of CPS practice lifespans). JAA additionally serves to substantiate and maintain the credibility and trust of NRCS with State boards of licensure, accrediting organizations, other agencies, units of government, and with the public.

The JAA process ensures that technical assistance related to the planning, design, and installation of CPS results in CPS that address the identified resource concerns; comply with NRCS standards, technical criteria, and policies; function as planned, meeting the requirements of site-specific conditions; and are cost effective with consideration given to installation, operation, and maintenance costs.

JAA is assigned based on each employee's knowledge, skills, and abilities as evidenced by training, experience, and demonstrated competence. A qualified person who has appropriate JAA can plan CPS and approve all CPS design, installation, and approval/certification. While others may do work associated with the planning, design and installation of a CPS, it must be accomplished under the direction of a person with the appropriate JAA.

CPS require job classifications that utilize controlling factors. Up to five Job Classes of JAA are designated within each CPS. Controlling factors describe a complexity or hazard component that require a specific level of demonstrated knowledge, skill, and ability to plan, design and install the CPS. Job Classes are based on size, hazard, or complexity. Job Classes 1 through 3 are considered low risk and are typically planned, designed, and implemented by NRCS Field Office staff. Job Classes 4 and 5 are considered medium to high risk and typically require review and approval by NRCS State Office staff.

1.3.3 Program Administration

NRCS proposes to apply the following as binding administrative requirements for each project authorized or funded under this programmatic as shown by use of the directive word “must” or “will.” The words “should” or “may” are used to show recommendations only, and are not binding as requirements. NRCS program participants are responsible for any and all permits required for project implementation. NRCS will notify program participants of this responsibility.

1) Designation of lead action agency. When an action is partly authorized, funded, or carried out by another federal agency or agencies in addition to NRCS, those agencies must designate a lead agency for ESA purposes, including consultation, monitoring and reporting. Generally, the agency with the principal responsibility for the project should be the lead agency. All applicable conservation measures and terms and conditions will apply.
2) Project Conditions. NRCS must include applicable Conservation Measures as practice implementation requirements for each project authorized or funded under this programmatic. Practice implementation requirements will be verified onsite before payments are made under financial assistance programs and during regularly scheduled monitoring of easement program compatible use authorizations.
3) Herbicide application recordkeeping. NRCS must ensure that each herbicide applicator maintains a daily log of all weed treatments, which includes the following information:

   a) The number of acres treated within 100 feet of surface water and greater than 100 feet from surface water. Identify treatment areas by 6th field hydrologic unit code (HUC; i.e., HUC6).
   b) The product names and herbicide formulations used.
   c) The herbicide application rate.
   d) The application method.
   e) Wind speed and air temperature at the time of application.
   f) The daily logs shall be retained by NRCS. If requested, the logs will be made available to the Services.
4) Annual Program Report. Each year by November 15, NRCS must provide an annual monitoring report to the Services for the previous fiscal year that describes NRCS' efforts to carry out the requirements of this programmatic. The report will include the following information:
   a) A list of any actions that NRCS funded or authorized using this programmatic.
   b) An assessment of overall program activity.
   c) Data required to monitor the ITS.
   d) Any other data or analyses that NRCS deems necessary or helpful to assess habitat trends as a result of actions funded or carried out under this programmatic.
5) Annual Coordination Meeting. If requested, NRCS will attend an annual coordination meeting with the Services each year to discuss the annual monitoring report and any actions that will improve conservation under this programmatic, or make the program more efficient or more accountable.

1.3.4 General Conservation Measures

The activities covered under this consultation are intended to conserve natural resources and have no long-term adverse impacts to ESA-listed species. However, project construction activities have short-term adverse effects to ESA-listed species and their critical habitats as well as EFH. To minimize these short-term adverse effects and make them predictable for purposes of programmatic analysis, NRCS will use the following general conservation measures as applicable to each project.

1) 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.
2) Compliance with federal, state, tribal, and local laws and regulations. Compliance with all applicable federal, state, tribal, and local laws and regulations will be documented and applicable regulatory permits and official project authorizations obtained before project implementation, in accordance with NRCS GM Title 450 Part 405 Subpart A. These permits and authorizations include, but are not limited to, National Environmental Policy Act, National Historic Preservation Act, state agency removal and fill permits, U.S. Army Corps of Engineers (USACE) 404 permits, and associated 401 water quality certifications.
3) Timing of in-water work. Appropriate state wildlife agency guidelines for timing of in-water work windows (IWW) will be followed. (e.g., http://wdfw.wa.gov/ licensing/hpa/freshwater_incubation_avoidance_times_28may2010.pdf;

http://app.leg.wa.gov/WAC/default.aspx?cite=220-660-330; http://www.dfw.state.or.us/lands/inwater/Oregon_Guidelines_for_Timing_of_%20InWater_Work2008.pdf). Isolation, dewatering, and fish salvage are included as in-water work activities, so will only occur during the appropriate in-water work windows.

4) Fisheries, Hydrology, Geomorphology, Wildlife, Botany, and Cultural Surveys in Support of Habitat Conservation:
   a) This includes assessments and monitoring projects that are associated with planning, implementation, and monitoring of projects covered by this programmatic. Such support projects may include surveys to document the following aquatic, riparian, coastal and upland attributes: habitat, hydrology, channel geomorphology, geology, water quality, fish spawning, species presence, macroinvertebrates, riparian vegetation, wildlife, and cultural resources. This includes excavating test pits up to approximately 5.5 square yards in size (e.g., for cultural resource and geotechnical surveys). This also includes effectiveness monitoring associated with projects implemented under this programmatic, provided the effectiveness monitoring is limited to the same survey techniques described in this section.
   b) Recent survey data will be reviewed to determine the potential presence of any listed species that may occur within the project area. If no survey data are available, occupancy for listed animal species will be assumed in all suitable habitat in proximity to known occupied habitat, unless absence can be confirmed.
   c) Train personnel in survey methods to prevent or minimize disturbance of fish and wildlife and plants. Contract specifications should include these methods where appropriate.
      i) Avoid impacts to fish redds. When possible, avoid sampling during spawning periods.
      ii) Avoid trampling and/or stepping on listed species, their nests and their forage plants when completing surveys, assessments, and monitoring activities.
      iii) Do not walk through vernal pool habitats, especially during the wet season, unless absolutely necessary to complete required surveys, assessments, and monitoring activities.
      iv) Complete surveys, assessments, and monitoring activities during non-critical life history periods for a listed species (e.g., not during spawning and breeding periods), unless the activity objective(s) require(s) this level of timing.
      v) Coordinate with other local agencies to prevent redundant surveys.
      vi) Locate excavated material from test pits away from stream channels. Replace all material in test pits when survey is completed and stabilize the surface.

5) Site contamination assessment. The level of detail and resources committed to such an assessment will be commensurate with the level and type of past or current development at the site. An assessment may include the following:
    a) Review available records, such as former site use and records of any prior contamination events.
    b) If the project site was used for industrial processes (i.e., mining or manufacturing with chemicals), inspect to determine the environmental condition of the property.
    c) Interview people who are knowledgeable about the site, e.g., site owners, operators, and occupants, neighbors, or local government officials.
    d) Consult with the services if ground disturbance to accomplish the proposed project would potentially release contaminants to aquatic habitat that supports listed fish species.
6) 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.
7) Temporary access roads and paths.
    a) Existing access roads and paths will be preferentially used whenever reasonable, and 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) The removal of riparian vegetation during construction of temporary access roads will be minimized. When temporary vegetation removal is required, 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 de-compacting 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 by the end of the in-water work window.
8) 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 wherever possible.

    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 to the maximum extent possible.
    f) No stream crossings will occur at active spawning sites, when holding adult listed fish are present, or when eggs or alevins are in the gravel. The appropriate state fish and wildlife agency will be contacted for specific timing information.
    g) After project completion, temporary stream crossings will be obliterated and the stream channel and banks restored.

9) 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.

10) 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 zone, such as a paved parking lot or adjacent, established road. 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 before operation below OHWM (or highest astronomical tide [HAT] for marine environments), and as often as necessary during operation, to remain grease free.

11) 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 any significant 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 to enter the stream, sediment barriers will be installed and maintained for the duration of project implementation.
ii) Temporary erosion control measures may include fiber wattles, silt fences, jute matting, wood fiber mulch and soil binder, or geotextiles and geosynthetic fabric.
iii) Soil stabilization utilizing wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the materials are noxious weed free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
iv) Sediment will be removed from erosion controls once it has reached one third of the exposed height of the control.
v) Once the site is stabilized after construction, temporary erosion control measures must be removed.

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, NRCS will require the program participant to obtain and implement the appropriate state water quality certification and its associated construction stormwater permits.

12) Dust abatement. NRCS 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 percent of available streamflow.
  e) During officially declared drought periods, no water will be withdrawn from the stream. In Washington State, drought is declared by the Washington Department of Ecology per rules in WAC 173-166-060, under the statutory authority of RCW 43.83B. In Oregon, drought is declared by the Governor (http://www.oregon.gov/owrd/WR/docs/State_Drought_Process_and_Tools_Final.pdf.).

13) 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. NRCS will specify the following measures for its client and the client's contractor:

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.

14) Invasive species control. The following measures will be used to avoid introduction of invasive plants and noxious weeds into project areas:

a) Prior to entering the 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) Watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species.

15) 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 state department of fish and wildlife 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 instream 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 experienced with 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 (PDC) will be used.
    a. If conductivity is less than 100 μs, voltage ranges from 900 to 1100 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 percent 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 2011a, or most

recent version). If the pumping rate exceeds 3 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.

16) 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 2011a, or most recent version).

17) Construction and discharge 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 percent of available streamflow.
c) During officially declared drought periods, no water will be withdrawn from the stream. In Washington State, drought is declared by the Washington Department of Ecology per rules in WAC 173-166-060, under the statutory authority of RCW 43.83B. 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 best management practices 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 2011a, or most recent version). If the pumping rate exceeds 3 cfs, a NMFS engineering review will be necessary.

18) 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.

19) 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.

20) 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 whenever practicable.

21) Revegetation. Long-term soil stabilization of the disturbed site will be accomplished with reestablishment 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) Invasive 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 percent 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).
22) Site access. NRCS will retain the right of reasonable access to the site, such that NRCS can monitor the success over the life of the CPS.
23) Obliteration. 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.

1.3.5 Minor Project Modification

The following minor project modifications are 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 biological opinion:

1. 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.
2. Alternate location for staging (e.g., construction equipment storage, fueling), provided the location is as far from the stream as practical, and will employ any additional measures as appropriate to prevent sediment and chemical delivery to the stream.

Minor project modification requests shall be included in the PNF. The appropriate NMFS branch chief for the project location will have 10 business days to reject the request in writing, otherwise work may proceed.

1.3.6 NRCS Design Report Documentation

Activities with potential high-risk effects on the species considered will require NMFS engineering and/or biologist review prior to submitting the PNF. Guidelines for review are described under each of the six action categories. Some activities have additional activity-specific design report documentation requirements listed under each.

All activities will follow NRCS Design Report documentation policy in accordance with NRCS National Engineering Manual Title 210 Part 511 Subpart B—Documentation. Design reports summarize in narrative form the design objective, data, criteria, assumptions, procedures, and decisions used in the design. Selected structure dimensions, elevations, and capacities may be used to augment the narrative.

Design of NRCS CPS shall document compliance with NRCS practice standards, specifications, and policy. The project documentation should provide other persons the means of quickly following the rationale used in determining all features of a design including the design objective(s), data, criteria, assumptions, procedures, and decisions used in design and resulting construction plans, specifications, and details. For activities requiring NMFS review, the design report shall serve as the design submittal framework used to assess and evaluate the adequacy of the proposed activities.

When NMFS review is required, the following items will be provided or completed. Additional activity-specific design report documentation shall also be submitted when required.

1) Summary—A concise statement of the site history and status of the design.
2) Description of the Job—A brief description of the resource concern(s), cause of problem if known, hazard classification, landscape resources, and proposed project elements.
3) Design Objective—A brief, clear statement of the objective to be achieved.
4) Basis for Design—A listing of reference documents used in the design, such as NRCS Practice Standards, handbooks, codes, reports, studies, and criteria.
5) General Basic Data—Hazard analyses, seismic assessment, limiting conditions or restraints that may influence the design, construction, or facility operation.
6) Location and Layout of the project, including equipment used to survey project.
7) Hydrology—Storm frequencies, procedures, data sources, hydrologic analyses, and summary of precipitation amount and intensity.
8) Hydraulic Design—A summary of the site hydraulics, including channel slope, geometry, calculated design velocities and water surface elevations, and hydraulic modeling input and output, as appropriate. Include channel stability and sediment transport considerations.
9) Foundations, Embankment Design, or Both—A summary of data, site conditions, assumptions, treatments selected, and design analyses used to:
    a) Perform seepage analyses and design control measures.
    b) Perform stability analyses and determine material quality and quantity.
    c) Perform foundation design analyses.
10) Structural Design—A summary listing the assumptions, loading conditions, and design procedures.

11) Environmental Considerations—Features or practices to provide for conservation of visual, biological, and surface and groundwater resources that may be affected by the planned measures, both during and after construction.
12) Construction Drawings—Drawings shall consist of the following, at a minimum:
    d) Plan view with scale, aerial photo, and proposed structure(s) locations.
    e) Longitudinal profile of the stream channel thalweg for 10 bankfull channel widths upstream and downstream of the structure.
    f) Three cross-sections: one downstream of proposed structure, one upstream of the structure in the area of influence, and one upstream of the structure outside the area of influence.
    g) Detail drawings as appropriate.
13) Site restoration plan, including work area isolation and erosion control notes and details and aerial photo outlining area of impact.
14) Construction Schedule.—Timing of in-water work windows and general construction schedule.
15) Operation and Maintenance Plan.— List of anticipated O&M activities.
16) Construction Review or Inspection Plan - A summary of those items, conditions, or features encountered during construction that require a field review by the engineer to ensure that conditions anticipated during the design are verified and consistent with the design assumptions. Include the request for timely notification. Note whether a preconstruction conference is needed.
17) Authority.—The name (with signature) and title of the designer and approving officer must appear on the report.

1.3.7 Action Categories and Activity Descriptions

Category 1. Fish Passage Restoration

NRCS proposes to fund or authorize fish passage projects for migrating ESA-listed species. The objective of fish passage is to allow all life stages of species access to historical habitat and focuses on restoring safe upstream and downstream fish passage to stream reaches that have become isolated by obstructions. The following activities will be used to improve fish passage under this category: (a) Structure Removal, (b) Irrigation Diversion Improvement, (c) Headcut and Grade Stabilization, (d) Fish Passage at Existing Structure, (e) Bridge or Culvert Replacement, and (f) Stream Crossing Improvement.

Structure Removal

Description. Removing dams, channel-spanning weirs (dam, diversions), earthen embankments, subsurface drainage features, spillway systems, outfalls, pipes, instream flow redirection structures (e.g., drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels to restore more natural channel and flow conditions.

If the structure being removed contains material (i.e., large wood, boulders) typically found within the stream or floodplain at that site, the material may be reused to improve habitat. Any such project must follow the requirements under the Stream Habitat Improvement with Natural Materials activity in Category 3 below.

Guidelines for Review. If more than 3 vertical feet of grade control is proposed in the engineering design, the activity will require NMFS review.

Additional Design Report Documentation.

1. The design shall include an assessment of the longitudinal vertical adjustment profile (LVAP) of the channel, as calculated in the "Stream Simulation: An ecological approach to providing passage for aquatic organisms at road crossings" (USDA–Forest Service 2008).
2. Sediment characterization to determine the proportion of coarse sediment (greater than 2 mm) in the reservoir area.
3. A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure or dam. Reservoirs with a d35 greater than 2 mm (i.e., 65 percent of the sediment by weight exceeds 2 mm in diameter) may be removed without excavation of stored material, if the sediment contains no contaminants; reservoirs with a d35 less than 2 mm (i.e., 65 percent of the sediment by weight is less than 2 mm in diameter) will require partial removal of the fine sediment to create a pilot channel, in conjunction with stabilization of the newly exposed streambanks with native vegetation.

Additional Conservation Measures.

1. Structure removal projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 500 Obstruction Removal, 396 Aquatic Organism Passage, 580 Streambank and Shoreline Protection, 584 Channel Stabilization, 410 Grade Stabilization, and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. Dams greater than 10 feet in height (measured on the upstream side of the structure at the approximate center line of the stream) will require a long-term monitoring and adaptive management plan developed between the action agencies.
3. Restore all structure bank line "keys" and fill in "key" holes with native materials as to restore contours of streambank and floodplain. Compact the fill material adequately to prevent washing out of the soil during overbank flooding. Do not mine material from the stream channel to fill in "key" holes. When removal of buried (keyed) structures may result in significant disruption to riparian vegetation and/or the floodplain, consider leaving the buried structure sections within the streambank.
4. If the legacy structures (log, rock, or gabion weirs) were placed to provide grade control, evaluate the site for potential headcutting and incision due to structure removal by using the appropriate guidance. If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts (see grade control options described under Headcut and Grade Stabilization activity category).
5. If the structure is being removed because it has caused an over-widening of the channel, NRCS will consider implementing other restoration activities to decrease the width-to-depth ratio of the stream at that location to a level commensurate with representative upstream and downstream sections (within the same channel type).

Irrigation Diversion Improvement

Description. NRCS proposes to fund or authorize the consolidation or replacement of existing diversions with pump stations or geomorphically appropriate in-stream structures to reduce the number of diversions on streams and thereby conserve water and improve habitat for fish, improve the design of diversions to allow for fish passage and adequate screening, or reduce the annual instream construction of push-up dams and instream structures. Geomorphically appropriate in-stream structures that facilitate proper pump station operations are allowed when designed in association with the pump station. Infiltration galleries and lay-flat stanchions are not proposed within this action. Periodic maintenance of irrigation diversions will be conducted to ensure their proper functioning, i.e., cleaning debris buildup, and replacement of parts.

Unneeded or abandoned irrigation diversion structures will be removed where they are barriers to fish passage, have created unacceptable habitat modifications, or are causing sediment concerns through deposition behind the structure or downstream scour according to the Structures Removal section.

Guidelines for Review. NMFS review is required when, as part of the engineering design, irrigation diversions and civil works affecting diversion operations are either (1) completely replaced, (2) water operations are modified which affect passage conditions, (3) a point of diversion (POD) is moved, or (4) more than 3 vertical feet of grade control is proposed in the engineering design. Additional NMFS review may be required related to fishway and fish screen design at diversions. Read corresponding action categories within this document for more guidance.

Additional Conservation Measures.

1. Diversion structures shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 362 Diversion, 584 Channel Stabilization, 410 Grade Stabilization, 396 Aquatic Organism Passage, and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. Placement of geomorphically appropriate in-stream structures shall follow criteria outlined in the Headcut and Grade Stabilization activity category.
3. Diversions will be designed so that diverted water withdrawal is equal to or less than the irrigator's legal water right.
4. Project design will include the installation of a totalizing flow meter device on all diversions for which installation of this device is possible. A staff gauge or other device capable of measuring instantaneous flow will be utilized on all other diversions.
5. Multiple existing diversions may be consolidated into one diversion if the consolidated diversion is located at the most downstream existing diversion point unless sufficient low flow conditions are available to support unimpeded passage. The design will clearly identify the low flow conditions within the stream reach relative to the cumulative diverted water right. If instream flow conditions are proven favorable for fish passage and habitat use, then diversion consolidation may occur at the upstream structure.

6. Project planning efforts will support prevention of low flow conditions which result in impassable conditions for fish. Diversion withdrawals coupled with low flow conditions will not be reduced below benchmark conditions and landowners will be informed of partner organizations which offer water transaction mechanisms that commit water savings back to the stream.

Headcut and Grade Stabilization

Description. NRCS proposes to fund or authorize the restoration of fish passage and grade control (i.e., headcut stabilization) with geomorphically appropriate structures constructed from rock or large wood. Boulder structures and roughened channels may be installed for grade control at culverts and bridges, to mitigate headcuts, and to provide passage at small dams or other channel obstructions that cannot otherwise be removed. For wood-dominated systems, use geomorphically appropriate grade control with natural materials.

Geomorphically appropriate grade control structures constructed using wood and rock are designed to arrest channel down-cutting or incision and retain sediment, dissipate stream energy, and increase water elevations to reconnect floodplain habitat and diffuse downstream flood peaks. They also serve to protect infrastructure that is exposed by channel incision and to stabilize over-steepened banks. Unlike hard weirs or rock grade control structures, a geomorphically appropriate grade control constructed using wood and rock is a complex broad-crested structure that dissipates energy more gradually, and mimics natural systems processes.

Guidelines for Review. Rock structures, roughened channels and grade control structures that propose less than 3 vertical feet of grade control and include all of the following conservation measures will not require NMFS review. Rock structures, roughened channels and grade control structures that propose more than 3 vertical feet of grade control will require NMFS review.

Additional Conservation Measures.

1. All structures shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 584 Channel Stabilization, 410 Grade Stabilization, 396 Aquatic Organism Passage, and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. Construction of fishways at dams or other passage barriers requires NMFS review.
3. Construction of passage structures is limited to facilitate passage at existing diversion dams, not in combination with new dams.
4. Install rock structures low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
5. Rock structures are to be placed diagonally across the channel or in more traditional upstream pointing “V” or “U” configurations with the apex oriented upstream. The apex should be lower than the structure wings to support low flow consolidation.
6. Rock structures are to be constructed to allow upstream and downstream passage of all native fish species and life stages that occur in the stream. This can be

accomplished by providing plunges no greater than 6 inches in height, allowing for juvenile fish passage at all flows.

7. Key rock structures into the streambed and banks to minimize structure undermining and flanking due to scour and erosion in accordance with NRCS Conservation Practice design criteria. Refer to Bureau of Reclamation (BOR) (2016; or current version), Soil Conservation Service (1989), and Oregon Department of Transportation (2014) for guidance on keying rock into streambeds and banks.
8. Include fine material in the structure material mix to help seal the structure/channel bed, thereby preventing subsurface flow.
9. Rock for structures shall be durable and of suitable quality to assure permanence in the climate in which it is to be used. Rock sizing depends on the size of the stream, maximum depth of flow, anticipated velocities, planform, entrenchment, and ice and debris loading
10. Channel spanning rock structure placement shall be coupled with measures to improve habitat complexity and protection of riparian areas, where possible. When stability concerns preclude the use of large wood, preferred alternatives for creating habitat complexity in the design may include; spawning gravel placement, habitat boulder complexes, multi-stage channels, and riparian planting.
11. The use of gabions, cable or other means to prevent the movement of individual boulders in a rock structure is not allowed.
12. Designers should evaluate geomorphic conditions and select geomorphically appropriate structures that facilitate “swim through” grade control structures to the extent possible.
13. Headcut stabilization shall incorporate the following measures:
    a. Sufficiently-sized and volumes of material based on hydraulic and geotechnical site conditions to prevent continued up-stream movement. Materials can include rock, wood and organic materials which are native to the area.
    b. Evaluation of plunge pool formation, headcut migration, and vertical adjustment profile of the stream within ten times the bankfull upstream and downstream of the area under consideration.
    c. Evaluation of flanking and scour in accordance with procedures outline in Additional Conservation Measure 7, above.
14. Structures will be constructed with geomorphically appropriate materials that are sized for site conditions based on site velocity, channel slope, and design discharge. Materials, including boulders, gravels, and fines, shall be washed into the streambed with pressurized flow to prevent subsurface flow through the media. Material shall be placed in lifts and washed using sufficient pressure and discharge to accumulate and compact fines into voids. Volumetric flow should move sand, gravel, and small cobble. Increased attention should be given to areas around rocks greater than 18 inches and around weirs as these areas are most often associated with subsurface flow. Adequately compacting and sealing these areas may require manual efforts beyond washing alone. Fines and sand shall be washed in until the streambed is sealed and wash water flows across the top of the streambed. Fill all voids with smaller material in layers as the rock is placed to minimize permeability. This

process shall be repeated until all voids are filled and structures are water tight. Periodic observations will be made by the NRCS engineer or designated representative to verify the streambed is sealing properly during placement. Observations are not limited to, and shall include determining the magnitude or lack of noticeable infiltration of pooled water for a minimum of a 5-minute period for every 2 lifts (or equivalent) of material placed. Sections of channel that fail to seal, as determined by the NRCS engineer or designated representative, shall be brought into compliance.

Fish Passage at Existing Structure

Description. NRCS proposes to fund or authorize projects to provide fish passage at existing structures that are not described under other categories above and below, including dams and water control structures. This includes re-engineering of improperly designed or outdated fish passage structures on dams, maintaining existing fish passage structures to ensure proper function (e.g., cleaning debris buildup), replacing parts, and installing fish ladders at existing structures.

Guidelines for Review. Maintenance of fish passage structures to ensure proper function will not require NMFS review. Activities that are not upkeep and maintenance will require NMFS review.

Additional Conservation Measures.

1. Fish Passage shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 396 Aquatic Organism Passage, 584 Channel Stabilization, 410 Grade Stabilization, and to the design benchmarks set in NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or more recent version).
2. Design consideration should be given for Pacific lamprey passage. Fish ladders that are primarily designed for salmonids are usually impediments to lamprey passage as they do not have adequate surfaces for attachment, velocities are often too high and there are inadequate places for resting. Providing rounded corners, resting areas or a natural stream channel (streambed simulation), or wetted ramp for passage over the impediment have been effective in facilitating lamprey passage. Streambed simulation refers to a design methodology based on pebble counts and analysis of stream geomorphology.

Bridge and Culvert Removal or Replacement

Description. For unimpaired fish passage it is desirable to have a crossing that is larger than the channel bankfull width, allows for a functional floodplain, allows for a natural variation in bed elevation, and provides bed and bank roughness similar to the upstream and downstream channel. Maintenance of structures is the responsibility of the landowner and is not funded through NRCS for any conservation practice. Landowners are expected to maintain CPS for their lifespan, which varies from 10 to 25 years. As such, landowners may perform regular maintenance, using the applicable conservation measures below, of NRCS-funded stream crossings under this consultation, for the duration of the practice lifespan. An O&M Plan will be developed for each conservation practice and provided to the landowner.

Guidelines for Review. Culverts and bridges that meet all of the following conservation measures, including those that are installed on entrenched tidally-influenced streams and agricultural ditches will not require NMFS review.

Additional Design Report Documentation.

1. Designs must demonstrate that the vertical and lateral stability of the stream channel were taken into consideration when designing a crossing.
2. Designs must demonstrate that culverts and bridges will mimic the natural stream processes and allow for fish passage, sediment transport, and flood and debris conveyance.
3. Design reports will include an explanation of why a particular design was chosen with consideration to the following alternatives listed in order of preference: (a) realign road to avoid crossing the stream; (b) bridge—new bridge will span the stream to allow for long-term dynamic channel stability (c) streambed simulation—bottomless arch or embedded culvert.
4. Designs must demonstrate that the crossings: (a) avoid causing local scour of streambanks and reasonably likely spawning areas; (b) allow for likely channel migration patterns within the functional floodplain for the design life of the structure; and otherwise align with well-defined, stable channels.

Additional Conservation measures.

1. Bridges and culverts shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 396 Aquatic Organism Passage, 584 Channel Stabilization, and 410 Grade Stabilization and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. A crossing shall: (a) maintain the general scour prism, as a clear, unobstructed opening (i.e., free of any fill, embankment, scour countermeasure, or structural material); (b) be a single-span structure that maintains a clear, unobstructed opening above the general scour elevation that is at least 1.5 times the bankfull width; or (c) be a multiple-span structure that maintains a clear, unobstructed opening above the general scour elevation, except for piers or interior bents, that is at least as wide as 2.2 times the bankfull. This criterion will restore any physical or biological processes associated with a fully functional floodplain that was degraded by the previous crossing.
3. Bridge scour and stream stability countermeasures may be applied below the general scour elevation; however, except as described above in (2), no scour countermeasure may be applied above the general scour elevation.
4. Abutment protection may be applied using riprap. When riprap is necessary for abutment protection, it will not restrict the bankfull width of the stream. If rock is necessary to stabilize the channel for a bridge or culvert replacement, it shall adhere to the "Headcut and Grade Stabilization" conservation measures above. Riprap may

be placed along the streambank and streambed when it is necessary for the protection of abutments and pilings.

5. Remove all other artificial constrictions within the functional floodplain of the project area as follows: (a) remove existing roadway fill, embankment fill, approach fill, or other fills; (b) install relief conduits through existing fill; (c) remove vacant bridge supports below total scour depth, unless the vacant support is part of the rehabilitated or replacement stream crossing; and (d) reshape exposed floodplains and streambanks to match upstream and downstream conditions.
6. The project shall include suitable grade controls to prevent culvert or bridge failure caused by changes in stream elevation. Grade control structures to prevent headcutting above or below the culvert or bridge may be built using rock or wood as outlined in the Headcut and Grade Stabilization activity.
7. Culverts will be cleaned by working from the top of the bank, unless culvert access using work area isolation would result in less habitat disturbance. Only the minimum amount of wood, sediment and other natural debris necessary to maintain culvert function will be removed; spawning gravel will not be disturbed.
8. All large wood, cobbles, and gravels recovered during cleaning will be placed downstream of the culvert.
9. Routine work will be conducted outside of active flow, if necessary, using work area isolation criteria outlined in the General Conservation Measures Applicable to all Actions.

Stream Crossing Improvement

Description. In many streams, existing crossings (i.e., fords) have degraded riparian corridors and in-stream habitat resulting in increased and chronic sedimentation and reduced riparian functions including lack of shading and recruitment of large wood. Stabilized areas will be installed at existing crossings to improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream and to reduce streambank and streambed erosion. New stream crossings will not be installed.

Guidelines for Review. Stabilized areas that meet all of the following conservation measures will not require NMFS review.

Additional Design Report Documentation.

1. Locations of ESA-listed salmonid spawning areas within the reach.

Additional Conservation Measures.

2. Stream crossing improvements shall be designed and/or approved by staff with the appropriate JAA to meet NRCS Practice Standard 578 Stream Crossing and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
3. The cross-sectional area of the stabilized area shall not be less than the natural channel cross-sectional area.

4. The finished top surface of the stabilized area in the bottom of the watercourse shall be no higher than the original stream bottom at the upstream edge of the ford crossing.
5. Stream crossing improvements shall include access control for animals and equipment to minimize disturbance to stream and riparian areas. Fences installed to control access will not inhibit upstream or downstream movement of fish or significantly impede the natural material exchange of large wood, and other debris.
6. The stabilized area will not create barriers to the passage of adult and juvenile fish.
7. Stream crossing improvements will involve the placement of rock along the stream bottom.
8. Improved stream crossings will not result in additional long term disturbance or damage to a riparian area.
9. Existing stabilized areas, such as bedrock or stable substrates, will be used whenever possible.
10. Bank cuts, if any, will be stabilized with vegetation, and approaches and crossings will be protected with rock when necessary to prevent erosion.
11. Stabilized areas will be a maximum of 20 feet wide from upstream to downstream.
12. Maintenance work will be conducted outside of active flow, if necessary using work area isolation criteria outlined in the General Conservation Measures Applicable to all Actions.

<u>Category 2. Tide and Flood Gate Removal, Replacement, or Upgrade</u>

Description. NRCS proposes to fund or authorize the removal, replacement, or the upgrade of existing tide and flood gates by modifying pipe and gate components and mechanisms in tidal stream systems where full tidal exchange is incompatible with current land use. Conservation systems will be implemented to reconnect stream/slough corridors, floodplains, and estuaries, reestablish wetlands, improve aquatic organism passage, and restore more natural channel and flow conditions, such that there will be a net conservation benefit to aquatic species. Tide/flood gate replacement may include, but is not limited to, excavation of existing channels and levees, adjacent floodplains, flood channels, and wetlands, and may include streambank restoration and hydraulic roughness elements. Placement of new gates where they did not previously exist is not covered in this consultation, unless part of a levee setback project. All tide/flood gate projects must include an O&M Plan that specifies water levels and timing to ensure that instream flows are not negatively impacted above baseline conditions.

Alternatives for removal, replacement or upgrade of tide/flood gates are listed below in order of preference:

1. Dike removal
2. Dike breach
3. Dike setback
4. Bridge
5. Non-gated pipe (NGP) or “bare” culvert
    a. Existing pipe minus the tide gate (removed)
    b. Installation of new pipe minus a tide gate
6. Tide Gate Options

    a. Fiberglass or aluminum gate
    b. Side hinged gate
    c. Self-regulating tide gate (SRT)
        i. Tension (cable) operated
        ii. Float (cam) operated
7. Hybrid (such as SRT coupled with NGP)
8. Other design options as recommended by the NMFS, state wildlife agency, and NRCS

Guidelines for Review. NMFS review and approval is required on all tide gate projects. NRCS will provide conceptual (30 percent), advanced conceptual (60 percent), and draft final (95 percent) designs for NMFS review. NMFS will review tide/flood gate removal, replacement, and retrofit projects for consistency with Anadromous Salmonid Passage Facility Design (NMFS 2011a).

Additional Design Report Documentation.

1. Design reports, drawings, and specifications shall document the following, in addition to the requirements of NRCS National Engineering Manual Title 210 Part 511 Subpart B–Documentation (NRCS 2010):
    a. A clear linkage to limiting factors identified within an appropriate sub-basin plan or recovery plan, or based on recommendations by a technical oversight and steering committee within a localized region.
    b. The identification and, to the extent possible, the improvement of the degraded baseline condition.
    c. The use of analytical approaches for determination of the tidal prism and exchange.
    d. Appropriate self-sustaining hydrologic design that includes climate change to reduce maintenance.
    e. Hydraulic Analysis, including hydraulic model inputs, boundary conditions, assumptions, duration, and output. NMFS and NRCS engineers will collaborate on model development.
    f. Sediment assessment
    g. Risk Analysis
    h. Construction sequencing and implementation
    i. Proposed work window
2. The Design Report shall document site specific project design criteria and the agencies/individuals involved in establishing criteria. Site-specific project design criteria will be set based on tidal restoration, fish passage, and flood protection needs as determined and set forth by NMFS, state wildlife agency, and NRCS.
3. A site-specific O&M plan will be developed for each project and reviewed with NMFS, state wildlife agency, landowner, and NRCS. The O&M Plan will incorporate monitoring and adaptive management activities, and will include the following:
    a. List of required O&M and monitoring activities and designation of responsible individual(s) for performing O&M and monitoring.
    b. Water management plan that specifies water levels and timing.

c. Any actions that the landowner or designated individual must perform as O&M and monitoring in order for the structure to function as intended, including description of technique and protocols.
d. Timing, frequency, and duration of O&M and monitoring.
e. Record keeping requirements for O&M and monitoring
f. Metrics for evaluating project effectiveness monitoring plan.
g. Metrics for when a landowner or designated individual should contact NRCS or NMFS for assistance, in the event an issue of concern arises after installation.
h. Literature cited.

Additional Conservation Measures.

1. Tide/Flood Gate projects shall be designed and/or approved by staff with the appropriate JAA to meet NRCS Practice Standard 396 Aquatic Organism Passage, 578 Stream Crossing, 587 Structure for Water Control, and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. For removal projects, if a culvert or bridge will be constructed at the location of a removed tide gate, the structure will be large enough to allow for a full tidal exchange.
3. Construction specifications and drawings shall specify that excavation below the OHWM line shall be conducted during low tide cycles or low flow cycles in the downstream watercourse to the maximum extent possible.
4. Projects will be designed to restore tidal exchange characteristics, such as elevation, cross-sectional area, and timing, in a manner that closely mimics, to the greatest degree possible, those that would naturally occur at that stream type and location.

Category 3. Stream, Floodplain, and Wetland Restoration and Management

NRCS proposes to fund or authorize river, stream, floodplain and wetland restoration actions with the objective to provide the appropriate habitat conditions required for foraging, rearing, and migrating ESA-listed salmonids in addition to restoring or enhancing wetland or stream functions for other wetland-dependent or aquatic fish and wildlife. Activities within this activity category may involve restoration and/or enhancement activities. The primary objective of conservation projects in this activity category will be to restore the original hydrologic, edaphic, and vegetative functions to the extent practicable. Enhancement activities are those which augment certain functions beyond original natural conditions to achieve a specific objective.

Individual projects may utilize a combination of the activities listed in this consultation. NRCS proposes the following activities to improve stream, floodplain, and wetland habitat: (a) Restore or Enhance Wetland and Secondary Channel Habitats, (b) Setback or Removal of Existing, Berms, Dikes, and Levees; (c) Bioengineering for Streambank Protection;
(d) Stream Habitat Improvement with Natural Materials; (e) Riparian and Wetland Vegetation Planting; (f) Fluvial Channel Reconstruction, and (g) Beaver Dam Analogues.

Restore Wetlands and Secondary Channels

Description. NRCS proposes to fund projects that restore or enhance wetland functions by reconnecting historic stream channels within floodplains, restoring or modifying hydrologic and other essential habitat features of historic river floodplain swales, abandoned side channels, wetlands, spring-flow channels, historic floodplain channels, and create new self-sustaining side channel habitats which are maintained through natural processes.

Actions include the restoration and enhancement of wetlands, secondary channels, and off channel habitats; increasing hydrologic capacity to provide resting areas for fish and wildlife species at various levels of inundation; reducing flow velocities; and providing food and cover for fish and other wetland-dependent and aquatic species.

Typical wetland activities include restoration of hydrology through decommissioning of surface and subsurface drainage features through breaking, removing, or plugging subsurface drainage tile, plugging of drainage ditches, and removal of dikes, levees, and/or diversions.
Where land-leveling has occurred, restoration of natural topography will be accomplished through construction of micro/macrotopographic features to re-create natural mound and swale topography. Restoration of wetland vegetation typically includes mechanical or chemical site preparation to remove undesirable vegetation in advance of establishing appropriate native vegetation through seeding or the planting of seedlings or vegetative plugs. Additional mechanical or chemical treatments are used to remove undesirable vegetation post planting to improve survivorship of desirable vegetation. Conservation measures listed under the Vegetation Management activity category will be followed when establishing vegetation. Restoration of historic off- and side channel habitats that have been blocked includes the removal of plugs, which impede water movement through off and side channels; excavating pools and ponds (micro/macrotopographic restoration) in the historic floodplain/channel migration zone to restore natural floodplain features and create connected wetlands; and reconnecting existing side channels with a focus on restoring fish access and habitat-forming processes (hydrology, riparian vegetation).

All activities intended for improving secondary channel habitats will provide the greatest degree of natural stream and floodplain function achievable and will be implemented to address basin specified limiting factors. Up to two project adjustments, including adjusting the elevation of the created side channel habitat are included under this proposal. The long-term development of a restored side channel will depend on natural processes like floods and mainstem migration.

Guidelines for Review. Secondary channel and wetland habitat restoration projects implemented using all conservation measures and design report documentation do not require NMFS review.

Additional Design Report Documentation.

1. Evidence of historic channel location and morphology shall be documented in the design report by including land use surveys, historic photographs, topographic maps, remote sensing information, or personal observations based on field visits.
2. If new side channel habitat is proposed, designs must document side channel hydrology and demonstrate the project will be self-sustaining over time. Self-

sustaining means that the restored or created habitat would not require major or frequent maintenance to function as designed within the natural processes of the main channel and floodplain.

3. Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity, and other hydraulic parameters.

Additional Conservation Measures.

1. Wetland and secondary channel restoration projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 657 Wetland Restoration, 658 Wetland Enhancement, 582 Open Channel, 395 Stream Habitat Improvement and Management, and 396 Aquatic Organism Passage and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. Off- and side channel improvements can include minor excavation of naturally accumulated sediment within historical channels. There is no limit as to the amount of excavation of anthropogenic fill within historic side channels as long as such channels can be clearly identified through field and/or aerial photographs.
3. Excavated material removed from off- or side channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity. Excavated material may be used to fill incised channels and/or artificial drainage ditches to reconnect the channel to its floodplain and restore original natural hydrologic conditions. Hydric soils may be salvaged to provide appropriate substrate and/or seed source for hydrophytic plant community development. Hydric soils will only be obtained from onsite excavation activities.
4. Excavation depth will never exceed the maximum thalweg depth in the main channel.
5. Restoration of existing side channels will include one-time excavation of the side channel to re-establish its form and function and up to two project adjustments, which can include adjustment of the elevation of the created side channel habitat to maintain the desired form and function of the side channel habitat.
6. Side channel habitat will be constructed to prevent fish stranding by maintaining positive drainage to the main channel to trigger fish movement as flow recedes.
7. All side channel and pool habitat work will occur in isolation from waters occupied by ESA-listed salmonid species until project completion, at which time a final opening may be made by excavation to waters occupied by ESA-listed salmonid, or water will be allowed to return into the area.
8. Adequate precautions will be taken to prevent the creation of fish passage issues or stranding of juvenile or adult fish.

Setback or Removal of Existing Berms, Dikes, and Levees

Description. NRCS proposes to fund or authorize projects that reconnect estuary, stream and river channels with floodplains, increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows by either removing existing berms, dikes or levees or increasing the distance that they are set back from active streams or wetlands. This action includes the removal of fill, such as dredge spoils from past channelization projects, road, trail, and railroad beds, dikes, berms, and levees, and construction of setback levees to restore natural estuary and fresh-water floodplain function.

Only actions intended solely for restoring floodplain and estuary functions or enhancing fish habitat are eligible. Covered actions in freshwater, estuarine, and marine areas include: 1) full and partial removal of levees, dikes, berms, and jetties; 2) breaching of levees, dikes and berms; 3) lowering of levees, dikes and berms; and 4) setback of levees, dikes and berms.

***Guidelines for Review*.** Setback or removal of existing berms, dikes, and levees projects implemented using all conservation measures do not require NMFS review.

Additional Conservation Measures.

1. Setback or removal of existing berms, dikes, and levees shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 356 Dike, 657 Wetland Restoration, 658 Wetland Enhancement, 582 Open Channel, 395 Stream Habitat Improvement and Management, and 396 Aquatic Organism Passage and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. Project implementation shall be conducted in a sequence that will not preclude repairing or restoring estuary functions once dikes/levees are breached and the project area is flooded.
3. To the greatest degree possible, non-native fill material, originating from outside the floodplain of the action area will be removed from the floodplain to an upland site. Non-native fill material may be imported from outside the floodplain for engineered fill in the construction of setbacks, berms, dikes, or levees.
4. Where it is not possible to remove or set back all portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, openings will be created with breaches.
5. Breaches shall be equal to or greater than the bankfull width to reduce the potential for channel avulsion during flood events.
6. Where feasible, the berm, dike, or levee shall be breached at the downstream end of the project and/or at the lowest elevation of the floodplain to ensure the flows will naturally recede back into the main channel to minimize fish entrapment.
7. When removing berms, dikes or levees, loosen compacted soils once overburden material is removed.
8. Overburden or spoils comprised of native materials that originated from the project area may be used within the floodplain to create setback berms, dikes, and levees and micro/macrotopographic features as long as floodplain function is not impeded. Engineered fill shall be used in the construction of setback berms, dikes, and levees to ensure moisture and compactions specifications are met.
9. When full removal of a berm, dike, or levee is not possible and a setback is required, the new structure location(s) should be prioritized to the outside of the meander belt width, or to the outside of the channel meander zone margins.

Bioengineering for Streambank Protection

Description. NRCS proposes to fund or authorize projects that restore eroding streambanks by bank shaping and installation of bioengineering techniques as necessary to support the development of riparian vegetation. This may include planting trees, shrubs, and herbaceous cover and installation of large wood or coir logs as necessary to restore ecological function in riparian and floodplain habitats. The goal of streambank protection is to re-establish long term riparian processes through revegetation and riparian buffer strips. Structural bank protection may be used to provide short-term stability to bank lines allowing for vegetation establishment.

The following bioengineering techniques are proposed for use either individually or in combination: (a) woody plantings and variations (e.g., live stakes, brush layering, fascines, brush mattresses); (b) herbaceous cover, for use on small streams or adjacent wetlands; (c) reinforced soil lifts ("burrito wraps") consisting of soil lifts wrapped with biodegradable coir fabric, seeded and liberally planted with live stakes; (d) coir logs (long bundles of coconut fiber), straw bales and straw logs used individually or in stacks to trap sediment and provide a growth medium for riparian plants; (e) bank reshaping and slope grading, when used to reduce a bank's angle of repose without changing the location of its toe, to increase roughness and cross-sectional area, and to provide more favorable planting surfaces; (f) large wood, live fascines, and brush mats in floodplains to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been removed; (g) floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain; (h) use of large wood as a primary structural component; (i) vegetated riprap with large wood; and (j) roughened toe.

Guidelines for Review. Streambank protection using bioengineering methods implemented using all conservation measures will not require NMFS review.

Additional Conservation Measures.

1. Bioengineering for streambank protection projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 580 Streambank and Shoreline Protection and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. Without changing the location of the bank toe, damaged streambanks will be restored to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose, or the use of benches in consolidated, cohesive soils. The purpose of bank shaping is to provide a more stable platform for the establishment of riparian vegetation, while also reducing the depth to the water table, thus promoting better plant survival.
3. Streambank protection projects shall include the planting of a riparian buffer strip consisting of a diverse assemblage of species native to the action area or region, including trees, shrubs, and/or herbaceous species. Do not use noxious or invasive species.

4. Stream barbs and channel-spanning weirs are not allowed for streambank protection under this opinion. Channel-spanning weirs necessary to address headcuts and grade stabilization are described under Headcut and Grade Stabilization.
5. When streambank protection is accomplished by using large wood as a primary structural component, placement of large wood will focus on providing near bank roughness for energy dissipation rather than flow re-direction that may affect the stability of the opposite bank. Large wood will be placed to maximize near bank hydraulic complexity and interstitial habitats by using a variety of large wood sizes and placement configurations.
6. Large wood will be intact, hard, and un-decayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground may be used for additional roughness and to add complexity to large wood placements but will not constitute the primary structural components.
7. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
8. Large wood anchoring will not utilize cable or chain. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections, then rebar pinning or bolting may be used. The utilization of structural connections will be used minimally and will ensure structural longevity.
9. Large wood should be distributed to engage flows up to the bankfull flow at a minimum. Large wood may be in the form of rootwad or non-rootwad, trimmed or untrimmed, whole trees, logs, snags, slash, etc. Maximize the exposure of wood to water by placing and orienting wood to project into the water column up to the bankfull elevation.
10. Large wood placed at the toe will be sturdy material, intact, hard, and un-decayed and should be sized or embedded sufficiently to withstand the design flood.
11. Vegetated riprap with large wood will meet the following measures:
    a. Vegetated riprap with large wood for streambank protection will only be used when it is necessary to prevent scouring or down-cutting around an existing flow control structure (e.g., a culvert or bridge support, headwall, or utility lines). In this case, rock may be used as the primary structural component for construction of vegetated riprap with large wood. The existing flow control structure requiring streambank protection will be specified in the design report documentation. Scour holes may be filled with rock to prevent damage to structure foundations but will not extend above the adjacent bed of the river. This does not include scour protection for bridge approach fills.
    b. When present, use natural hard points, such as large, stable trees or rock outcrops, to begin or end the toe of the streambank protection.
    c. Develop rock size gradations for elevation zones on the bank, especially if the rock will extend above OHWM—the largest rock should be placed at the toe of the slope, while small rock can be used higher in the bank where the shear stress is generally lower. Most upper bank areas will not require the use of any rock but may require rock protection depending on the location of flow control structures being protection and on the vegetation planted for erosion

protection. Rock shall be sized for anticipated velocities and shear stresses associated with the design flood.

d. For bank areas above OHWM where rock is deemed necessary, mix rock with soil to provide a better growing medium for plants.
e. Large wood will be incorporated into vegetated riprap to the maximum extent possible without interfering with the function and stability of existing flow control structures. If large wood cannot be incorporated into the vegetated riprap due to interference with existing flow control structures, mitigation will be required as described in section p. below.
f. Where whole trees are not used (i.e., snags, logs, and partial trees) designers are required to estimate the dimensions of parent material based on rootwad diameter, and calculating a cumulative equivalency of whole trees.
g. Large wood should be distributed throughout the structure (not just concentrated at the toe) to engage flows up to the bankfull flow. Large wood placed above the toe may be in the form of rootwad or non-rootwad, trimmed or untrimmed, whole trees, logs, snags, slash, etc. Maximize the exposure of wood to water by placing and orienting wood to project into the water column up to the bankfull elevation.
h. Develop an irregular toe and bank line to increase roughness and habitat value.
i. Do not use geotextile fabrics as filter behind the riprap whenever possible, if a filter is necessary to prevent sapping, use a graduated gravel filter.
j. Structure toe will incorporate large wood with intact rootwads where feasible. Minimum spacing between rootwads placed at the toe will be no greater than an average rootwad diameter.
k. Large wood placed at the toe will be sturdy material, intact, hard, and undecayed and should be sized or embedded sufficiently to withstand the design flood.
l. Space between root wads may be filled with large boulders, trimmed or untrimmed, whole trees, logs, snags, slash, etc. When used, diameter of boulders placed between toe logs with rootwads should be sized for anticipated velocities and shear stresses associated with the design flood.
m. Plant woody vegetation in the joints between the rocks to enhance streambank vegetation where rooting vegetation will not negatively impact existing flow control structures.
n. Where possible, use terracing, or other bank shaping, to increase habitat diversity.
o. When possible, create or enhance a vegetated riparian buffer.
p. Any riprap revetment that extends the use of riprap laterally into an area that was not previously revetted, or a revetment that does not include adequate vegetation and large wood, will require mitigation. Specific mitigation measures will be determined on a site-specific basis with NMFS input. Acceptable mitigation includes: removal of existing riprap; retrofit existing riprap with vegetated riprap and large wood; one or more other streambank protection methods described in this opinion; and restoration of shallow water or off-channel habitats.

12. Roughened Rock Toes will meet the following requirements:
    a. Roughened rock toes will be used in locations where the primary mechanism of bank failure is toe erosion and large wood alone is not sufficient due to anticipated velocities, shear stresses, water surface elevations or in-situ soils. The design report shall document the need for a roughened rock toe.
    b. A roughened rock toe is typically composed of large angular rock placed along the toe parallel to the direction of flow with large wood and other bioengineering techniques used for upper-bank treatment. Roughened rock toes shall adhere to project criteria outlined in the "Vegetated Riprap with Large Wood" section above.
    c. Minimum amount of wood incorporated into the treated area, for mitigation of riprap, is equal to the number of whole trees whose cumulative summation of rootwad diameters is equal to 80 percent of linear feet of treated streambank.
13. Projects that require riprap (i.e., protection of flow control structures and roughened rock toes) will be limited as follows:
    a. No more than four projects per year
    b. No single project will include more than 500 feet of shoreline
    c. Additional mitigation will be required if vegetation and large wood cannot be incorporated into the design (see 11. p. above)
14. Rock used in streambank protection may not impair natural stream flows into or out of secondary channels or riparian wetlands.
15. Any action that requires additional excavation or structural changes to a road, culvert, bridge foundation or that may affect fish passage is covered under the Fish Passage Restoration activity category.
16. Fencing will be installed as necessary to prevent access and grazing damage to revegetated sites and project buffer strips.
17. Riparian buffer strips required for streambank protection shall extend from the project bank line towards the floodplain a minimum distance of 35 feet.

Stream Habitat Improvement with Natural Materials

Description. NRCS proposes to fund or authorize projects that include placement of natural habitat-forming structures to provide instream spawning, rearing and resting habitat for salmonids and other aquatic species. Projects will provide high flow refugia; increase interstitial spaces for benthic organisms; increase instream structural complexity and diversity including rearing habitat and pool formation; promote natural vegetation composition and diversity; reduce embeddedness in spawning gravels and promote spawning gravel deposition; reduce siltation in pools; reduce the width/depth ratio of the stream; mimic natural input of large wood (e.g., whole conifer and hardwood trees, logs, root wads); decrease flow velocities; and deflect flows into adjoining floodplain areas to increase channel and floodplain function. Covered actions include: large wood and boulder placement, constructed riffles, porous boulder structures and vanes, and tree removal for large wood projects.

Guidelines for Review. Projects where the average channel design depth through the treated area is greater than 3 feet, or where more than 6 vertical feet of stream channel is treated, shall require NMFS review.

Additional Design Report Documentation.

1. Designs must demonstrate that the large wood placements mimic natural accumulations of large wood in the channel, estuary, or marine environment and addresses basin-defined limiting factors.
2. Designs must demonstrate that boulder sizing is appropriate for the size of the stream, maximum depth of flow, planform, entrenchment, and ice and debris loading.
3. For systems where boulders were not historically a component of the project stream reach, it must be demonstrated how this use of this technique will address limiting factors and provide the appropriate post-restoration habitats.
4. Designs must demonstrate that large wood and boulder placements will not result in a fish passage barrier.

Additional Conservation Measures for the use of Large Wood

1. Stream habitat improvement projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 395 Stream Habitat Improvement and Management and NMFS Anadromous Salmonid Passage Facility Design Guidelines (NMFS 2011a or most recent version).
2. When the primary purpose of large wood placement is to address streambank erosion, the designer shall follow the measures of Bioengineering for Streambank Protection.
3. When available and if the project is located within the appropriate morphology and sized stream, channel spanning wood placements using logs with root wads attached should be a minimum length of 1.5 times the bankfull channel width, and logs without root wads should be a minimum of 2.0 times the bankfull width.
4. Large wood placements will incorporate a diverse size distributions (diameter and length) of trees, logs, snags, and slash.
5. Consider orienting key pieces of wood such that the hydraulic forces acting upon the wood increase stability.
6. Stabilizing or key pieces of large wood that will be relied on to provide streambank stability or redirect flows must be intact, hard, and un-decayed to partly decaying, and may have untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found lying on the ground or partially sunken in the ground is not acceptable for key pieces but may be incorporated to add habitat complexity.
7. The partial burial of large wood and boulders may constitute the dominant means of placement, and key boulders (footings) or large wood can be buried into the streambank or channel.
8. If large wood anchoring is required, a variety of methods may be used. This includes buttressing the wood between riparian trees or, if hydraulic conditions warrant use of structural connections, then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity.
9. Rock may be used for ballast but is limited to that needed to anchor the large wood.

Additional Conservation Measures for Boulder Placement

10. The cross-sectional area of boulder placements may not exceed 25 percent of the cross- sectional area of the low flow channel, or be installed to shift the stream flow to a single-flow pattern in the middle or to the side of the stream.
11. Boulders will be machine-placed (no end dumping allowed) and will rely on the size of boulder for stability.
12. Boulders will be installed low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
13. Permanent anchoring, including rebar or cabling, may not be used in boulder placement.

Riparian and Wetland Vegetation Planting

Description. NRCS proposes to fund or authorize vegetation planting to recover watershed processes and functions associated with native plant communities and that will help restore natural plant species composition and structure. Under this activity category, project proponents would plant trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils, and to provide habitat structure and food sources for wildlife, including invertebrates. Plant species selection will be based primarily upon the probable original plant community composition. Native plant species and seeds will be obtained from local sources, where available. Additional activity categories may be utilized in conjunction with riparian and wetland vegetation planting (e.g., mechanical and chemical plant control).

Vegetation management strategies will be utilized that are consistent with local native succession and disturbance regimes and will specify seed/plant source, seed/plant mixes, and soil preparation.

Planting will address the abiotic factors contributing to the sites' succession, i.e., climate and disturbance patterns, nutrient cycling, and hydrologic condition. Only certified noxious weed-free seed (99.9 percent), hay, straw, mulch, or other vegetation material for site stability and revegetation projects will be utilized.

Guidelines for Review. Riparian and wetland vegetation planting will not require NMFS review.

Additional Conservation Measures.

1. An experienced botanist or ecologist, or associated technician shall be involved in designing vegetation treatments.
2. Species to be planted must be of the same species that originally occurred in the project area prior to disturbance. If original hydrology cannot be replicated, then species to be planted will consist of native species that naturally occur in the area that are best suited to the planned hydrologic regime.
3. Tree and shrub species as well as vegetative plugs or mats to be used as transplant material shall come from outside the bankfull width, typically in abandoned flood plains, and where such plants are abundant.

4. Vegetative plugs or mats should be sized and installed so as to prevent their movement during high flow events.
5. Species will be planted in the appropriate hydrologic zone to meet their water requirements.

Fluvial Channel Reconstruction

Description. NRCS proposes to fund or authorize fluvial channel reconstruction projects to improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species by reconstructing stream channels and floodplains that are compatible within the appropriate watershed context and geomorphic setting.

The reconstructed stream system shall be composed of a naturally sustainable and dynamic planform, cross-section, and longitudinal profile that incorporates unimpeded passage and temporary storage of water, sediment, organic material, and species. Stream channel adjustment over time is expected in naturally dynamic systems and is a necessary component to restore a wide array of stream functions. It is expected that for most projects there will initially be a primary channel with secondary channels that are activated at various flow levels to increase floodplain connectivity and to improve aquatic habitat through a range of flows. This proposed action is not intended to artificially stabilize streams into a single location or into a single channel for the purposes of protecting infrastructure or property.

Fluvial channel reconstruction consists of re-meandering or movement of the primary active channel, and may include structural elements such as streambed simulation materials, streambank restoration, and hydraulic roughness elements. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and rock structures shall be preferentially used in step-pool and cascade stream types. Material selection (large wood, rock, gravel) shall also mimic natural stream system materials.

Due to the complexity of fluvial channel reconstruction projects, there may be additional guidelines, data, and information requirements which will be developed and agreed upon in a long-term monitoring and adaptive management plan developed between the action agencies. The long-term adaptive management plan will be developed through an iterative collaborative process with NRCS, NMFS, and USFWS.

Guidelines for Review. All channel reconstruction activities will require review by NMFS.

Additional Design Report Documentation.

1. Ensure section 1.3.6 NRCS Design Report Documentation is developed collaboratively with the applicable action agencies.

2. Develop long-term monitoring and adaptive management plan between the action agencies.
3. Because of the complexity of fluvial channel reconstruction projects, there shall be an interdisciplinary design team minimally consisting of a biologist, engineer, and plant ecologist.
4. Designs must demonstrate that channel reconstruction will identify, correct to the extent possible, and then account for in the project development process, the conditions that lead to the degraded condition.
5. Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
6. Designs must demonstrate that structural elements shall fit within the geomorphic context of the stream system.
7. Designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.
8. Designs must demonstrate that the proposed action will not result in the creation of fish passage issues or post-construction stranding of juvenile or adult fish.

Beaver Dam Analogues

Description. Beaver habitat restoration actions, as defined by this document, will be designed to modify floodplain connectivity and interaction with the adjacent hyporheic environment. Improving riparian hardwood vegetation establishment and growth is critical to recruiting and sustaining beaver activity. Planting native riparian hardwoods as described under the Riparian and Wetland Vegetation Planting activity may be done to more quickly provide food sources that will further encourage beaver occupancy. When the ecologic goal of riparian hardwood vegetation establishment and growth cannot be feasibly met, or has little chance of being met by an action, it is not defined as beaver habitat restoration.

Guidelines for Review. Installation of beaver dam analogues will require NMFS review.

Additional Conservation Measures.

1. All beaver habitat restoration actions will be consistent with guidance documents including the Beaver Restoration Guidebook (Pollock et al. [2017] or subsequent).
2. In-channel structures/beaver dam analogues (BDAs)
    a. BDAs may be channel spanning when seeking to simulate an active beaver dam complex or non-channel spanning when seeking to simulate abandoned, or legacy, beaver dam complexes.
    b. BDAs are porous structures comprised of biodegradable vertical posts (beaver dam support structures) approximately 0.5 to 1 meter apart and at a height intended to act as the crest elevation of an active beaver dam. Variation of this restoration treatment may include post lines only, post lines with wicker weaves, construction of starter dams, reinforcement of existing active beaver dams, and reinforcement of abandoned beaver dams as described by the Beaver Restoration Guidebook (Pollock et al. 2017 or subsequent).

c. Place beaver dam support structures in areas conducive to dam construction as determined by stream gradient, valley form, and historical beaver use. Additional information on how to identify preferred site characteristics for BDA projects can be found in Macfarlane et al. (2014).
d. Place in areas with sufficient deciduous shrubs and trees to promote sustained beaver occupancy.
e. Fish passage around BDAs is maximized by simulating the hydrologic and hydraulic diversity and function found in a natural beaver dam complex. This is best provided by simulating a beaver dam complex vs. a single BDA. BDA design will include the following physical characteristics:
    i. A minimum BDA crest elevation consistent with the adjacent functional floodplain. In incised channels disconnected from the floodplain, a series of BDAs may be used to reach crest elevation consistent with adjacent functional floodplain.
    ii. Provide concentrated flows around BDA abutments at all floodplain inundating flows using roughness and side/erosion channels. Visual concept on this feature is found in figure 4 of Lokteff et al. (2013)
    iii. Designs which mimic the function and purpose of technical fishways (i.e., requirements for pool volume, jump height, etc.) are not defined as BDAs in this document, and are not authorized.
f. The design report will clearly describe the rationale for choosing the type of structures and their locations. At a minimum the design report will document the following information:
    i. Responsible designer
    ii. Written rationale for the BDA structure type and design
    iii. Written rationale for choosing structure location(s)
    iv. Detail how the project meets the BDA guidelines and techniques found in the Beaver Restoration Guidebook (Pollock et al. 2017 or subsequent).
    v. Specific BDA design elements, including:
    vi. BDA heights and locations
    vii. Channel bankfull width and elevation
    viii. Floodplain elevation
    ix. Monitoring protocol
    x. Adaptive management process

3. Habitat Restoration
    a. Beaver Restoration activities may include planting native riparian hardwoods (species such as willow, red osier dogwood, and alder) and building exclosures (such as temporary fences) to protect and enhance existing or planted riparian hardwoods until they are established[1].
    b. Maintain or develop grazing plans that will ensure the success of beaver habitat restoration objectives.

[1] E.g., Beaver Management Strategy, Malheur National Forest and the Keystone Project, September 2007.

Category 4. Vegetation Management

NRCS proposes to fund or authorize management of vegetation using physical control, herbicides, juniper removal, and prescribed burning. The long-term goal is to recover watershed processes and functions associated with native plant communities.

Physical Control

Description. NRCS proposes to use the following two mechanisms for vegetation management by physical control: (a) manual control includes hand pulling and grubbing with hand tools; bagging plant residue for burning or other proper disposal; mulching with organic materials; shading or covering unwanted vegetation; controlling brush, and pruning using hand and power tools such as chain saws and machetes; using grazing/browsing animals (e.g., goats). When possible, manual control (e.g., hand pulling, grubbing, and cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality; (b) mechanical control includes techniques such as mowing, tilling, disking, or plowing. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping).

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. For mechanical control that will disturb the soil, an untreated area will be maintained within the immediate riparian buffer area to prevent any potential adverse effects to stream channel or water quality conditions.
2. Ground-disturbing mechanical activity will be restricted in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20 percent, a buffer width of at least 35 feet will be used. For slopes over 20 percent, no ground-disturbing mechanical equipment will be used.
3. When possible, manual control (e.g., hand pulling, grubbing, and cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality.
4. All noxious weed material will be disposed of in a manner that will prevent its spread. Noxious weeds that have developed seeds will be bagged and burned.

Herbicide

Description. NRCS proposes to fund or authorize management of vegetation using chemical herbicides to reduce unwanted vegetative cover and recover watershed processes and functions associated with native plant communities. Herbicides will be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species and that will cause the least impact to non-target species.

The following herbicides and treatment techniques will be used to control various invasive species of concern. Herbicides may be used for site preparation, short-term management during the period when revegetated areas are becoming established, and site maintenance as needed during the length of the contract or compatible use authorization to control invasive plants.

1. 2,4-D. A colorless, odorless powder Restricted Use Herbicide (RUH) used for the control of broad-leaf weeds in agriculture, and for control of woody plants along roadsides, railways, and utilities rights of way. Amine and ester forms have been most widely used on such crops as wheat and corn, and on pasture and rangelands.
2. Aminopyralid. A selective systemic herbicide for the control of broadleaf weeds in rangeland, non-crop areas, and grazed areas.
3. Chlorsulfuron. RUH for pre-emergent and early post-emergent control of many annual, biennial, and perennial broadleaf weeds. Products containing this active ingredient will not be used on Riparian Forest Buffer (CPS 391) sites.
4. Clopyralid. A selective RUH used primarily in the control of broadleaf weeds. It is effective on the sunflower, legume, nightshade, knotweed, thistles, and violet families. It has little effect on grasses and mustard family plants.
5. Dicamba. RUH recommended for the control of a variety of broadleaf weeds and woody vegetation.
6. Aquatic Glyphosate. Broad spectrum RUH, non-selective systemic herbicide used near streams. Trade names include Rodeo, AquaMaster, and AquaPro.7 Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (e.g., Roundup) are not included in this programmatic.
7. Hexazinone. Granular and liquid formulations of this RUH are used to control broadleaf weeds, grasses, and woody plants. It inhibits photosynthesis, and is readily absorbed through leaves and roots moving in an upward direction through the plant.
8. Imazapic. RUH used in the control of grasses, broadleaves, and vines, and for turf height suppression in non-cropland areas.
9. Imazapyr. This RUH is a systemic plant growth inhibitor, the primary use is on woody vegetation as a foliar spray. It is applied to cut stumps or injected into the plant.
10. Metsulfuron methyl. This RUH is a selective pre-emergence and post-emergence sulfonyl urea herbicide used primarily to control many annual and perennial weeds and woody plants.
11. Picloram. RUH used in the control of a number of broadleaf weeds and undesirable brush.
12. Sethoxydim. Used as a selective post-emergent herbicide for the control of annual or perennial grass weeds. Products containing this active ingredient will not be used on Riparian Forest Buffer (CPS 391) sites.
13. Sulfometuron-methyl. A broad-spectrum pre- and post-emergent RUH. It is less selective than chlorsulfuron or metsulfuron-methyl, and is effective against broadleaf and grass species. It has residual activity and is an important tool on sites where it is critical to get long-term weed control with one application.
14. Triclopyr. A selective systemic RUH. Amine (triclopyr-TEA) and ester (triclopyr-BEE) forms are used on broadleaf and woody species.

Liquid or granular forms of herbicides will be applied as follows: (a) broadcast spraying—hand-held nozzles attached to backpack tanks or vehicles, or by using vehicle mounted booms; (b) spot spraying—hand-held nozzles attached to back packtanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants; (c) hand/selective—wicking and wiping, basal bark, frill ("hack and squirt"), stem injection, cut-stump; (d) triclopyr-BEE will not be applied by broadcast spraying.

NRCS will adhere to the no-application buffers listed in Table 3. These buffers are based on the herbicide formula, stream type, and application method during initial herbicide applications. Buffer widths are measured as map distance perpendicular to the edge of water (EOW) or ordinary high water mark (OHWM) for streams, the upland boundary for wetlands, or the upper bank for roadside ditches. Before initial herbicide application begins, the no-application boundary will be flagged or marked. Follow-up herbicide applications to maintain weed control in established native plantings will be spot treatments only; no broadcast spraying will be used.

Table 3. No-application buffers for each active ingredient measured in feet from the high water mark (HWM) or edge of water (EOW), per type of application method in wet and dry waterways.

Herbicide	Streams and Roadside Ditches with flowing or standing water present and wetlands			Dry Streams, Roadside Ditches, and Wetlands		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
Aquatic Glyphosate	15 EOW	EOW	EOW	none	none	none
Aquatic Imazapyr	25 EOW	EOW	EOW	none	none	none
Aquatic Triclopyr-amine	25 EOW*	EOW	EOW	25 EOW	none	none
Low Risk to Aquatic Organisms						
Imazapic	15 HWM	HWM	HWM	none	none	none
Clopyralid	15 HWM	HWM	HWM	15 HWM	HWM	HWM
Metsulfuron-methyl	25 HWM	HWM	HWM	25 HWM	HWM	HWM
Aminopyralid	15 HWM	HWM	HWM	none	none	none
Dicamba	15 HWM	HWM	HWM	none	none	none
Moderate Risk to Aquatic Organisms						
Imazapyr	100 HWM	HWM	HWM	50 HWM	none	none
Sulfometuron-methyl	100 HWM	HWM	HWM	50 HWM	HWM	HWM

Chlorsulfuron	100 HWM	HWM	HWM	50 HWM	HWM	HWM
2,4-D amine	100 HWM	HWM	HWM	50 HWM	HWM	HWM
Hexazinone	100 HWM	15 HWM	15 HWM	50 HWM	none	none
High Risk to Aquatic Organisms						
Triclopyr-BEE	Not Allowed	150 HWM	25 HWM	Not Allowed	150 HWM	25 HWM
Picloram	100 HWM	50 HWM	15 HWM	100 HWM	50 HWM	none
Sethoxydim	100 HWM	50 HWM	HWM	100 HWM	50 HWM	HWM
2,4-D ester	100 HWM	50 HWM	HWM	100 HWM	50 HWM	HWM

* Broadcast spray would be used when deemed essential on relatively flat, large acreage sites.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Do not exceed treating 10 percent of the acres of riparian habitat within a 6th-field HUC with herbicides per year.
2. All herbicide label requirements will be followed.
3. Temperature inversions and certain other conditions increase the likelihood of off- target drift. Herbicides shall only be broadcast applied when there is minimal potential for drift to listed salmonid-bearing waters. Be aware of wind directions and potential for herbicides to affect aquatic habitat downwind. Keep boom or spray as low as possible to reduce wind effects.
4. Adjust spray nozzle pressure to the lowest practical level to minimize fine particle size and drift, while still providing for reasonable spray coverage. Use high flow rate nozzles, water diluents instead of oil, and add thickening agents. Use drift control agents if necessary to prevent spray from drifting from the project site.
5. Do not broadcast spray when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters.
6. Do not broadcast spray during temperature inversions, or when air temperature exceeds 80 degrees Fahrenheit.
7. Do not spray when rain, fog, or other precipitation is falling or imminent.
8. Wind and other weather data will be monitored and reported for all broadcast applications.
9. Herbicides shall not be applied when the soil is saturated or when a precipitation event likely to produce direct runoff to salmon bearing waters from the treated area is forecasted by NOAA/National Weather Service (NWS) or other similar forecasting service within 48 hours following application. Soil-activated herbicides can be applied as long as the label is followed. Do not conduct hack-squirt/injection applications during periods of heavy rainfall.
10. Allow a post-application rain-free period according to herbicide label requirements. It is preferable to apply hexazinone, metsulfuron-methyl, sulfometuron methyl, and picloram to moist soil (or dry soil that will be

moistened relatively soon) to reduce the potential for off-site movement. Application within 24 hours of rain or between frequent light showers is desirable. If a good application opportunity is missed and weeks pass before the next rain event, the initial application is likely to be ineffective and require a re-application.

11. Herbicides will be mixed more than 150 feet from any natural water body 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.
12. Spray tanks will be washed farther than 300 feet away from surface water.
13. Keep the spray nozzle within 4 feet of the ground when applying herbicide. If spot or patch spraying tall vegetation more than 15 feet away from the ordinary high water mark (OHWM), keep the spray nozzle within 6 feet of the ground.
14. Apply spray in swaths parallel to the project area, away from water and desirable vegetation, i.e., the person applying the spray will generally have their back to the stream.
15. Avoid unnecessary runoff during cut surface, basal bark, and hack-squirt /injection applications.
16. Agri-Dex and LI-7009 are the only adjuvants to be used within 200 feet of OHWM.
17. Water will be used to dilute most herbicides. Consistent with label instructions, only crop oils (vegetable oil) will be used when oil carriers are needed; use of diesel oil is prohibited.
18. Do not apply pesticide products containing 2,4-D butoxyethyl ester directly to any surface waters accessible to listed salmonids.
19. Control of invasive plants by 2,4-D within riparian areas shall be by individual plant treatments for woody species, and spot treatment of less than 1/10 acre for herbaceous species.
20. A non-hazardous indicator dye (Hi-Light or Dynamark) is required to be used with herbicides applied within 100 feet of streams. The presence of dye makes it easier to see where the herbicide has been applied and where or whether it has dripped, spilled, or leaked. Dye also makes it easier to detect missed spots, avoid spraying a plant or area more than once, and minimize over-spraying (SERA 1997).
21. A spill cleanup kit will be available whenever herbicides are used, transported, or stored. At a minimum, cleanup kits will include Material Safety Data Sheets, the herbicide label, emergency phone numbers, and absorbent material such as cat litter to contain spills.
22. NRCS program participants will provide NRCS with an herbicide application summary, indicating who, what, when, how, rate, and location of the application on the project map.
23. All herbicide applications will be reported as required by federal and state law.

Juniper Tree Removal

Description. Juniper tree removal will be conducted in riparian areas and adjoining uplands to help restore plant species composition and structure that would occur under natural fire regimes. Juniper removal will occur in those areas where juniper has encroached into riparian and upland areas as a result of fire exclusion, thereby replacing more desired riparian plant species such as willow, cottonwood, aspen, alder, sedge, and rush.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Juniper will be reduced to natural stocking levels where juniper trees are expanding into neighboring plant communities to the detriment of other native riparian vegetation, soils, or streamflow.
2. Old-growth juniper trees as described by Miller et al. (2005) will not be cut.
3. Felled trees may be left in place, lower limbs may be cut and scattered, or all or part of the trees may be used for streambank or wetland restoration (e.g., manipulated as necessary to protect riparian or wetland shrubs from grazing by livestock or wildlife or otherwise restore ecological function in floodplain, riparian, and wetland habitats).
4. Where appropriate, cut juniper may be placed into stream channels and floodplains to provide aquatic benefits. Juniper may be felled or placed into the stream to promote channel aggradation as long as such actions do not obstruct fish movement and use of spawning gravels or increase width to depth ratios.
5. On steep or south-facing slopes, where ground vegetation is sparse, felled juniper will be left in sufficient quantities to promote reestablishment of vegetation and prevent erosion.
6. If seeding is a part of the action, consideration will be given to whether seeding is most appropriate before or after juniper treatment.
7. When using feller-buncher and slash-buster equipment, equipment will be operated in a manner that minimizes soil compaction and disturbance to soils and native vegetation to the extent possible. Equipment exclusion areas (buffer area along stream channels) will generally be at least as wide as the feller-buncher or slash-buster arm.

Prescribed Burning

Description. NRCS proposes to fund or authorize reintroduction of low- and moderate-severity fire into riparian and wetland areas to help restore plant species composition and structure that would occur under natural fire regimes for fire-dependent plant communities throughout the action area. Conifer thinning may be required to adjust fuel loads for moderate-severity burns to regenerate deciduous trees and shrubs. Equipment would include drip torches and chainsaws, along with fire suppression vehicles and heavy equipment.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Prescribed burn projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 338 Prescribed Burn.
2. Experienced fuels specialists, silviculturists, fisheries biologist, and hydrologists shall be involved in designing prescribed burn treatments.
3. Prescriptions will focus on restoring the plant species composition and structure that would occur under natural fire regimes.
4. Burn plans are required for each action and shall include, but not be limited to the following: existing and target stand structure and species composition (including basis for target conditions); other ecological objectives, type, severity, area, fuel model, and timing of proposed burn; and measures to prevent destruction of vegetation providing shade and other ecological functions important to fish habitat.
5. Low-severity burns will be used except where the objective is to restore deciduous trees, as described below under Conservation Measure 5, with a goal of creating a mosaic pattern of burned and unburned landscape. Low-severity burns are characterized by the following: Low soil heating or light ground char occurs where litter is scorched, charred, or consumed, but the duff is left largely intact. Large wood accumulation is partially consumed or charred. Mineral soil is not changed. Minimal numbers of trees, typically pole/saplings, will be killed.
6. Moderate-severity burns are permitted only where needed to invigorate decadent aspen stands, willows, and other native deciduous species. Such burns shall be contained within the observable historical boundaries of the aspen stand, willow site, other deciduous species, and associated meadows; additional area outside of the “historical boundaries” may be added to create controllable burn boundaries. Moderate severity are characterized by the following: Moderate soil heating or moderate ground char occurs where the litter on forest sites is consumed and the duff is deeply charred or consumed, but the underlying mineral soil surface is not visibly altered. Light-colored ash is present. Large wood is mostly consumed, except for logs, which are deeply charred.
7. Fire lines will be limited to 10 feet in width, constructed with erosion control structures, such as water bars, and restored to pre-project conditions before the winter following the controlled fire. To the extent possible, do not remove vegetation providing stream shade or other ecological functions that are important to streams.
8. Water withdrawals from fish bearing streams will be avoided whenever possible. Water drafting must take no more than 10 percent of the stream flow and must not dewater the channel to the point of isolating fish. Pump intakes shall have fish screens consistent with NMFS fish screening criteria.
9. To protect large or mature trees from damage, removal of trees and understory vegetation that could fuel a ladder fire is allowed. If conifers are even-aged pole, sapling, or mid-seral with no legacy trees, thin existing trees to the degree necessary to promote a moderate-severity burn.

10. No slash burning is allowed within 30 feet of any stream. To the extent possible, avoid creating hydrophobic soils when burning slash. Slash piles should be far enough away from the stream channel so any sediment resulting from this action will be unlikely to reach any stream.

Category 5. Road Maintenance, Erosion Control, and Decommissioning

NRCS proposes to fund or authorize maintenance and erosion control activities on existing roads and decommissioning of roads no longer needed, in order to reduce sediment transport to streams and wetlands.

Road Maintenance and Erosion Control

Description. NRCS proposes to fund or authorize erosion control activities associated with existing unpaved and gravel-surfaced roads. Erosion control activities include: creating barriers to human access—gates, fences, boulders, logs, vegetative buffers, and signs; road shaping and/or surfacing to improve drainage; installation of drainage features including roadside ditches, water bars, relief culverts and sediment traps; removing and hauling or stabilizing pre-existing cut and fill material; and relocating roads to less sensitive areas outside of riparian buffers.

Road grading and shaping will maintain, not destroy, the designed drainage of the road, unless modification is necessary to improve drainage problems that were not anticipated during the design phase. Road maintenance will not be attempted when surface material is saturated with water, and erosion problems could result. Impervious surface material such as asphalt and concrete will not be used.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. 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.
2. Water trucks will be used for dust abatement.

Road Decommissioning

Description. NRCS proposes to fund or authorize decommissioning of roads that are no longer needed, e.g., logging roads. Water bars will be installed, road surfaces will be in-sloped or out-sloped, asphalt and gravel will be removed from road surfaces, culverts and bridges will be altered or removed, streambanks will be re-contoured at stream crossings, cross drains will be removed and water bars or rolling dips will be installed, fill or side-cast materials will be removed, road prism will be reshaped, sediment catch basins will be created.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Road decommissioning projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 654 Road Trail Landing Closure and Treatment.
2. All surfaces will be revegetated to reduce surface erosion of bare soils, surface drainage patterns will be recreated, and energy dissipaters will be placed at remaining water bar or rolling dip outlets.
3. Activities will be conducted during dry-field conditions—low to moderate soil moisture levels.
4. Waste material will be disposed in stable, non-floodplain sites unless materials are to restore natural or near-natural contours, and approved by an engineer or other qualified personnel.

<u>Category 6. Irrigation and Water Delivery and Management</u>

NRCS proposes to fund the following activities for Irrigation and Water Delivery Management Actions: (a) irrigation efficiency improvement; (b) water conveyance improvement; (c) conversion of instream diversions to groundwater wells; (d) irrigation water siphons; (e) livestock watering facilities; (f) fish screens; and (g) pump station diversions.

NRCS will only cover irrigation efficiency actions within this category that will benefit stream and riparian function and not result in a reduction of instream flow. This includes reductions to base flow from subsurface flow supported by percolation of flood irrigation water. Any conservation actions NRCS funds or approves that result in a reduction of instream flow will require individual consultation. NRCS will develop an O&M Plan for activities in this category.

Irrigation Efficiency Improvement

Description. NRCS proposes to fund practices that increase efficiency of existing inefficient irrigation systems, which may include conversion of flood irrigation systems to drip or sprinkler irrigation. Flood irrigation to sprinkler conversion that reduces base flow to streams will require individual consultation. This proposed activity may involve the installation of pipe, possibly trenched and buried into the ground, and pumps to pressurize the system.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Irrigation efficiency improvement projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 449 Irrigation Water Management, 430 Irrigation Pipeline, 441/442/443/447 Irrigation Systems, 587 Structure for Water Control, and 533 Pumping Plant.

2. Education will be provided to irrigators on ways to make their systems more efficient.
3. Information will be provided to landowners on organizations that can legally protect and offer compensation for water left instream as a result of efficiency actions.
4. NRCS will ensure that surface water intakes are screened to meet NMFS fish screen criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011a or the most recent version), be self-cleaning or regularly maintained by removing debris. The O&M Plan will designate the responsible party to conduct regular inspection and maintenance as needed to ensure pumps and screens are functioning properly.

Water Conveyance Improvement

Description. NRCS proposes to fund replacement of open ditch irrigation water conveyance systems with pipelines or lining with concrete, bentonite, or other appropriate materials to reduce evaporation and transpiration losses.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Water conveyance projects shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 430 Irrigation Pipeline, 428 Irrigation Ditch Lining, 441/442/443/447 Irrigation Systems, and 587 Structure for Water Control.
2. Information will be provided to landowners on organizations that can legally protect and offer compensation for water left instream as a result of efficiency actions.
3. NRCS will ensure that surface water intakes are screened to meet NMFS fish screen criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011a or the most recent version), be self-cleaning or regularly maintained by removing debris. The O&M Plan will designate the responsible party to conduct regular inspection and maintenance as needed to ensure pumps and screens are functioning properly.

Conversion of Instream Diversions to Groundwater Wells

Description. Wells will be drilled as an alternative water source to surface water withdrawals. Water from the wells will be pumped into ponds or troughs for livestock, or used to irrigate agricultural fields. Instream diversion infrastructure will be removed or downsized, if feasible. If an instream diversion is downsized, it will be covered under this programmatic consultation only by following all criteria outlined under the Irrigation Diversion Improvement activity.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Wells shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 642 Water Well.
2. Information will be provided to landowners on organizations that can legally protect and offer compensation for water left instream as a result of efficiency actions.

Irrigation Water Siphons

Description. NRCS proposes to fund siphons to transport irrigation water beneath waterways where irrigation ditch water currently enters a stream and mixes with stream water, with subsequent withdrawal of irrigation water back into an irrigation ditch system downstream. Periodic maintenance of the siphon will be conducted. Work may entail use of heavy equipment, power tools, and/or hand tools.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Irrigation water siphons shall be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 430 Irrigation Pipeline, 441/442/443/447 Irrigation Systems, 587 Structure for Water Control, and 533 Pumping Plant.
2. Directional drilling to create siphon pathway will be employed whenever possible.
3. Trenching will occur in dry streambeds only; work area isolation will be employed in wetted streams.
4. Stream widths will be maintained at bankfull width or greater.
5. No part of the siphon structure will block fish passage.
6. No concrete will be placed within the bankfull width.
7. Siphon surface structures will be located to meet design requirements, minimize impacts on stream flows, and minimize flood plain impacts.
8. Install the siphon below scour depth as calculated by an engineer.
9. Waterway will be reconstructed to a natural streambed configuration upon completion.
10. NRCS will ensure that surface water intakes are screened to meet NMFS fish screen criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011a or the most recent version), be self-cleaning or regularly maintained by removing debris. The O&M Plan will designate the responsible party to conduct regular inspection and maintenance as needed to ensure pumps and screens are functioning properly.

Livestock Watering Facilities

Description. NRCS proposes to fund or authorize livestock watering facilities to reduce or eliminate livestock use of streams and riparian areas. Watering facilities will include low-volume pumping or gravity-feed systems to move water to a trough or pond at an upland site. Either above-ground or underground piping will be installed between the troughs or ponds and the water source. Water sources may include hillslope springs and seeps, streams, or groundwater wells. The landowner must have existing appropriate water rights. Springs occupied by federal or state listed species will not be developed. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment. Where appropriate, water gaps will be constructed in association with riparian fencing to control livestock access to surface water for drinking water supply.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Livestock watering facilities will be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 614 Watering Facility, 574 Spring Development, 561 Heavy Use Area Protection, 533 Pumping Plant, and 516 Pipeline.
2. Watering facilities will not be located on steep slopes.
3. Float valves or similar devices limiting use to demand will be used.
4. Water withdrawals will not de-water the source or cause low stream flows. Withdrawals may not exceed 10 percent of available flow at any time.
5. Where ESA-listed species could be present, NRCS will ensure that surface water intakes are screened to meet NMFS fish screen criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011a or the most recent version), be self-cleaning or regularly maintained by removing debris. The O&M Plan will designate the responsible party to conduct regular inspection and maintenance as needed to ensure pumps and screens are functioning properly.
6. Escape ramps or other devices to prevent entrapment of wildlife will be used on all troughs.
7. Overflows from spring developments will be sized, located, and livestock excluded so that overflow does not cause erosion, degrade water quality or create wet conditions near the watering facility.
8. Removal of vegetation around springs and seeps will be minimized.
9. Spring points of discharge will be protected from overuse by livestock, wildlife, and humans.
10. Livestock Fencing: Where appropriate, construct fences at water gaps in a manner that allows passage of large wood and other debris.
11. Water gaps will only be used in conjunction with riparian fencing designed to control and reduce livestock access to the riparian area and stream.

12. Water gaps will be designed and constructed to a width of 10 to 15 feet in the upstream–downstream direction to minimize the time livestock will spend in the riparian area.
13. Water gaps will not extend across the channel.
14. When using pressure treated lumber for fence posts, complete all cutting/drilling offsite (to the extent possible) so that treated wood chips and debris do not enter water of flood prone areas.
15. Riparian fencing is not to be used to create livestock handling facilities.

Fish Screens

Description. NRCS proposes to fund or authorize the installation of new or replacement and upgrade of existing fish screens. Irrigation diversion intake and return points will be designed or replaced to prevent fish and other aquatic organisms of all life stages from swimming or being entrained into the irrigation system.

Guidelines for review. Fish screens for surface water diverted by gravity or by pumping at a rate exceeding 3 cfs will be submitted to NMFS for review and approval.

Additional Conservation Measures

1. All diversions with automated cleaning devices will have a fish screen with a minimum effective surface area of 2.5 square feet per cfs and a nominal maximum approach velocity of 0.4 feet per second (fps).
2. Diversions without an automated cleaning device will have a fish screen with a minimum effective surface area of 1 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and a round or square screen mesh that is no larger than 2.38 mm (0.094 inches) in the narrow dimension or any other shape that is no larger than 1.75 mm (0.069 inches) in the narrow dimension.
3. NRCS will ensure that fish screens will be designed in accordance with the most recent state and federal fish and wildlife agency criteria.
4. NRCS will ensure that fish screens will be installed, operated, and maintained according to NMFS' fish screen criteria (NMFS 2011a or the most recent version).
5. Periodic maintenance, which may include temporary removal, of fish screens will be conducted to ensure their proper functioning, e.g., cleaning debris buildup, and replacement of parts.

Pump Station Diversions

Description. NRCS proposes to fund or authorize installation of new or upgrade of existing pump stations. Pump stations will consist of pumping station infrastructure to move water to efficient pressurized irrigation systems. Either above-ground or underground piping will be installed between the water source and the irrigation application sources. Water sources may include springs and seeps, streams, ponds, reservoirs, or groundwater wells. Placement of the pipes in the ground will typically involve minor trenching using a backhoe or similar equipment. Minor concrete foundations, housing, and power poles may be needed to operate and protect the pump station infrastructure.

Guidelines for Review. The proposed activities will not require NMFS review.

Additional Conservation Measures.

1. Pump Stations will be designed and/or approved by staff with the appropriate JAA to meet applicable NRCS Practice Standards such as 561 Heavy Use Area Protection and 533 Pumping Plant,
2. Irrigation systems will be designed to minimize runoff, erosion, deep percolation of applied irrigation water, and to conserve water and energy.
3. NRCS will ensure that surface water intakes are screened to meet NMFS fish screen criteria in Anadromous Salmonid Passage Facility Design (NMFS 2011a or the most recent version), be self-cleaning or regularly maintained by removing debris. The O&M Plan will designate the responsible party to conduct regular inspection and maintenance as needed to ensure pumps and screens are functioning properly.

"Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). Though restoration actions in general could be considered "interrelated" because they are usually part of a larger recovery planning effort that includes long-term restoration actions, for purposes of this consultation NMFS considered each action separately and did not identify any interrelated or interdependent actions, so no such effects are analyzed in this opinion.

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 provides 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 RPMs and terms and conditions to minimize such impacts.

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

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 for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features (PBFs) essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

The designation of critical habitat for many salmon and steelhead species uses the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with 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.

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

- Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- Suggest a reasonable and prudent alternative to the proposed action, if necessary.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential 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). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote 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 percent 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; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). 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).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015 this resulted in 3.5 to 5.3^{o}C increases in Columbia basin streams and a peak temperature of 26^{o}C in the Willamette (NWFSC 2015). 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 as a result 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 to 3.7^{o}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. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent CO_2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al. 2012, Feely et al. 2012). 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 to 32 inches by 2081 to 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 the Species

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

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

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

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

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

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

The summaries that follow describe the status of the 22 ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (FR) (Table 4).

Table 4. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for ESA-listed species considered in this opinion. Listing status: "T" means listed as threatened; "E" means listed as endangered; "P" means proposed for listing or designation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon *(Oncorhynchus tshawytscha)*			
Lower Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer-run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Puget Sound	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Chum salmon *(O. keta)*			
Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Hood Canal summer-run	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon *(O. kisutch)*			
Lower Columbia River	T 6/28/05; 70 FR 37160	2/24/16; 81 FR 9252	6/28/05; 70 FR 37160
Oregon Coast	T 6/20/11; 76 FR 35755	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Southern Oregon/Northern California Coasts	T 6/28/05; 70 FR 37160	5/5/99; 64 FR 24049	6/28/05; 70 FR 37160
Sockeye salmon *(O. nerka)*			
Lake Ozette	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Snake River	E 8/15/11; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	2/1/06; 71 FR 5178
Snake River Basin	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Puget Sound	T 5/11/07; 72 FR 26722	2/24/16; 81 FR 9252	P 2/7/07; 72 FR 5648
Green sturgeon (*Acipenser medirostris*)			
Southern DPS	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	6/2/10; 75 FR 30714
Eulachon *(Thaleichthys pacificus)*			
Southern DPS	T 3/18/10; 75 FR 13012	10/20/11; 76 FR 65324	Not applicable
Southern resident killer whale (*Orcinus orca*)	E 11/18/2005; 70 FR 69903	11/29/2006; 71 FR 69054	11/18/2005

Status of LCR Chinook Salmon

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

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

For late fall Chinook salmon, recovery requires maintenance of the North Fork Lewis and Sandy populations which are comparatively healthy, together with improving the probability of persistence of the Sandy population from its current status of "high" to "very high." Improving the status of the Sandy population depends largely on harvest and hatchery changes. Habitat improvements to the Columbia River estuary and tributary spawning areas are also necessary. Of the 32 demographically independent populations (DIPs) in this ESU, only the two late-fall-run populations (Lewis River and Sandy River) could be considered viable or nearly so (NWFSC 2015).

Spatial Structure and Diversity. The ESU includes all naturally-produced populations of Chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River, and includes the Willamette River to Willamette Falls, Oregon, with the exception of spring-run Chinook salmon in the Clackamas River. On average, fall-run Chinook salmon programs have released 50 million fish annually, with spring-run and upriver bright (URB) programs releasing a total of 15 million fish annually. As a result of this high level of hatchery production and low levels of natural production, many of the populations contain over 50 percent hatchery fish among their naturally-spawning assemblages.

The ESU spans three distinct ecological regions: Coastal, Cascade, and Gorge. Distinct life-histories (run and spawn timing) within ecological regions in this ESU were identified as major population groups (MPGs). In total, 32 historical DIPs were identified in this ESU, nine spring-run, 21 fall-run, and two late-fall run, organized in six MPGs (based on run timing and ecological region; LCR Chinook populations exhibit three different life history types base on return timing and other features: fall-run (or "tules"), late-fall-run (or "brights"), and spring-run.

Abundance and Productivity. Of the seven spring-run DIPs in this MPG only the Sandy River spring-run population appears to be a currently self-sustaining population. Both of the two spring-run historical DIPs in the Spring-run Gorge MPG are extirpated or nearly so. In general, the DIPs in the Coastal Fall-run MPG are dominated by hatchery-origin spawners. In surveys conduct in both 2012 and 2013, no Chinook salmon were observed in Scappoose Creek. Overall, the Fall-run Cascade MPG exhibits stable population trends, but at low abundance levels, and most populations have hatchery contribution exceeding the target of 10 percent identified in

NMFS' Lower Columbia River Recovery Plan (Dornbusch and Sihler 2013). Many of the populations in the Fall-run Gorge MPG have limited spawning habitat available. Additionally, the prevalence of returning hatchery-origin fish to spawning grounds presents a considerable threat to diversity. Natural-origin returns for most populations are in the hundreds of fish. The two populations in the late fall-run MPG the most viable of the ESU. The Lewis River late fall DIP has the largest natural abundance in the ESU and has a strong short-term positive trend and a stable long term trend, suggesting a population near capacity. The Sandy River late fall run has not been directly monitored in a number of years; the most recent estimate was 373 spawners in 2010 (Takata 2011).

Limiting factors. Limiting factors for this species include NMFS (2013a):

- Reduced access to spawning and rearing habitat
- Hatchery-related effects
- Harvest-related effects on fall Chinook salmon
- An altered flow regime and Columbia River plume
- Reduced access to off-channel rearing habitat
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Contaminants

Status of Upper Willamette River Chinook Salmon

Upper Willamette River (UWR) Chinook salmon were listed as threatened on June 28, 2005 (70 FR 37160). A recovery plan is available for this species (ODFW and NMFS 2011). There are a number of general considerations that affect some or all of the UWR Chinook populations, including high levels of prespawning mortality, lack of access to historical habitat, high levels of total dissolved gases (TDG), and a reduction in returning adult abundance between Willamette Falls and census points in the main tributaries (NWFSC 2015). Prespawning mortality levels are generally high in the lower tributary reaches where water temperatures and fish densities are the highest. Access to historical spawning and rearing areas is restricted by large dams in the four historically most productive tributaries, and in the absence of effective passage programs will continue to confine spawning to more lowland reaches where land development, water temperatures, and water quality may be limiting. Areas immediately downstream of high head dams may also be subject to high levels of TDG, which could affect a significant portion of the incubating embryos, in-stream juveniles, and adults in the basin (NWFSC 2015). Shortfalls in counts of returning adults between Willamette Falls and upper tributary reaches also indicate additional pre-spawning mortality or spawning in lower quality habitat in lower tributary reaches could be limiting the recovery of these populations (Jepson et al. 2013; Jepson et al. 2014).

Spatial Structure and Diversity. This species includes all naturally spawned populations of spring-run Chinook salmon originating from the Clackamas River; from the Willamette River and its tributaries above Willamette Falls; and from six artificial propagation programs (USDC 2014, NMFS 2016a). All seven historical DIPs of UWR Chinook salmon identified by the Willamette–Lower Columbia Technical Recovery Team (WLC-TRT) occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 5).

Table 5. Scores for the key elements (abundance and productivity (A&P), diversity, and spatial structure) used to determine current overall viability risk for UWR Chinook salmon (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH). The current general directions of population viability scores based on data reviewed in the 2015 status update are also shown (NWFSC 2015).

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

<u>Abundance and Productivity</u>. Abundance levels for five of the seven DIPs in this ESU remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low (although perhaps only marginally better than the 0 VSP score estimated in the recovery plan; (ODFW and NFMS 2011). Abundances in the North and South Santiam rivers have risen since the 2010 review, but still range only in the high hundreds of fish. The proportion of natural origin spawners improved in the North and South Santiam basins, but was still well below identified recovery goals. Improvement in the status of the Middle Fork Willamette River relates solely to the return of natural adults to Fall Creek, however the capacity of the Fall Creek basin alone is insufficient to achieve the recovery goals for this DIP. The Clackamas and McKenzie Rivers have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Fish passage improvements made at dams and numerous habitat restoration projects completed in upper Willamette River tributaries are expected to eventually provide benefit to the UWR Chinook salmon ESU, however, the scale of improvements needed is greater than the scale of habitat actions implemented to date (NMFS 2016a). Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk (NWFSC 2015).

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, impaired fish passage, and increased pre-spawn mortality associated with conditions below dams
- Altered food web due to reduced inputs of microdetritus
- Predation by native and non-native species, including hatchery fish
- Competition related to introduced races of salmon and steelhead
- Altered population traits due to fisheries, bycatch, and natural origin fish interbreeding with hatchery origin fish

Status of UCR Spring-run Chinook Salmon

A recovery plan is available for this species (UCSRB 2007). Achieving recovery (i.e., delisting the species) of each ESU via sufficient improvement in the abundance, productivity, spatial structure, and diversity is the longer-term goal of the Upper Columbia Salmon Recovery Board (UCSRB) Plan. The plan calls for meeting or exceeding the same basic spatial structure and diversity criteria adopted from the Interior Columbia Basin Technical Recovery Team (ICTRT) viability report for recovery (NWFSC 2015). None of the three populations are viable with respect to A&P, and they all have a greater than 25 percent chance of extinction in 100 years (UCSRB 2007).

Spatial Structure and Diversity**.** This species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam (excluding the Okanogan River), the Columbia River upstream to Chief Joseph Dam, and progeny of six artificial propagation programs. The composite spatial structure and diversity (SS/D) risks for all three of the extant natural populations in this MPG are rated at high (Table 6). The natural processes component of the SS/D risk is low for the Wenatchee and Methow River populations and moderate for the Entiat River population. All three of the extant populations in this MPG are rated at high risk for diversity, driven primarily by chronically high proportions of hatchery-origin spawners in natural spawning areas and a lack of genetic diversity among the natural-origin spawners (ICTRT 2008; NWFSC 2015).

Table 6. UCR spring-run Chinook Salmon ESU population viability status summary.*

Population	Abundance and productivity (A&P) metrics[1]				Spatial structure and diversity metrics			Overall viability rating
	ICTRT minimum threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated A&P Risk	Natural Processes Risk	Diversity Risk	Integrated SS/D Risk	
Wenatchee River 2005–2014	2,000	545 (311-1,030)	0.60 (0.27,15/20)	High	Low	High	High	High Risk
Entiat River 2005–2014	500	166 (78-354)	0.94 (0.18, 12/20)	High	Moderate	High	High	High Risk
Methow River 2005–2014	2,000	379 (189-929)	0.46 (0.31, 16/20)	High	Low	High	High	High Risk

*Current abundance and productivity estimates are geometric means. The range in annual abundance, standard error, and number of qualifying estimates for production are in parentheses. Upward arrows = current estimates increased from prior review. Oval = no change since prior review (NWFSC 2015). The Wenatchee, Entiat, and Methow River populations are considered a high risk for both abundance and productivity (A&P) and composite spatial structure/diversity (SS/D), as they are noted in the above table.

Abundance and Productivity. Overall A&P remains rated at high risk for each of the three extant populations in this MPG/ESU (Table 6) (NWFSC 2015). The 10-year geometric mean abundance of adult natural-origin spawners has increased for each population relative to the levels reported in the 2011 status review, but natural origin escapements remain below the corresponding ICTRT thresholds. The combinations of current A&P for each population result in a high risk rating when compared to the ICTRT viability curves (NWFSC 2015).

Limiting Factors include (UCSRB 2007):

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

Status of Snake River Spring/summer-run Chinook Salmon

NMFS just released a recovery plan for this species (NOAA Fisheries 2017a). This species includes all naturally-spawned populations of spring/summer-run Chinook salmon originating from the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins, and from 11 artificial propagation programs (USDC 2014). The ICTRT recognized 27 extant and four extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into five MPGs that correspond to ecological subregions (Table 7) (ICTRT 2003; McClure et al. 2005). All extant populations face a "high" risk of extinction (NWFSC 2015).

Table 7. MPGs, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for SR spring/summer-run Chinook salmon (NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), very high (VH), and extirpated (E).

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

Major Population Groups	Spawning Populations (Watershed)	A&P	Natural Processes Risk	Diversity	Integrated SS/D	Overall Viability Risk
Upper Salmon River	Salmon Lower Main	H	L	L	L	H
	Salmon Upper Main	H (M)	L	L	L	H
	Lemhi River	H	H	H	H	H
	Pahsimeroi River	H (M)	M	H	H	H
	Salmon East Fork	H	L	H	H	H
	Yankee Fork	H	M	H	H	H
	Valley Creek	H	L	M	M	H
	North Fork	*	L	L	L	H
	Panther Creek					E

*Insufficient data

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

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

Status of Snake River Fall-run Chinook Salmon

We just released a recovery plan for this species (NOAA Fisheries 2017b). This species includes all naturally-spawned populations of fall-run Chinook salmon originating from the mainstem Snake River below Hells Canyon Dam; from the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins; and from four artificial propagation programs (USDC 2014).

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

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

Overall population viability for the Lower Mainstem Snake River fall Chinook salmon population is determined based on the combination of ratings for current A&P and combined spatial structure diversity (Table 8).

Table 8. Lower Mainstem Snake River fall Chinook salmon population risk ratings integrated across the four viable salmonid population (VSP) metrics. Viability Key: Highly Viable (HV); Viable (V); Maintained (M); High Risk (HR); Green shaded cells—meets criteria for Highly Viable; Gray shaded cells—does not meet viability criteria (darkest cells are at greatest risk).

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

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

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

Status of Puget Sound Chinook Salmon

The PS Chinook salmon ESU was listed as threatened on June 28, 2005 (70 FR 37160). We adopted the recovery plan for this ESU in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (Shared Strategy for Puget Sound 2007) and a supplement by NMFS (2006a). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus et al. 2002). The PSTRT's biological recovery criteria will be met when all of the following conditions are achieved:

- The viability status of all populations in the ESU is improved from current conditions, and when considered in the aggregate, persistence of the ESU is assured.
- Two to four Chinook salmon populations in each of the five biogeographical regions of the ESU (Table 9) achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region.
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable.

- Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario; Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery.
- Populations that do not meet the viability criteria for all VSP parameters are sustained to provide ecological functions and preserve options for ESU recovery.

Spatial Structure and Diversity. The PS Chinook salmon ESU includes all naturally-spawning populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. The ESU also includes the progeny of numerous artificial propagation programs (NWFSC 2015). The PSTRT identified 22 extant populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. The PSTRT distributed the 22 populations among five major biogeographical regions, or MPGs, that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 9).

Between 1990 and 2014, the proportion of natural-origin spawners has trended downward across the ESU, with the Whidbey Basin the only MPG with consistently high fractions of natural-origin spawner abundance. All other MPG have either variable or declining spawning populations with high proportions of hatchery-origin spawners (NWFSC 2015).Overall, the new information on abundance, productivity, spatial structure and diversity since the 2010 status review supports no change in the biological risk category (NWFSC 2015).

Table 9. Extant Puget Sound Chinook salmon populations in each biogeographic region (Ruckelshaus et al. 2002), NWFSC 2015).

Biogeographic Region	Population (Watershed)
Strait of Georgia	North Fork Nooksack River
	South Fork Nooksack River
Strait of Juan de Fuca	Elwha River
	Dungeness River
Hood Canal	Skokomish River
	Mid Hood Canal River
Whidbey Basin	Skykomish River
	Snoqualmie River
	North Fork Stillaguamish River
	South Fork Stillaguamish River
	Upper Skagit River
	Lower Skagit River
	Upper Sauk River
	Lower Sauk River

Biogeographic Region	Population (Watershed)
	Suiattle River
	Upper Cascade River
Central/South Puget Sound Basin	Cedar River
	North Lake Washington/Sammamish River
	Green/Duwamish River
	Puyallup River
	White River
	Nisqually River

Abundance and Productivity. Available data on total abundance since 1980 indicate that although abundance trends have fluctuated between positive and negative for individual populations, there are widespread negative trends in natural-origin Chinook salmon spawner abundance across the ESU (NWFSC 2015). Productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Available data now shows that most populations have declined in abundance over the past 7 to 10 years. Further, escapement levels for all populations remain well below the technical recovery team (TRT) planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery (NWFSC 2015).

Limiting Factors. Limiting factors for this species include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation and loss of in-river LWD
- Excessive fine-grained sediment in spawning gravel
- Degraded water quality and temperature
- Degraded nearshore conditions
- Impaired passage for migrating fish
- Altered flow regime

Status of CR Chum Salmon

Columbia River chum salmon are included in the Lower Columbia River Recovery Plan (NMFS 2013a). Recovery targets for this species focus on improving tributary and estuarine habitat conditions, and re-establishing populations where they may have been extirpated, in order to increase all four viability parameters. Specific recovery goals are to restore Coast and Cascade chum salmon strata to high probability of persistence, and to improve persistence probability of the two Gorge populations by protecting and restoring spawning habitat, side channel, and off channel habitats alcoves, wetlands, floodplains, etc. Even with improvements observed during the last five years, the majority of DIPs in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals (NWFSC 2015).

Spatial Structure and Diversity. The ESU includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, as well as four artificial propagation programs (Grays River Hatchery, Big Creek Hatchery, Lewis River Hatchery, and Washougal Hatchery). With the exception of the Grays River stock of fish raised at Big Creek Hatchery, all of the hatchery programs in this ESU use integrated stocks developed to supplement natural production. Ford et al. (2011) concluded that the vast majority (14 out of 17) chum populations remain extirpated or nearly so. The ESU is comprised of three MPGs—the Coastal Range MPG, the Cascade Range MPG, and the Gorge MPG.

In this ESU there have been a number of large-scale efforts to improve habitat accessibility, one of the primary metrics for spatial structure. On the Hood River, Powerdale Dam was removed in 2010 and while this dam previously provided for fish passage, removal of the dam is thought to eliminate passage delays and injuries. Condit Dam, on the White Salmon River, was removed in 2012 and this provided access to previously inaccessible habitat. Both of these dams were above Bonneville Dam, and at present there are few fish available (122 adults in 2014) to colonize these recently accessible habitats.

Abundance and Productivity. Populations in the Coast Range MPG other than the Grays River DIP exist at very low abundances, intermittently observed in very low numbers (fewer than ten) in most tributaries other than the Grays River. Two chum spawning aggregates in the mainstem Columbia River just upstream of the I-205 bridge are part of the Washougal River aggregate. In November 2013, two adult chum salmon were observed at the North Fork Dam in the Clackamas River. Chum salmon have also been collected at a number of hatcheries and weirs throughout the Cascade Range MPG, but only in very limited numbers (fewer than ten). While the absolute numbers of fish present in many populations are critically low, they may represent important reserves of genetic diversity. Within the Gorge MPG, the Lower Gorge population includes chum salmon returning to Hamilton, Hardy, and Duncan Creeks, and the Ives Island area of the mainstem Columbia River below Bonneville Dam. Other mainstem Columbia River spawning aggregations include Multnomah and Horsetail Creeks on the Oregon shoreline, and in the St. Cloud area along the Washington shoreline. The overall trend since 2000 is negative, with the recent peak in abundance (2010 to 2011) being considerably lower than the previous peak in 2002. The Upper Gorge population is comprised of a small number (105.6 ± 47.7) that migrate past Bonneville Dam to the upper Gorge population area in most years. (Data from http://www.nwp.usace.army.mil/Missions/Environment/Fish/Counts.aspx accessed 4 March 2015).

Limiting Factors. Limiting factors for this species are (NMFS 2013a):

- Degraded estuarine and nearshore marine habitat
- Degraded freshwater habitat
- Degraded stream flow as a result of hydropower and water supply operations
- Reduced water quality
- Current or potential predation
- An altered flow regime and Columbia River plume
- Reduced access to off-channel rearing habitat in the lower Columbia River

Status of Hood Canal Summer-run Chum Salmon

We adopted a recovery plan for HC summer-run chum salmon in May of 2007. The recovery plan consists of two documents: the Hood Canal and Eastern Strait of Juan de Fuca Summer Chum Salmon recovery plan (Hood Canal Coordinating Council 2005) and a supplemental plan by NMFS (2007). The recovery plan adopts ESU and population level viability criteria recommended by the PSTRT (Sands et al. 2007). The PSTRT's biological recovery criteria will be met when the following conditions are achieved:

- Spatial Structure: (1) spawning aggregations are distributed across the historical range of the population; (2) most spawning aggregations are within 20 km of adjacent aggregations; (3) major spawning aggregations are distributed across the historical range of the population and are not more than approximately 40 km apart. Further, a viable population has spawning, rearing, and migratory habitats that function in a manner that is consistent with population persistence
- Diversity: Depending on the geographic extent and ecological context of the population, a viable population includes one or more persistent spawning aggregations from each of the two to four major ecological diversity groups historically present within the two populations (see also McElhany et al. 2000).
- A&P: Achievement of minimum abundance levels associated with persistence of Hood Canal Summer Chum ESU populations that are based on two assumptions about productivity and environmental response (Table 10).

Despite substantive gains towards meeting viability criteria in the Hood Canal and Strait of Juan de Fuca summer chum salmon populations, the ESU still does not meet all of the recovery criteria for population viability at this time (NWFSC 2015).

Table 10. Hood Canal summer-run chum ESU abundance and productivity recovery goals (Sands et al. 2007).

Population	Low Productivity Planning Target for Abundance (productivity in parentheses)	High Productivity Planning Target for Abundance (productivity in parentheses)
Strait of Juan de Fuca	12,500 (1.0)	4,500 (5.0)
Hood Canal	24,700 (1.0)	18,300 (5.0)

Spatial Structure and Diversity. The ESU includes all naturally-spawning populations of summer-run chum salmon in Hood Canal tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington, as well as several artificial propagation programs. The PSTRT identified two independent populations for the Hood Canal summer chum, one which includes the spawning aggregations from rivers and creeks draining into the Strait of Juan de Fuca, and one which includes spawning aggregations within Hood Canal proper (Sands et al. 2009).

Spatial structure and diversity measures for the Hood Canal summer chum recovery program have included the reintroduction and sustaining of natural-origin spawning in multiple small streams where summer chum spawning aggregates had been extirpated. Supplementation programs have been very successful in both increasing natural spawning abundance in 6 of 8 extant streams (Salmon, Big Quilcene, Lilliwaup, Hamma Hamma, Jimmycomelately, and Union) and increasing spatial structure due to reintroducing spawning aggregations to three streams (Big Beef, Tahuya, and Chimacum). Spawning aggregations are present and persistent within five of the six major ecological diversity groups identified by the PSTRT (Table 11). As supplementation program goals have been met in most locations, they have been terminated except in Lilliwaup/Tahuya, where supplementation is ongoing (NWFSC 2015). Spatial structure and diversity viability parameters for each population have increased and nearly meet the viability criteria.

Table 11. Seven ecological diversity groups as proposed by the Puget Sound Technical Recovery Team for the Hood Canal Summer Chum ESU by geographic region and associated spawning aggregation.

Geographic Region (population)	Proposed Ecological Diversity Groups	Spawning aggregations: Extant* and extinct**
Eastern Strait of Juan de Fuca	Dungeness	Dungeness R (unknown status)
	Sequim-Admiralty	Jimmycomelately Cr* Salmon Cr* Snow Cr* Chimacum Cr**
Hood Canal	Toandos	Unknown
	Quilcene	Big Quilcene R* Little Quilcene R*
	Mid-West Hood Canal	Dosewallips R* Duckabush R*
	West Kitsap	Big Beef Cr** Seabeck Cr** Stavis Cr** Anderson Cr** Dewatto R** Tahuya R** Mission Cr** Union R*
	Lower West Hood Canal	Hamma Hamma R* Lilliwaup Cr* Skokomish R*

<u>Abundance and Productivity</u>. Smoothed trends in estimated total and natural population spawning abundances for both Hood Canal and Strait of Juan de Fuca populations have generally increased over the 1980 to 2014 time period. The Hood Canal population has had a 25 percent increase in abundance of natural-origin spawners in the most recent 5-year time period over the 2005 to 2009 time period. The Strait of Juan de Fuca has had a 53 percent increase in abundance of natural-origin spawners in the most recent 5-year time period.

Trends in population productivity, estimated as the log of the smoothed natural spawning abundance in year t minus the smoothed natural spawning abundance in year (t-4), have increasing over the past five years, and were above replacement rates in the 2012 and 2013. However, productivity rates have been varied above and below replacement rates over the entire time period up to 2014. PNPTT and WDFW (2014) provide a detailed analysis of productivity for the ESU, each population, and by individual spawning aggregation, and report that 3 of the 11 stocks exceeded the comanager's interim productivity goal of an average of 1.6 Recruit/Spawner over 8 years. They also report that natural-origin Recruit/Spawner rates have been highly variable in recent brood years, particularly in the Strait of Juan de Fuca population. Only one spawning aggregation (Chimacum) meets the comanager's interim recovery goal of 1.2

recruits per spawner in 6 of most recent 8 years. Productivity of individual spawning aggregates shows only two of eight aggregates have viable performance. (NWFSC 2015).

Limiting factors. Limiting factors for this species include (Hood Canal Coordinating Council 2005):

- Reduced floodplain connectivity and function
- Poor riparian condition
- Loss of channel complexity (reduced large wood and channel condition, loss of side channels, channel instability)
- Sediment accumulation
- Altered flows and water quality

Status of Lower Columbia River Coho Salmon

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

Spatial Structure and Diversity. This ESU includes all naturally spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia River up to and including the Big White Salmon and Hood Rivers, and includes the Willamette River to Willamette Falls, Oregon, as well as multiple artificial propagation programs. Most of the populations in the ESU contain a substantial number of hatchery-origin spawners. Myers et al. (Myers et al. 2006) identified three MPGs (Coastal, Cascade, and Gorge), containing a total of 24 DIPs in the LCR coho salmon ESU (NWFSC 2015).

There have been a number of large-scale efforts to improve accessibility, one of the primary metrics for spatial structure, in this ESU. On the Hood River, Powerdale Dam was removed in 2010 and while this dam previously provided fish passage removal of the dam is thought to eliminate passage delays and injuries. Condit Dam, on the White Salmon River, was removed in 2011 and this provided access to previously inaccessible habitat. Fish passage operations (trap and haul) were begun on the Lewis River in 2012, reestablishing access to historically-occupied habitat above Swift Dam though, juvenile passage efficiencies are still relatively poor. Presently, the trap and haul program for the Upper Cowlitz, Cispus, and Tilton River populations are the only means by which coho salmon can access spawning habitat for these populations. A trap and haul program also currently maintains access to the North Toutle River above the sediment retention structure with coho salmon and steelhead being passed above the dam (NWFSC 2015).

Abundance and Productivity. Long-term abundances in the Coast Range Cascade MPG were generally stable. Scappoose Creek is exhibiting a positive abundance trend. Clatskanie River coho salmon population maintains moderate numbers of naturally produced spawners. Washington tributaries indicate the presence of moderate numbers of coho salmon, with total abundances in the hundreds to low thousands of fish. Oregon tributaries have abundances in the hundreds of fish. In the Western Cascade MPG, the Sandy and Clackamas Rivers were the only two populations identified in the original 1996 Status Review that appeared to be self-sustaining natural populations. Natural origin abundances in the Columbia Gorge MPG are low, with hatchery-origin fish contributing a large proportion of the total number of spawners, most notably in the Hood River. With the exception of the Hood and Big White Salmon Rivers, much of the spawning habitat accessibility is relatively poor. There was no clear trend in the abundance data.

Limiting Factors. Limiting factors for this species include (NMFS 2013a):

- Degraded estuarine and near-shore marine habitat
- Fish passage barriers
- Degraded freshwater habitat: Hatchery-related effects
- Harvest-related effects
- An altered flow regime and Columbia River plume
- Reduced access to off-channel rearing habitat in the lower Columbia River
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Juvenile fish wake strandings
- Contaminants

Status of Oregon Coast Coho Salmon

We released a recovery plan for this species in 2016 (NMFS 2016b). NMFS first listed OC coho salmon as a threatened species under the ESA in 1998. The species was relisted in 2008 and NMFS re-affirmed the OC coho salmon listing status as threatened on June 20, 2011 (76 FR 35755). In 2016, we completed a 5-year review for OC coho salmon in which we concluded this listing status remains appropriate (NMFS 2016b).

Spatial Structure and Diversity**.** This species includes populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco. The Cow Creek Hatchery Program (South Umpqua population) is included as part of the ESU because the original brood stock was founded from the local, natural origin population and natural origin coho salmon have been incorporated into the brood stock on a regular basis. The OC-TRT identified 56 populations, including 21 independent and 35 dependent populations in five biogeographic strata (Table 12) (Lawson et al. 2007). Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent or potentially independent. Dependent populations (D) are populations that historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance (McElhany et al. 2000; Lawson et al. 2007). 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 (NWFSC 2015).

Table 12. Oregon Coast (OC) coho salmon populations. Population types included functionally independent (FI), potentially independent (PI) and dependent populations (D) (McElhany et al. 2000; Lawson et al. 2007).

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

A 2010 biological review team (BRT) (Stout et al. 2012) noted significant improvements in hatchery and harvest practices had been made, although, harvest and hatchery reductions have changed the population dynamics of the ESU. Recent re-evaluation of hatchery influence on diversity criteria were positive with even the lowest ranked populations showing improvement since the previous assessment (NWFSC 2015). Additional ESU diversity criteria were not updated in 2015 although the recent increases in abundance and diversity across all the strata suggest that ESU diversity has not decreased since 2012 (NWFSC 2015).

Abundance and Productivity. It has not been demonstrated that productivity during periods of poor marine survival is now adequate to sustain the ESU. Recent increases in adult escapement do not provide strong evidence that the century-long downward trend has changed. There is concern that increased abundances are being incorrectly credited to stream restoration activities when the increases are a result of recent high marine survival. When future conditions are taken into account, the OC coho salmon ESU, as a whole, is at moderate risk of extinction, but the recent risk trend is stable and improving (Stout et al. 2012, NWFSC 2015).

Limiting Factors. Today, OC coho salmon are primarily affected by threats that reduce the quantity and quality of coho salmon rearing habitat. Reviews by NMFS' BRTs in 2011 and 2015 found that the long-term decline in OC coho salmon productivity reflected deteriorating conditions in freshwater habitat, and that the remaining habitat may not be high enough to sustain the species productivity during cycles of poor ocean conditions (NWFSC 2015; Stout et al. 2012)

Limiting factors of high concern cited in the recovery plan 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

According to the recovery plan (NMFS 2016b), climate change is a threat, of medium-high concern, with effects on primary limiting factors including further habitat degradation and productivity; a BRT reached the broad conclusion that the rising temperatures anticipated with global climate change will have an overall negative effect on the status of the ESU (Stout et al. 2012). The main predicted effects in terrestrial and freshwater habitats include warmer, drier summers, reduced snowpack, lower summer flows, higher summer stream temperatures, and increased winter floods, which would affect coho salmon by reducing available summer rearing habitat, increasing potential scour and egg loss in spawning habitat, increasing thermal stress, and increasing predation risk. In estuarine habitats, the main physical effects are predicted to be rising sea level and increasing water temperatures, which would lead to a reduction in intertidal wetland habitats, increasing thermal stress, increasing predation risk, and unpredictable changes in biological community composition.

Status of Southern Oregon/Northern California Coast Coho Salmon

A recovery plan is available for this species (NMFS 2014). In 2016, we completed a 5-year review for this ESU in which we concluded that the ESU should remain listed as threatened; in the last 5 years there has not been improvement in the status of SONCC coho salmon or a significant change in risk to persistence of the ESU (NMFS 2016c).

<u>Spatial Structure and Diversity</u>. This species includes all naturally-spawned populations of coho salmon in coastal streams from the Elk River near Cape Blanco, Oregon, through and including the Mattole River near Punta Gorda, California; progeny of three artificial propagation programs are also included in the ESU (NMFS 2016c). Williams et al. (2006) designated 45 populations of coho salmon in the SONCC coho salmon ESU as dependent or independent based on their historical population size. Independent populations are populations that historically would have had a high likelihood of persisting in isolation from neighboring populations for 100 years and are rated as functionally independent or potentially independent. Dependent populations historically would not have had a high likelihood of persisting in isolation for 100 years. These populations relied upon periodic immigration from other populations to maintain their abundance. Two populations are both small enough and isolated enough that they are only intermittently present (McElhany et al. 2000; Williams et al. 2006; NMFS 2014). These populations were further grouped into seven diversity strata based on the geographical arrangement of the populations and basin-scale genetic, environmental, and ecological characteristics (Table 13).

NMFS (2014) determined the role each of the populations will serve in recovery (Table 13). Independent populations likely to respond to recovery actions and achieve a low risk of extinction most quickly are designated “Core” populations. We based this designation on current condition, geographic location in the ESU, a low risk threshold compared to the number of spawners needed for the entire stratum, and other factors. Independent populations with little to no documentation of coho salmon presence in the last century, and poor prospects for recovery were designated as non-core 2. All other independent populations are designated non-core 1. With improved data from 2006, NMFS (2014) found five of the 45 populations were ephemeral. We also established biological recovery objectives and criteria for each population role (Table 14) in our recovery plan for this species; core populations will play a major role in recovering this ESU while the other populations will contribute to maintaining and increasing connectivity and diversity (NMFS 2014).

Table 13. Independent and dependent Southern Oregon Northern California Coast (SONCC) coho salmon populations by stratum and role of each population in recovery (Williams et al. 2006). Ephemeral populations per NMFS (2014) not listed.

Diversity Stratum	Independent Population	Population Role
Northern Coastal Basins	Elk River	Independent - Core
	Brush Creek	Dependent
	Mussel Creek	Dependent

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

Diversity Stratum	Independent Population	Population Role
	Upper Mainstem Eel River	Independent - Non-Core 2

Table 14. Biological recovery objectives and criteria to measure whether recovery objectives are met for Southern Oregon Northern California Coast (SONCC) coho salmon (NMFS 2014).

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

VSP Parameter	Population Role	Biological Recovery Objective	Biological Recovery Criteria[1]

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

Abundance and Productivity. Although long-term data on abundance of SONCC coho salmon are scarce, the best available data indicate that none of the seven diversity strata appear to support a single viable population, although all diversity strata are occupied (NMFS 2014). Further, 24 out of 31 independent populations are at high risk of extinction and six are at moderate risk of extinction. The extinction risk of an ESU depends upon the extinction risk of its constituent independent populations; because the population abundance of most independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable (Williams et al. 2011). Estimates from the Rogue River with its four independent populations indicate a small but significant positive trend ($p = 0.01$) over the past 35 years and a non-significant negative trend ($p > 0.05$) over the past 12 years or four generations (NMFS 2016c). The decline in abundance from historical levels and the poor status of population viability criteria are the main factors behind the extinction risk of the ESU.

Limiting Factors. There is a heightened risk to SONCC coho salmon since the 2011 status review, primarily due to drought conditions, poor ocean conditions, and increased water withdrawals in many areas (NMFS 2016c). The recovery plan uses "stresses" to describe the physical, biological, or chemical conditions and associated ecological processes that may be impeding SONCC coho salmon recovery (NMFS 2014). Stresses for this species include:

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

Status of Lake Ozette Sockeye Salmon

We adopted a recovery plan for Lake Ozette sockeye salmon (NMFS 2009a) in May 2009. The criteria of the recovery plan were based upon Rawson et al. (2009). Recovery criteria include:

- Multiple, spatially distinct and persistent spawning aggregations throughout the historical range of the population (i.e., along the lake beaches and in one or more tributaries).
- One or more persistent spawning aggregations from each major genetic and life history group historically present. Also, genetic distinctness between anadromous sockeye, and kokanee salmon in the lake.
- Abundance between 31,250 and 121,000 adult spawners, over a number of years.

Spatial Structure and Diversity. The ESU includes all naturally spawned aggregations of sockeye salmon in Lake Ozette and streams and tributaries flowing into Lake Ozette, Washington. The ESU also includes fish originating from two artificial propagation programs: the Umbrella Creek and Big River sockeye hatchery programs. The PSTRT considers the Lake Ozette sockeye salmon ESU to be composed of one historical population (Currens et al. 2009), with substantial sub-structuring of individuals into multiple spawning aggregations.

The primary existing spawning aggregations occur in two beach locations (Allen's and Olsen's beaches), and in two tributaries (Umbrella Creek and Big River) (NWFSC 2015). Tributary spawners appear to have a higher incidence of 3- and 5-year-old returns compared to the historic beach spawning dominated population (Haggerty et al. 2009). The historical geographic extent of beach spawning is not well documented but it is certain that it was more spatially extensive than the current distribution. For example, Umbrella beach historically supported spawning before sediment input from Umbrella Creek covered the suitable substrate. Also, spawning on the upper beach (in shallower water) has declined in recent years, likely resulting from increased shoreline vegetation. There is strong evidence that from 2005 to 2010 there were very few beach spawners though more recent observation suggests the number of beach spawners has recovered to levels seen before the decline (NWFSC 2015).

Abundance and Productivity. There is little evidence of a trend in abundance over the full range of years or more recently since the last status review in Ford et al. (2011). There is some evidence of the dominant 4-year age of return in the abundance series, with the 1980 brood cycle line surpassing the other lines in late 1980s and maintaining this higher level until 2000. Estimated productivity, calculated as the abundance in year t divided by the abundance in year t-4, fluctuated around 1 with no apparent overall trend but a suggestion of a 10- to 20-year cycle in both raw and smoothed data. Given the degree of uncertainty in the abundance estimates, any interpretation of trends of small magnitude or over short time periods is speculative. (NWFSC 2015). The Umbrella creek population is a large component of the total population (averaging over 50 percent for the last decade of data). Abundance of Lake Ozette sockeye has not changed substantially from the last status review.

Limiting factors. The recovery plan for this species (NMFS 2009a; NOAA Fisheries 2011) lists "key" and "contributing" limiting factors that vary by population segment. Key limiting factors have the greatest effect on the population's ability to reach the status desired for it. Contributing limiting factors have a low, moderate or unknown effect on attaining the desired status. We list the key limiting factors below:

- Predation by harbor seals, river otters, and predaceous non-native and native species of fish
- Reduced quality and quantity of beach spawning habitat in Lake Ozette
- Increased competition for beach spawning sites due to reduced habitat availability
- Stream channel simplification and increased sediment in tributary spawning areas

Status of Lowe Columbia River Steelhead

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

Spatial Structure and Diversity. The DPS includes all naturally-spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), as well as multiple artificial propagation programs. There are four MPGs comprised of 23 DIPs, including six summer-run steelhead populations and 17 winter-run populations that comprise (NWFSC 2015). Summer steelhead return to freshwater long before spawning. Winter steelhead, in contrast, return from the ocean much closer to maturity and spawn within a few weeks. Summer steelhead spawning areas in the lower Columbia River are found above waterfalls and other features that create seasonal barriers to migration. Where no temporal barriers exist, the winter-run life history dominates.

There have been a number of large-scale efforts to improve accessibility (one of the primary metrics for spatial structure) in this ESU. Trap and haul operations were begun on the Lewis River in 2012 for winter-run steelhead, reestablishing access to historically-occupied habitat above Swift Dam. In 2014, 1,033 adult winter steelhead (integrated program fish) were transported to the upper Lewis River; however, juvenile collection efficiency is still below target levels. In addition, there have been a number of recovery actions throughout the ESU to remove or improve culverts and other small-scale passage barriers. Many of these actions (including the removal of Condit Dam on the White Salmon River) have occurred too recently to be fully evaluated.

Total steelhead hatchery releases in the LCR Steelhead DPS have decreased since the last status review, declining from n total (summer and winter run) release of approximately 3.5 million to 3 million from 2008 to 2014. Some populations continue to have relatively high fractions of hatchery-origin spawners, whereas others (e.g., Wind River) have relatively few hatchery origin spawners.

Abundance and Productivity. The winter-run Western Cascade MPG includes native winter-run steelhead in 14 DIPs from the Cowlitz River to the Washougal River. Abundances have remained fairly stable and have remained low, averaging in the hundreds of fish. Notable exceptions to this were the Clackamas and Sandy River winter-run steelhead populations, that are exhibiting recent rises in natural origin returns abundance and maintaining low levels of hatchery-origin steelhead on the spawning grounds (Jacobsen et al. 2014). In the summer-run Cascade MPG, there are four summer-run steelhead populations. Absolute abundances have been in the hundreds of fish. Long- and short-term trends for three DIPs (Kalama, East Fork Lewis and Washougal) are positive, though the 2014 surveys indicate a drop in abundance for all three. The winter-run Gorge MPG has three DIPs. In both the Lower and Upper Gorge population surveys for winter steelhead are very limited. Abundance levels have been low, but relatively stable, in the Hood River. In recent years, spawners from the integrated hatchery program have constituted the majority of the naturally-spawning fish. The Wind River and Hood River are the two DIPs in the summer-run Gorge MPG. Hood River summer-run steelhead have not been monitored since the last status review. Adult abundance in the Wind River remains stable, but at a low level (hundreds of fish). The overall status of the MPG is uncertain.

Limiting factors. Limiting factors for this species include (NMFS 2013a):

- Degraded estuarine and nearshore marine habitat
- Degraded freshwater habitat
- Reduced access to spawning and rearing habitat
- Avian and marine mammal predation
- Hatchery-related effects
- An altered flow regime and Columbia River plume
- Reduced access to off-channel rearing habitat in the lower Columbia River
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Juvenile fish wake strandings
- Contaminants

Status of Upper Willamette River Steelhead

Upper Willamette River 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 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 DIPs of UWR steelhead occur within the DPS (Table 15). Historical observations, hatchery records, and genetics suggest that the presence of UWR steelhead in many tributaries on the west side of the upper basin is the result of recent introductions. Nevertheless, the WLC-TRT recognized that although west side UWR steelhead does not represent a historical population, those tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. Hatchery summer-run steelhead that are released in the subbasins are from an out-of-basin stock, and are not part of the DPS, nor are stocked summer steelhead that have become established in the McKenzie River (ODFW and NMFS 2011).

Table 15. 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

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 percent 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 to 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 2016a). 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, as in 2014 when 11 to 18 percent 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 2016a).

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 to 2014, and redd survey data indicate consistent low numbers of spawners in tributaries (NWFSC 2015). Radio-tagging studies in the Calapooia from 2012 to 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 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 (Figure 98 in NWFSC 2015).

<u>Limiting Factors.</u> 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.

Status of Middle Columbia River Steelhead

A recovery plan is available for this species (NMFS 2009b). This species includes all naturally-spawned steelhead populations originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River; excluding steelhead originating from the Snake River basin. This DPS does include steelhead from seven artificial propagation programs (USDC 2014). The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project in the Deschutes River Basin, Oregon (USDC 2013a). The ICTRT identified 17 extant populations in this DPS (ICTRT 2003; McClure et al. 2005). The populations fall into four MPGs: Cascade eastern slope tributaries (five extant and two extirpated populations), the John Day River (five extant populations), the Walla Walla and Umatilla rivers (three extant and one extirpated populations), and the Yakima River (four extant populations) (Table 16) (ICTRT 2003; McClure et al. 2005). Viability ratings for these populations range from extirpated to viable (Table 16) (NMFS 2009b; NWFSC 2015).

Table 16. MPGs, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for MCR steelhead (NMFS 2009; NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), very high (VH), and extirpated (E). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

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

* Re-introduction efforts underway (NMFS 2009)

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

There have been improvements in the viability ratings for some of the component populations, but the MCR Steelhead DPS is not currently meeting the viability criteria described in the Mid-Columbia Steelhead recovery plan. In addition, several of the factors cited by the 2005 BRT remain as concerns or key uncertainties. Natural origin returns to the majority of populations in two of the four MPGs in this DPS increased modestly relative to the levels reported in the previous 5-year review. Abundance estimates for two of three populations with sufficient data in the remaining two MPGs (Eastside Cascades and Umatilla/Walla-Walla) were marginally lower. Natural-origin spawning estimates are highly variable relative to minimum abundance thresholds across the populations in the DPS. Three of the four MPGs in this DPS include at least one population rated at low risk for A&P (Table 37 in NWFSC 2015). The survival gaps for the remaining populations are generally smaller than those for the other Interior Columbia Basin listed DPSs (Figure 52 in NWFSC 2015). Updated information indicates that stray levels into the John Day River populations have decreased in recent years. Out of basin hatchery stray proportions, although reduced, remain high in spawning reaches within the Deschutes River basin populations. In general, the majority of population level viability ratings remained unchanged from prior reviews for each MPG within the DPS.

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

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

Status of Upper Columbia River Steelhead

The UCR steelhead DPS was originally listed under the ESA in 1997. The Upper Columbia River Recovery Plan calls for "…restoring the distribution of naturally produced spring Chinook salmon and steelhead to previously occupied areas where practical, and conserving their genetic and phenotypic diversity." (UCSRB 2007). In 2015, the 5-year review for the UCR steelhead concluded the species should maintain its threatened listing classification (NWFSC 2015).

<u>Spatial Structure and Diversity</u>**.** The UCR steelhead DPS includes all naturally-spawned anadromous *O. mykiss* (steelhead) populations below natural and artificial impassable barriers in streams within the Columbia River Basin, upstream from the Yakima River, Washington, to the U.S.–Canada border, as well as six artificial propagation programs: the Wenatchee River, Wells Hatchery (in the Methow and Okanogan Rivers), Winthrop National Fish Hatchery (NFH), Omak Creek and the Ringold steelhead hatchery programs. NMFS has defined the UCR steelhead DPS to include only the anadromous members of this species (70 FR 67130). The UCR steelhead DPS is composed of three MPGs, two of which are isolated by dams.

With the exception of the Okanogan population, the Upper Columbia River populations were rated as low risk for spatial structure. Each population is at high risk for diversity, largely driven by chronic high levels of hatchery spawners within natural spawning areas and lack of genetic diversity among the populations. The proportions of hatchery-origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations.

Abundance and Productivity. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin A&P remain well below viability thresholds for three out of the four populations. The most recent estimates of natural-origin spawner abundance for each of the four populations in the UCR Steelhead DPS show fairly consistent patterns throughout the years. None of the populations have reached their recovery goal numbers during any of the years (500 for the Entiat, 2,300 for the Methow, 2,300 for the Okanogan, and 3,000 for Wenatchee). In spite of recent increases, natural origin A&P remain well below viability thresholds for three out of the four populations, and the Okanogan River natural-origin spawner abundance estimates specifically are well below the recovery goal for that population. Three of four extant natural populations are considered to be at high risk of extinction and one at moderate risk (Table 17).

Table 17. Summary of the key elements (A&P, diversity, and SS/D) and scores used to determine current overall viability risk for UCR steelhead populations (NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH).

Population (Watershed)	ICTRT Min Threshold	A&P	Natural Processes Risk	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	1,000	L	L	H	H	MT
Entiat River	500	H	M	H	H	H
Methow River	1,000	H	L	H	H	H
Okanogan River	750	H	H	H	H	H

Limiting Factors. Limiting factors for this species include (UCSRB 2007):

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

Status of Snake River Basin Steelhead

This ESU was first listed as endangered under the ESA in 1991. NMFS just released a recovery plan for this species (NOAA Fisheries 2017a). The overall viability ratings for natural populations in the SRB Steelhead DPS range from moderate to high risk. Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan; the Grande Ronde MPG is tentatively rated as viable.

Spatial Structure and Diversity**.** The SRB steelhead DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho as well as six artificial production programs: the Tucannon River, Dworshak NFH, Lolo Creek, North Fork Clearwater River, East Fork Salmon River, and the Little Sheep Creek/Imnaha River Hatchery steelhead hatchery programs. With one exception, spatial structure ratings for all of the SRB steelhead populations were low or very low risk, given the evidence for distribution of natural production with populations. The exception was the Panther Creek population, which was given a high risk rating for spatial structure based on the lack of spawning in the upper sections. No new information was provided for the 2015 status update that would change those ratings (Table 18) (NWFSC 2015).

Table 18. MPGs, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for SRB steelhead (NWFSC 2015). Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

Major Population Group	Spawning Populations (Watershed)	ICTRT min threshold	A&P	Diversity	Integrated SS/D	Overall Viability Risk*
Lower Snake River	.	1,000	H?	M	M	H?
	Asotin Creek	500	M?	M	M	MT
Grande Ronde River	Lower Grande Ronde	1,000	**	M	M	MT?
	Joseph Creek	500	VL	L	L	Highly viable
	Upper Grande Ronde	1,500	V	M	M	Viable
	Wallowa River	1,000	H?	L	L	M?
Clearwater River	Lower Clearwater	1,500	M?	L	L	MT?
	South Fork Clearwater	1,000	H	M	M	H?/MT
	Lolo Creek	500	H	M	M	H?/MT
	Selway River	1,000	M?	L	L	MT?
	Lochsa River	1,000	M?H	L	L	MT?
Salmon River	Little Salmon River	500	M?	M	M	MT?
	South Fork Salmon	1,000	M?	L	L	MT?
	Secesh River	500	M?	L	L	MT?
	Chamberlain Creek	500	M?	L	L	MT?
	Lower MF Salmon	1,000	M?	L	L	MT?
	Upper MF Salmon	1,000	M?	L	L	MT?
	Panther Creek	500	M?	M	H	H?
	North Fork Salmon	500	M	M	M	MT?
	Lemhi River		**	M	M	MT
	Pahsimeroi River	1,000	M	M	M	MT?
	East Fork Salmon	1,000	M	M	M	MT?
	Upper Main Salmon	1,000	M	M	M	MT?
Imnaha	Imnaha River	1,000	M	M	M	M

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

<u>Abundance and Productivity</u>. Population-specific adult population abundance is generally not available for the Snake River Basin steelhead due to difficulties conducting surveys in much of their range. Evaluations in the 2015 status review were done using both a set of metrics corresponding to those used in prior BRT reviews, as well as a set corresponding to the specific viability criteria based on ICTRT recommendations for this DPS. The BRT level metrics were consistently done across all ESUs and DPSs to facilitate comparisons across domains. The most recent 5-year geometric mean abundance estimates for the two long-term data series' of direct population estimates (Joseph Creek and Upper Grande Ronde Mainstem populations) both increased compared to the prior review estimates; each of the populations increased an average of 2 percent per year over the past 15 years. Hatchery-origin spawner estimates for both populations continued to be low, and both populations are currently approaching the peak abundance estimates observed since the mid-1980s (NWFSC 2015).

Limiting Factors. Limiting factors for this species include (NOAA Fisheries 2017a):

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

Status of Puget Sound Steelhead

The PSTRT produced viability criteria, including population viability analyses (PVAs), for 20 of 32 DIPs and three MPGs in the DPS (Hard et al. 2015). It also completed a report identifying historical populations of the DPS (Myers et al. 2015). The DIPs are based on genetic, environmental, and life history characteristics. Populations display winter, summer, or summer/winter run timing (Myers et al. 2015). The TRT concludes that the DPS is currently at "very low" viability, with most of the 32 DIPs and all three MPGs at "low" viability.

The designation of the DPS as "threatened" is based upon the extinction risk of the component populations. Hard et al. 2015, identify several criteria for the viability of the DPS, including that a minimum of 40 percent of summer-run and 40 percent of winter-run populations historically present within each of the MPGs must be considered viable using the VSP-based criteria. For a DIP to be considered viable, it must have at least an 85 percent probability of meeting the viability criteria, as calculated by Hard (2015).

We are developing a recovery plan for this species.

Spatial Structure and Diversity**.** The PS steelhead DPS is the anadromous form of *O. mykiss* that occur in rivers, below natural barriers to migration, in northwestern Washington State that drain to Puget Sound, Hood Canal, and the Strait of Juan de Fuca between the U.S./Canada border and the Elwha River, inclusive. The DPS also includes six hatchery stocks that are considered no more than moderately diverged from their associated natural-origin counterparts: Green River natural winter-run; Hamma Hamma winter-run; White River winter-run; Dewatto River winter-run; Duckabush River winter-run; and Elwha River native winter-run (USDC 2014). Steelhead are the anadromous form of *O. mykiss* that occur in rivers, below natural barriers to migration, in northwestern Washington State (Ford 2011). Non-anadromous "resident" *O. mykiss* occur within the range of PS steelhead but are not part of the DPS due to marked differences in physical, physiological, ecological, and behavioral characteristics (Hard et al. 2007).

DIPs can include summer steelhead only, winter steelhead only, or a combination of summer and winter run timing (e.g., winter run, summer run or summer/winter run). Most DIPs have low viability criteria scores for diversity and spatial structure, largely because of extensive hatchery influence, low breeding population sizes, and freshwater habitat fragmentation or loss (Hard et al. 2007). In the Central and South Puget Sound and Hood Canal and Strait of Juan de Fuca

MPGs, nearly all DIPs are not viable (Hard 2015). More information on PS steelhead spatial structure and diversity can be found in NMFS' technical report (Hard et al. 2015).

Abundance and Productivity. Abundance of adult steelhead returning to nearly all Puget Sound rivers has fallen substantially since estimates began for many populations in the late 1970s and early 1980s. Smoothed trends in abundance indicate modest increases since 2009 for 13 of the 22 DIPs. Between the two most recent 5-year periods (2005 to 2009 and 2010 to 2014), the geometric mean of estimated abundance increased by an average of 5.4 percent. For seven populations in the Northern Cascades MPG, the increase was 3 percent; for five populations in the Central and South Puget Sound MPG, the increase was 10 percent; and for six populations in the Hood Canal and Strait of Juan de Fuca MPG, the increase was 4.5 percent. However, several of these upward trends are not statistically different from neutral, and most populations remain small. Inspection of geometric means of total spawner abundance from 2010 to 2014 indicates that nine of 20 populations evaluated had geometric mean abundances fewer than 250 adults and 12 of 20 had fewer than 500 adults. Between the most recent two 5-year periods (2005 to 2009 and 2010 to 2014), several populations showed increases in abundance between 10 and 100 percent, but about half have remained in decline. Long-term (15-year) trends in natural spawners are predominantly negative (NWFSC 2015).

There are some signs of modest improvement in steelhead productivity since the 2011 review, at least for some populations, especially in the Hood Canal and Strait of Juan de Fuca MPG. However, these modest changes must be sustained for a longer period (at least two generations) to lend sufficient confidence to any conclusion that productivity is improving over larger scales across the DPS. Moreover, several populations are still showing dismal productivity, especially those in the Central and South Puget Sound MPG (NWFSC 2015).

Little or no data are available on summer-run populations to evaluate extinction risk or abundance trends. Because of their small population size and the complexity of monitoring fish in headwater holding areas, summer steelhead have not been broadly monitored.

Limiting factors. In our 2013 proposed rule designating critical habitat for this species (USDC 2013b), we noted that the following factors for decline for PS steelhead persist as limiting factors:

- The continued destruction and modification of steelhead habitat
- Widespread declines in adult abundance (total run size), despite significant reductions in harvest in recent years
- Threats to diversity posed by use of two hatchery steelhead stocks (Chambers Creek and Skamania)
- Declining diversity in the DPS, including the uncertain but weak status of summer run fish
- A reduction in spatial structure
- Reduced habitat quality through changes in river hydrology, temperature profile, downstream gravel recruitment, and reduced movement of LWD
- In the lower reaches of many rivers and their tributaries in Puget Sound where urban development has occurred, increased flood frequency and peak flows during storms

and reduced groundwater-driven summer flows, with resultant gravel scour, bank erosion, and sediment deposition

- Dikes, hardening of banks with riprap, and channelization, which have reduced river braiding and sinuosity, increasing the likelihood of gravel scour and dislocation of rearing juveniles

Status of Eulachon

The southern DPS of Eulachon was listed as a threatened species on March 18, 2010 (75 FR 13012). On April 1, 2016, we announced the results of our 5-year review of eulachon status. After completing the review, we recommended the southern DPS of eulachon remain classified as a threatened species. We released a recovery plan for this DPS in September, 2017 (NMFS 2017a).

<u>Spatial Structure and Diversit</u>y. The southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Core populations for this species include the Fraser River, Columbia River, and (historically) the Klamath River. Eulachon leave saltwater to spawn in their natal streams late winter through early summer, and typically spawn at night in the lower reaches of larger rivers fed by snowmelt. After hatching, larvae are carried downstream and widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly known, although the amount of eulachon bycatch in the pink shrimp fishery seems to indicate that the distribution of these organisms overlap in the ocean. The southern DPS includes four major subpopulations: Columbia, Klamath, Frazier, and British Columbia. However, these subpopulations do not include all spawning aggregations within the DPS. For instance, spawning runs of eulachon have been noted in Redwood Creek and the Mad River in California, the Umpqua River and Tenmile Creek in Oregon, and the Naselle and Quinault rivers in Washington (NMFS 2017a).

<u>Abundance and Productivity</u>. The number of eulachon returning to the Umpqua River seems to have declined in the 1980s, and does not appear to have rebounded to previous levels. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River with no evidence of returning to their former population levels since then (Drake et al. 2008). Persistent low returns and landings of eulachon in the Columbia River from 1993 to 2000 prompted the states of Oregon and Washington to adopt a Joint State Eulachon Management Plan in 2001 that provides for restricted harvest management when parental run strength, juvenile production, and ocean productivity forecast a poor return (WDFW and ODFW 2001). Despite a brief period of improved returns in 2001 to 2003, the returns and associated commercial landings have again declined to the very low levels observed in the mid-1990s (Joint Columbia River Management Staff 2009). Starting in 2005, the fishery has operated at the most conservative level allowed in the management plan. Although eulachon abundance in monitored rivers improved in the 2013 to 2015 return years, recent conditions in the northeast Pacific Ocean are likely linked to the sharp declines in eulachon abundance in monitored rivers in 2016 and 2017. The likelihood that these poor ocean conditions will persist into the near future suggest that subpopulation declines may again be widespread in the upcoming return years (NMFS 2017a).

Limiting Factors. The eulachon BRT categorized climate change impacts on ocean conditions as the most serious threat to the persistence of eulachon in all four subpopulations of the DPS. Climate change impacts on freshwater habitat and eulachon bycatch in offshore shrimp fisheries were also ranked in the top four threats in all subpopulations of the DPS. Dams and water diversions in the Klamath and Columbia rivers and predation in the Fraser and British Columbia coastal rivers filled out the last of the top four threats (Gustafson et al. 2010; NMFS 2017a)

2.2.2 Status of the Critical Habitats

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

Salmon and Steelhead. For salmon and steelhead, NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC_5) in terms of the conservation value they provide to each listed species they support.[2] The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, NMFS' critical habitat analytical review teams (CHARTs) evaluated the quantity and quality of habitat features (e.g., spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area (NOAA Fisheries 2005). Thus, even a location that has poor quality of habitat could be ranked with a high conservation value if it were essential due to factors such as limited availability (e.g., one of a very few spawning areas), a unique contribution of the population it served (e.g., a population at the extreme end of geographic distribution), or if it serves another important role (e.g., obligate area for migration to upstream spawning areas).

The PBFs of freshwater spawning and incubation sites include water flow, quality and temperature conditions, and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles (Tables 19 and 20). These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The PBFs of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

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

Table 19. Physical and biological features of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion (except for Snake River [SR] spring/summer-run Chinook salmon, SR fall-run Chinook salmon, and Southern Oregon Northern California Coast coho salmon, which are found in the next table), and corresponding species life history events.

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

Table 20. Physical and biological features of critical habitats designated for Snake River (SR) spring/summer-run Chinook salmon, SR fall-run Chinook salmon, Southern Oregon Northern California Coast coho salmon, and corresponding species life history events.

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

Critical Habitat Analytical Review Team Salmon and Steelhead Critical Habitat Assessments

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

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

Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality–current condition), which considers the existing condition of the quality of PBFs in the HUC_5 watershed; and Factor 3 (quality–potential condition), which considers the likelihood of achieving PBF potential in the HUC_5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.

Puget Sound Recovery Domain. Critical habitat has been designated in Puget Sound for PS Chinook salmon, HC summer-run chum salmon, LO sockeye salmon, PS steelhead, southern green sturgeon, and eulachon. Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek.

Landslides can occur naturally in steep, forested lands, but inappropriate land use practices likely have accelerated their frequency and the amount of sediment delivered to streams. Fine sediment from unpaved roads has also contributed to stream sedimentation. Unpaved roads are widespread on forested lands in the Puget Sound basin, and to a lesser extent, in rural residential areas. Historical logging removed most of the riparian trees near stream channels. Subsequent agricultural and urban conversion permanently altered riparian vegetation in the river valleys, leaving either no trees, or a thin band of trees. The riparian zones along many agricultural areas are now dominated by alder, invasive canary grass and blackberries, and provide substantially reduced stream shade and large wood recruitment (Shared Strategy for Puget Sound 2007).

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flows that remove smaller substrate particles and large wood. The loss of side channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat. When the water level of Lake Washington was lowered 9 feet in the 1910s, thousands of acres of wetlands along the shoreline of Lake Washington, Lake Sammamish, and the Sammamish River corridor were drained and converted to agricultural and urban uses. Wetlands play an important role in hydrologic processes, as they store water which ameliorates high and low flows. The interchange of surface and groundwater in complex stream and wetland systems helps to moderate stream temperatures. Forest wetlands are estimated to have diminished by one-third in Washington State (FEMAT 1993; Spence et al. 1996; Shared Strategy for Puget Sound 2007).

Loss of riparian habitat, elevated water temperatures, elevated levels of nutrients, increased nitrogen and phosphorus, and higher levels of turbidity, presumably from urban and highway runoff, wastewater treatment, failing septic systems, and agriculture or livestock impacts, have been documented in many Puget Sound tributaries (Shared Strategy for Puget Sound 2007).

Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clear cuts (Shared Strategy for Puget Sound 2007). In urbanized PS, there is a strong association between land use and land cover attributes and rates of coho spawner mortality likely due to runoff containing contaminants emitted from motor vehicles (Feist et al. 1996).

Dams constructed for hydropower generation, irrigation, or flood control have substantially affected PS Chinook salmon populations in a number of river systems. The construction and operation of dams have blocked access to spawning and rearing habitat (e.g., Elwha River dams block anadromous fish access to 70 miles of potential habitat) changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants, and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel and large wood to downstream areas (Shared Strategy for Puget Sound 2007). These actions tend to promote downstream channel incision and simplification (Kondolf 1997), limiting fish habitat. Water withdrawals reduce available fish habitat and alter sediment transport. Hydropower projects often change flow rates, stranding and killing fish, and reducing aquatic invertebrate (food source) productivity (Hunter 1992).

Juvenile mortality occurs in unscreened or inadequately screened diversions. Water diversion ditches resemble side channels in which juvenile salmonids normally find refuge. When diversion headgates are shut, access back to the main channel is cut off and the channel goes dry. Mortality can also occur with inadequately screened diversions from impingement on the screen, or mutilation in pumps where gaps or oversized screen openings allow juveniles to get into the system (WDFW 2009). Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins (Shared Strategy for Puget Sound 2007).

The nearshore marine habitat has been extensively altered and armored by industrial and residential development near the mouths of many of PS’s tributaries. A railroad runs along large portions of the eastern shoreline of PS, eliminating natural cover along the shore and natural recruitment of beach sand (Shared Strategy for Puget Sound 2007).

Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has degraded certain physical and chemical characteristics of the near-shore environment (Hood Canal Coordinating Council 2005; Shared Strategy for Puget Sound 2007).

The Lake Ozette tributary basin is 77 mi^2 and includes several large tributaries and numerous smaller tributaries. Currently, land ownership in the watershed is 73 percent private land, 15 percent Olympic National Park, 11 percent Washington State, and 1 percent tribal. Natural disturbance in the watershed was dominated by wind and hydrogeomorphic events, while contemporary disturbance additionally includes logging, road construction and maintenance, residential and agricultural development, stream channelization, and direct and indirect stream wood clearance. These activities alter stream flow patterns and elevate sediment loads and sedimentation. Wood removal has resulted in less hydraulic roughness, reduced instream water depths, and reduced backwater effects on Lake Ozette, which has thus altered the entire hydraulic control on Lake Ozette levels and changed the in-river stage–discharge relationship.

More recently, deposition of sediment originating from Coal Creek at the lake outlet has further altered lake and river levels (Haggerty et al. 2009).

Private timber companies own approximately 93 percent of the four largest tributary watersheds to Lake Ozette. Logging accelerated over the period of record, with 8.7 percent of the Lake Ozette basin clear-cut by 1953, increasing to 83.6 percent of the basin area clear-cut by 2003 (Haggerty et al. 2009). Effects associated with logging depended on stream size, gradient, and time elapsed. In high-energy coast streams, landslides and debris torrents often modify steep slope tributaries and the mainstem of creeks. Bank erosion also alters stream channels on alluvial floodplains. These effects are additive in the system and reduced the quality of spawning and rearing habitat for juvenile salmonids (Hartman et al. 1996). Lower gradient streams typically have an accumulation of sediment. Second-growth logged sections (12 to 35 years after logging), re-shaded by deciduous forest canopy, have lower biomass of trout and fewer predator taxa than old-growth sites (Murphy and Hall 1981). Based on the quantity and quality of the PBFs, the CHART assessed the conservation value of the Lake Ozette HUC_5 watershed (#1710010102) for sockeye salmon to be “high” (NOAA Fisheries 2005).

In summary, critical habitat throughout the Puget Sound basin has been degraded by numerous management activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large wood, intense urbanization, agriculture, alteration of floodplain and stream morphology (*i.e*., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, logging, and mining. Changes in habitat quantity, availability, diversity, flow, temperature, sediment load, and channel instability are common limiting factors in areas of critical habitat.

The Puget Sound recovery domain CHART (NOAA Fisheries 2005) determined that only a few watersheds with PBFs for Chinook salmon in the Whidbey Basin (Skagit River/Gorge Lake, Cascade River, Upper Sauk River, and the Tye and Beckler rivers) are in good-to-excellent condition with no potential for improvement. Most HUC_5 watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or a high potential for improvement (Table 21).

Table 21. Puget Sound Recovery Domain: Current and potential quality of HUC5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK) and chum salmon (CM) (NOAA Fisheries 2005).[3] Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

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

Watershed Name(s) and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Strait of Georgia and Whidbey Basin #1711000xxx			
Skagit River/Gorge Lake (504), Cascade (506) & Upper Sauk (601) rivers, Tye & Beckler rivers (901)	CK	3	3
Skykomish River Forks (902)	CK	3	1
Skagit River/Diobsud (505), Illabot (507), & Middle Skagit/Finney Creek (701) creeks; & Sultan River (904)	CK	2	3
Skykomish River/Wallace River (903) & Skykomish River/Woods Creek (905)	CK	2	2
Upper (602) & Lower (603) Suiattle rivers, Lower Sauk (604), & South Fork Stillaguamish (802) rivers	CK	2	1
Samish River (202), Upper North (401), Middle (402), South (403), Lower North (404), Nooksack River; Nooksack River (405), Lower Skagit/Nookachamps Creek (702) & North Fork (801) & Lower (803) Stillaguamish River	CK	1	2
Bellingham (201) & Birch (204) bays & Baker River (508)	CK	1	1
Whidbey Basin and Central/South Basin #1711001xxx			
Lower Snoqualmie River (004), Snohomish (102), Upper White (401) & Carbon (403) rivers	CK	2	2
Middle Fork Snoqualmie (003) & Cedar rivers (201), Lake Sammamish (202), Middle Green River (302) & Lowland Nisqually (503)	CK	2	1
Pilchuck (101), Upper Green (301), Lower White (402), & Upper Puyallup River (404) rivers, & Mashel/Ohop(502)	CK	1	2
Lake Washington (203), Sammamish (204) & Lower Green (303) rivers	CK	1	1
Puyallup River (405)	CK	0	2
Hood Canal #1711001xxx			
Dosewallips River (805)	CK/CM	2	1/2
Kitsap – Kennedy/Goldsborough (900)	CK	2	1
Hamma Hamma River (803)	CK/CM	1/2	1/2
Lower West Hood Canal Frontal (802)	CK/CM	0/2	0/1
Skokomish River (701)	CK/CM	1/0	2/1
Duckabush River (804)	CK/CM	1	2
Upper West Hood Canal Frontal (807)	CM	1	2

[3] On January 14, 2013, NMFS published a proposed rule for the designation of critical habitat for LCR coho salmon and PS steelhead (USDC 2013b). A draft biological report, which includes a CHART assessment for PS salmon, was also completed (NMFS 2012). Habitat quality assessments for PS steelhead are out for review; therefore, they are not included on this table.

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

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Big Quilcene River (806)	CK/CM	1	1/2
Deschutes Prairie-1 (601) & Prairie-2 (602)	CK	1	1
West Kitsap (808)	CK/CM	1	1
Kitsap – Prairie-3 (902)	CK	1	1
Port Ludlow/Chimacum Creek (908)	CM	1	1
Kitsap – Puget (901)	CK	0	1
Kitsap – Puget Sound/East Passage (904)	CK	0	0
Strait of Juan de Fuca Olympic #1711002xxx			
Dungeness River (003)	CK/CM	2/1	1/2
Discovery Bay (001) & Sequim Bay (002)	CM	1	2
Elwha River (007)	CK	1	2
Port Angeles Harbor (004)	CK	1	1

Willamette–Lower Columbia Recovery Domain. Critical habitat was designated in the Willamette–Lower Columbia recovery domain for UWR Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, CR chum salmon, southern green sturgeon, and eulachon, and has been proposed for LCR coho salmon. In addition to the Willamette and Columbia River mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappoose River in the Oregon Coast subbasin; Hood River in the Gorge; and the Sandy, Clackamas, Molalla, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades subbasin.

Land management activities have severely degraded stream habitat conditions in the Willamette River mainstem above Willamette Falls and in associated subbasins. In the Willamette River mainstem and lower sub-basin mainstem reaches, high density urban development and widespread agricultural effects have reduced aquatic and riparian habitat quality and complexity, and altered sediment and water quality and quantity, and watershed processes. The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75 percent. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Logging in the Cascade and Coast Ranges, and agriculture, urbanization, and gravel mining on valley floors have contributed to increased erosion and sediment loads throughout the WLC domain.

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

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

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

Hyporheic flow in the Willamette River has been examined through discharge measurements and is significant in some areas, particularly those with gravel deposits (Wentz et al. 1998; Fernald et al. 2001). The loss of channel complexity and meandering that fosters creations of gravel deposits decreases the potential for hyporheic flows, as does gravel mining. Hyporheic flow processes water and affects its quality on reemerging into the main channel, stabilizing variations in physical and chemical water characteristics. Hyporheic flow is important for ecological functions, some aspects of water quality (such as temperature and dissolved oxygen), and some benthic invertebrate life stages. Alcove habitat, which has been limited by channelization, combines low hydraulic stress and high food availability with the potential for hyporheic flows across the steep hydraulic gradients in the gravel separating them from the main channel (Fernald et al. 2001).

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

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

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

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom et al. 2005; Fresh et al. 2005; NMFS 2013a). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates that feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood et al. (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80 percent reduction in emergent vegetation production and a 15 percent decline in benthic algal production.

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

The CHART for the WLC recovery domain determined that most HUC_5 watersheds with PBFs for salmon or steelhead are in fair-to-poor or fair-to-good condition (NOAA Fisheries 2005). However, most of these watersheds have some or a high potential for improvement. Only watersheds in the upper McKenzie River and its tributaries are in good-to-excellent condition with no potential for improvement (Table 22).

Table 22. Willamette–Lower Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST) (NOAA Fisheries 2005).[4] Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

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

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Columbia Gorge #1707010xxx			
Wind River (511)	CK/ST	2/2	2/2
East Fork Hood (506), & Upper (404) & Lower Cispus (405) rivers	CK/ST	2/2	2/2
Plympton Creek (306)	CK	2	2
Little White Salmon River (510)	CK	2	0
Grays Creek (512) & Eagle Creek (513)	CK/CM/ST	2/1/2	1/1/2
White Salmon River (509)	CK/CM	2/1	1/2
West Fork Hood River (507)	CK/ST	1/2	2/2
Hood River (508)	CK/ST	1/1	2/2
Unoccupied habitat: Wind River (511)	Chum conservation value "Possibly High"		
Cascade and Coast Range #1708000xxx			
Lower Gorge Tributaries (107)	CK/CM/ST	2/2/2	2/3/2
Lower Lewis (206) & North Fork Toutle (504) rivers	CK/CM/ST	1/3/1	2/1/2
Salmon (101), Zigzag (102), & Upper Sandy (103) rivers	CK/ST	2/2	2/2
Big Creek (602)	CK/CM	2/2	2/2
Coweeman River (508)	CK/CM/ST	2/2/1	2/1/2
Kalama River (301)	CK/CM/ST	1/2/2	2/1/2
Cowlitz Headwaters (401)	CK/ST	2/2	1/1

[4] On January 14, 2013, NMFS published a proposed rule for the designation of critical habitat for LCR coho salmon and PS steelhead (USDC 2013b). A draft biological report, which includes a CHART assessment for PS steelhead, was also completed (NMFS 2012). Habitat quality assessments for LCR coho salmon are out for review; therefore, they are not included on this table.

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

Watershed Name(s) and HUC$_5$ Code(s)	**Listed Species**	**Current Quality**	**Restoration Potential**
Skamokawa/Elochoman (305)	CK/CM	2/1	2
Salmon Creek (109)	CK/CM/ST	1/2/1	2/3/2
Green (505) & South Fork Toutle (506) rivers	CK/CM/ST	1/1/2	2/1/2
Jackson Prairie (503) & East Willapa (507)	CK/CM/ST	1/2/1	1/1/2
Grays Bay (603)	CK/CM	1/2	2/3
Upper Middle Fork Willamette River (101)	CK	2	1
Germany/Abernathy creeks (304)	CK/CM	1/2	2
Mid-Sandy (104), Bull Run (105), & Lower Sandy (108) rivers	CK/ST	1/1	2/2
Washougal (106) & East Fork Lewis (205) rivers	CK/CM/ST	1/1/1	2/1/2
Upper Cowlitz (402) & Tilton rivers (501) & Cowlitz Valley Frontal (403)	CK/ST	1/1	2/1
Clatskanie (303) & Young rivers (601)	CK	1	2
Rifle Reservoir (502)	CK/ST	1	1
Beaver Creek (302)	CK	0	1
Unoccupied Habitat: Upper Lewis (201) & Muddy (202) rivers; Swift (203) & Yale (204) reservoirs	CK & ST Conservation Value “Possibly High”		
Willamette River #1709000xxx			
Upper (401) & South Fork (403) McKenzie rivers; Horse Creek (402); & McKenzie River/Quartz Creek (405)	CK	3	3
Lower McKenzie River (407)	CK	2	3
South Santiam River (606)	CK/ST	2/2	1/3
South Santiam River/Foster Reservoir (607)	CK/ST	2/2	1/2
North Fork of Middle Fork Willamette (106) & Blue (404) rivers	CK	2	1
Upper South Yamhill River (801)	ST	2	1
Little North Santiam River (505)	CK/ST	1/2	3/3
Upper Molalla River (905)	CK/ST	1/2	1/1
Abernethy Creek (704)	CK/ST	1/1	1/2
Luckiamute River (306) & Yamhill (807) Lower Molalla (906) rivers; Middle (504) & Lower (506) North Santiam rivers; Hamilton Creek/South Santiam River (601); Wiley Creek (608); Mill Creek/Willamette River (701); & Willamette River/Chehalem Creek (703); Lower South (804) & North (806) Yamhill rivers; & Salt Creek/South Yamhill River (805)	CK/ST	1	1
Hills (102) & Salmon (104) creeks; Salt Creek/Willamette River (103), Hills Creek Reservoir (105), Middle Fork Willamette/Lookout Point (107); Little Fall (108) & Fall (109) creeks; Lower Middle Fork of Willamette (110), Long Tom (301), Marys (305) & Mohawk (406) rivers	CK	1	1
Willamina Creek (802) & Mill Creek/South Yamhill River (803)	ST	1	1
Calapooia River (303); Oak (304) Crabtree (602), Thomas (603) & Rickreall (702) creeks; Abiqua (901), Butte (902) & Rock (903) creeks/Pudding River; & Senecal Creek/Mill Creek (904)	CK/ST	1/1	0/1
Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value “Possibly High”		

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

Watershed Name(s) and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx			
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) Clackamas rivers	CK/ST	2/2	3/2
Middle Clackamas River (104)	CK/ST	2/1	3/2
Eagle Creek (105)	CK/ST	2/2	1/2
Gales Creek (002)	ST	2	1
Lower Clackamas River (106) & Scappoose Creek (202)	CK/ST	1	2
Dairy (001) & Scoggins (003) creeks; Rock Creek/Tualatin River (004); & Tualatin River (005)	ST	1	1
Johnson Creek (201)	CK/ST	0/1	2/2
Lower Willamette/Columbia Slough (203)	CK/ST	0	2

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

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

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

Hydroelectric development modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile salmon and steelhead, and delayed migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles. Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have altered hydrological cycles.

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

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

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

The Interior Columbia recovery domain is a very large and diverse area. The CHART determined that few watersheds with PBFs for Chinook salmon or steelhead are in good-to-excellent condition with no potential for improvement. Overall, most Interior Columbia recovery domain watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or high potential for improvement. In Washington, the Upper Methow, Lost, White, and Chiwawa watersheds are in good-to-excellent condition with no potential for improvement. In Oregon, only the Lower Deschutes, Minam, Wenaha, and Upper and Lower Imnaha Rivers HUC_5 watersheds are in good-to-excellent condition with no potential for improvement. In Idaho, a number of watersheds with PBFs for steelhead (Upper Middle Salmon, Upper Salmon/Pahsimeroi, Middle Fork Salmon, Little Salmon, Selway, and Lochsa rivers) are in good-to-excellent condition with no potential for improvement. Additionally, several Lower Snake River HUC_5watersheds in the Hells Canyon area, straddling Oregon and Idaho, are in good-to-excellent condition with no potential for improvement (Table 23).

Table 23. Interior Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK) and steelhead (ST) (NOAA Fisheries 2005). Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

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

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Upper Columbia # 1702000xxx			
White (101), Chiwawa (102), Lost (801) & Upper Methow (802) rivers	CK/ST	3	3
Upper Chewuch (803) & Twisp rivers (805)	CK/ST	3	2
Lower Chewuch River (804); Middle (806) & Lower (807) Methow rivers	CK/ST	2	2
Salmon Creek (603) & Okanogan River/Omak Creek (604)	ST	2	2
Upper Columbia/Swamp Creek (505)	CK/ST	2	1
Foster Creek (503) & Jordan/Tumwater (504)	CK/ST	1	1
Upper (601) & Lower (602) Okanogan River; Okanogan River/Bonaparte Creek (605); Lower Similkameen River (704); & Lower Lake Chelan (903)	ST	1	1
Unoccupied habitat in Sinlahekin Creek (703)	ST Conservation Value "Possibly High"		
Upper Columbia #1702001xxx			
Entiat River (001); Nason/Tumwater (103); & Lower Wenatchee River (105)	CK/ST	2	2
Lake Entiat (002)	CK/ST	2	1
Columbia River/Lynch Coulee (003); Sand Hollow (004); Yakima/Hansen Creek (604), Middle Columbia/Priest Rapids (605), & Columbia River/Zintel Canyon (606)	ST	2	1
Icicle/Chumstick (104)	CK/ST	1	2
Lower Crab Creek (509)	ST	1	2
Rattlesnake Creek (204)	ST	0	1
Yakima #1703000xxx			
Upper (101) & Middle (102) Yakima rivers; Teanaway (103) & Little Naches (201) rivers; Naches River/Rattlesnake Creek (202); & Ahtanum (301) & Upper Toppenish (303) & Satus (305) creeks	ST	2	2
Umtanum/Wenas (104); Naches River/Tieton River (203); Upper Lower Yakima River (302); & Lower Toppenish Creek (304)	ST	1	2
Yakima River/Spring Creek (306)	ST	1	1
Lower Snake River #1706010xxx			
Snake River/Granite (101), Getta (102), & Divide (104) creeks; Upper (201) & Lower (205) Imnaha River; Snake River/Rogersburg (301); Minam (505) & Wenaha (603) rivers	ST	3	3
Grande Ronde River/Rondowa (601)	ST	3	2
Big (203) & Little (204) Sheep creeks; Asotin River (302); Catherine Creek (405); Lostine River (502); Bear Creek (504); & Upper (706) & Lower (707) Tucannon River	ST	2	3
Middle Imnaha River (202); Snake River/Captain John Creek (303); Upper Grande Ronde River (401); Meadow (402); Beaver (403); Indian	ST	2	2

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

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
(409), Lookingglass (410) & Cabin (411) creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) creeks			
Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	ST	1	3
Five Points (404); Lower Joseph (606) & Deadman (703) creeks	ST	1	2
Tucannon/Alpowa Creek (701)	ST	1	1
Mill Creek (407)	ST	0	3
Pataha Creek (705)	ST	0	2
Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	ST	0	1
Flat Creek (704) & Lower Palouse River (808)	ST	0	0
Upper Salmon and Pahsimeroi #1706020xxx			
Germania (111) & Warm Springs (114) creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) creeks	ST	3	3
Basin Creek (124)	ST	3	2
Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	ST	2	3
Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi River/Falls Creek (202)	ST	2	2
Yankee Fork/Jordan Creek (125)	ST	1	3
Salmon River/Kinnikinnick Creek (112); Garden Creek (129); Challis Creek/Mill Creek (130); & Patterson Creek (203)	ST	1	2
Road Creek (107)	ST	1	1
Unoccupied habitat in Hawley (410), Eighteenmile (411) & Big Timber (413) creeks	Conservation Value for ST "Possibly High"		
Middle Salmon, Panther and Lemhi #1706020xxx			
Salmon River/Colson (301), Pine (303) & Moose (305) creeks; Indian (304) & Carmen (308) creeks, North Fork Salmon River (306); & Texas Creek (412)	ST	3	3
Deep Creek (318)	ST	3	2
Salmon River/Cow Creek (312) & Hat (313), Iron (314), Upper Panther (315), Moyer (316) & Woodtick (317) creeks; Lemhi River/Whimpey Creek (402); Hayden (414), Big Eight Mile (408), & Canyon (408) creeks	ST	2	3
Salmon River/Tower (307) & Twelvemile (311) creeks; Lemhi River/Kenney Creek (403); Lemhi River/McDevitt (405), Lemhi River/Yearian Creek (406); & Peterson Creek (407)	ST	2	2
Owl (302) & Napias (319) creeks	ST	2	1
Salmon River/Jesse Creek (309); Panther Creek/Trail Creek (322); & Lemhi River/Bohannon Creek (401)	ST	1	3

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

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
Salmon River/Williams Creek (310)	ST	1	2
Agency Creek (404)	ST	1	1
Panther Creek/Spring Creek (320) & Clear Creek (323)	ST	0	3
Big Deer Creek (321)	ST	0	1
Mid-Salmon-Chamberlain, South Fork, Lower, and Middle Fork Salmon #1706020xxx			
Lower (501), Upper (503) & Little (504) Loon creeks; Warm Springs (502); Rapid River (505); Middle Fork Salmon River/Soldier (507) & Lower Marble Creek (513); & Sulphur (509), Pistol (510), Indian (511) & Upper Marble (512) creeks; Lower Middle Fork Salmon River (601); Wilson (602), Upper Camas (604), Rush (610), Monumental (611), Beaver (614), Big Ramey (615) & Lower Big (617) creeks; Middle Fork Salmon River/Brush (603) & Sheep (609) creeks; Big Creek/Little Marble (612); Crooked (616), Sheep (704), Bargamin (709), Sabe (711), Horse (714), Cottonwood (716) & Upper Chamberlain Creek (718); Salmon River/Hot Springs (712); Salmon River/Kitchen Creek (715); Lower Chamberlain/McCalla Creek (717); & Slate Creek (911)	ST	3	3
Marsh (506); Bear Valley (508) Yellow Jacket (604); West Fork Camas (607) & Lower Camas (608) creeks; & Salmon River/Disappointment Creek (713) & White Bird Creek (908)	ST	2	3
Upper Big Creek (613); Salmon River/Fall (701), California (703), Trout (708), Crooked (705) & Warren (719) creeks; Lower South Fork Salmon River (801); South Fork Salmon River/Cabin (809), Blackmare (810) & Fitsum (812) creeks; Lower Johnson Creek (805); & Lower (813), Middle (814) & Upper Secesh (815) rivers; Salmon River/China (901), Cottonwood (904), McKenzie (909), John Day (912) & Lake (913) creeks; Eagle (902), Deer (903), Skookumchuck (910), French (915) & Partridge (916) creeks	ST	2	2
Wind River (702), Salmon River/Rabbit (706) & Rattlesnake (710) creeks; & Big Mallard Creek (707); Burnt Log (806), Upper Johnson (807) & Buckhorn (811) creeks; Salmon River/Deep (905), Hammer (907) & Van (914) creeks	ST	2	1
Silver Creek (605)	ST	1	3
Lower (803) & Upper (804) East Fork South Fork Salmon River; Rock (906) & Rice (917) creeks	ST	1	2
Little Salmon #176021xxx			
Rapid River (005)	ST	3	3
Hazard Creek (003	ST	3	2
Boulder Creek (004)	ST	2	3
Lower Little Salmon River (001) & Little Salmon River/Hard Creek (002)	ST	2	2
Selway, Lochsa and Clearwater #1706030xxx			
Selway River/Pettibone (101) & Gardner (103) creeks; Bear (102), White Cap (104), Indian (105), Burnt Knob (107), Running (108) & Goat (109) creeks; & Upper Selway River (106); Gedney (202), Upper Three Links (204), Rhoda (205), North Fork Moose (207), Upper East	ST	3	3

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

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1 = fair to poor	1 = some potential for improvement
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Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Middle (103) & Lower (105) South Fork John Day rivers; Murderers (104) & Canyon (107) creeks; Upper John Day (106) & Upper North Fork John Day (201) rivers; & Desolation Creek (204)	ST	2	2
North Fork John Day/Big Creek (203); Cottonwood Creek (209) & Lower NF John Day River (210)	ST	2	1
Strawberry (108), Beech (109), Laycock (110), Fields (111), Mountain (113) & Rock (114) creeks; Upper Middle John Day River (112); Granite (202) & Wall (208) creeks; Upper (205) & Lower (206) Camas creeks; North Fork John Day/Potamus Creek (207); Upper Middle Fork John Day River (301) & Camp (302), Big (303) & Long (304) creeks; Bridge (403) & Upper Rock (411) creeks; & Pine Hollow (407)	ST	1	2
John Day/Johnson Creek (115); Lower Middle Fork John Day River (305); Lower John Day River/Kahler Creek (401), Service (402) & Muddy (404) creeks; Lower John Day River/Clarno (405); Butte (406), Thirtymile (408) & Lower Rock (412) creeks; Lower John Day River/Ferry (409) & Scott (410) canyons; & Lower John Day River/McDonald Ferry (414)	ST	1	1
Deschutes #1707030xxx			
Lower Deschutes River (612)	ST	3	3
Middle Deschutes River (607)	ST	3	2
Upper Deschutes River (603)	ST	2	1
Mill Creek (605) & Warm Springs River (606)	ST	2	1
Bakeoven (608) & Buck Hollow (611) creeks; Upper (701) & Lower (705) Trout Creek	ST	1	2
Beaver (605) & Antelope (702) creeks	ST	1	1
White River (610) & Mud Springs Creek (704)	ST	1	0
Unoccupied habitat in Deschutes River/McKenzie Canyon (107) & Haystack (311); Squaw Creek (108); Lower Metolius River (110), Headwaters Deschutes River (601)	ST Conservation Value "Possibly High"		

Oregon Coast Recovery Domain. In this recovery domain, critical habitat has been designated for OC coho salmon, southern green sturgeon, and eulachon. Many large and small rivers supporting significant populations of coho salmon flow through this domain, including the Nehalem, Nestucca, Siletz, Yaquina, Alsea, Siuslaw, Umpqua, Coos, and Coquille.

The 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 (Stout et al. 2012, NWFSC 2015). 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 2016b). 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 amount of tidal wetland habitat available to support coho salmon rearing has declined substantially relative to historical estimates. Water quality has also been identified as a factor for decline; Stout et al. (2012) determined that water temperature is the primary source of water quality impairment in the OC coho salmon critical habitat.

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

Habitat conditions in many stream reaches have improved due to restoration efforts. Restoration activities to improve coho salmon habitat have been ongoing since the 1990s, supported by NMFS, Oregon Watershed Enhancement Board, USFWS, U.S. Forest Service (USFS), other state and federal agencies, and many landowners and stakeholders. Together, these different projects are contributing to the restoration of habitat conditions in estuarine, tidal, and freshwater areas. However, despite restoration efforts, there is little evidence for an overall improving trend in freshwater habitat conditions since the mid-1990s, and evidence of negative trends in some strata (Stout et al. 2012). The most recent assessment indicates that this has not changed (NWFSC 2015).

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

Southern Oregon/Northern California Coasts Recovery Domain. In this recovery domain, critical habitat has been designated for SONCC coho salmon and southern green sturgeon. Key habitat concerns are insufficient instream flow, unsuitable water temperature, and insufficient winter- and summer-rearing habitat (NMFS 2016c). Numerous habitat restoration projects have been completed in many rivers and streams in the SONCC coho salmon range, but many more are needed to achieve the scale of habitat changes needed for this species to recover.

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

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

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

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

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

The Chetco River estuary has been significantly modified from its historical condition. Jetties were erected by the USACE in 1957, which stabilized and deepened the mouth of the river. These jetties have greatly altered the mouth of the Chetco River and how the estuary functions as habitat for salmon migrating to the ocean. A boat basin and marina were built in the late 1950s and eliminated most of the functional tidal marsh. The structures eliminated shallow water habitats and vegetation in favor of banks stabilized with riprap. Since then, nearly all remaining bank habitat in the estuary has been stabilized with riprap. The factors limiting fish production in the Chetco River appear to be high water temperature caused by lack of shade, especially in tributaries, high rates of sedimentation due to roads, poor over-wintering habitat due to a lack of large wood in tributaries and the mainstem, and poor quality estuary habitat (Maguire 2001).

Southern DPS Eulachon. Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). All of these areas are designated as migration and spawning habitat for this species. In Oregon, 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek have been designated. In Washington, designated critical habitat includes the Columbia River from the mouth to Bonneville Dam, and sections of the Grays, Skamokawa, Elochoman, Cowlitz, Toutle, Kalama, Lewis, East Fork Lewis, Quinault, and Elwha rivers. Sightings of southern DPS eulachon from creeks or rivers outside of this area have been extremely infrequent, and have consisted of very few fish (Gustafson et al. 2010). Table 24 delineates the designated PBFs for eulachon.

Table 24 Physical or biological features of critical habitats designated for eulachon and corresponding species life history events.

Physical or biological features		Species Life History Event
Site Type	**Site Attribute**	
Freshwater spawning and incubation	Flow Water quality Water temperature Substrate Migratory access	Adult spawning Incubation
Freshwater migration	Obstruction-free Flow Water quality Water temperature Prey items	Adult and larval mobility Larval feeding

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

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

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). For purposes of this consultation, the overall program action area consists of the combined action areas for each individual project in waters in Washington and Oregon where the species considered in this consultation may exist, or where there is designated critical habitat.

Each individual project authorized under this programmatic will impact a project-level footprint that occurs within the program action area. Individual action areas will include the in-stream and adjacent riparian area project footprint at a minimum. The extent of the project-level action area is defined by the extent of all effects of the action; this will often be defined by the extent of turbidity plumes caused by construction-generated suspended sediment but may be delineated by other project effects such as water quality parameters.

2.4 Environmental Baseline

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

2.4.1 Freshwater Habitat

While there has been substantial habitat degradation across all land ownerships in Oregon and Washington, habitat in many headwater stream segments is generally in better condition than in the largely privately-owned lower portions of tributaries (Lee et al. 1997). Much of the salmonid spawning and rearing occurs in tributaries where riparian areas are still relatively intact and dominated by mature forests, though some of these areas remain affected by the legacy of poor forest practices.

Beginning in the early 1800s, stream morphologies and riparian areas in the low elevation rivers were extensively changed by human activities such as logging, mining, livestock grazing, agriculture, beaver removal, dams, and water diversions. Additional factors affecting freshwater habitat include transportation infrastructure, industrialization, urbanization, and other development. Very little of the once-extensive riparian vegetation and wetland habitat remains to maintain water quality and provide habitats for ESA-listed species. Introduced (non-native) plant species pose a risk to some riparian habitat by dominating local habitats and reducing the diversity and abundance of native species. Improper grazing in riparian areas is another significant threat. The width and age of stream-adjacent vegetation decreases in the middle and lower portions of the watersheds, and today less than 20 percent of the riparian vegetation consists of mature trees.

Dams, diversions, and other water control structures have negatively affected several habitat attributes such as hydrographs, minimum flows, sediment, large wood, nutrient transport, side channel and floodplain connectivity, and temperatures. They have also blocked fish passage to suitable habitat, or entrained fish into unsuitable habitat. Habitat changes due to dams have also improved conditions for predators including marine mammals, birds, and both native and introduced fish.

2.4.2 Water Quality

Water quality throughout much of the program action area is degraded to various degrees from several sources including aerial deposition, wastewater treatment plant effluents, stormwater runoff, agricultural practices, industrial effluents, and others. The full presence of contaminants throughout the program action area is poorly understood, but the concentration of many increase in downstream reaches (Fuhrer et al. 1996; Johnson et al. 2013a; Johnson et al. 2005; Morace 2012). Both the physical and chemical properties of water are affected. For example, the most common increase in 303(d) listings (water bodies that are considered “impaired” under the Clean Water Act) in Washington in the past decade are related to high stream temperatures.

Although the states regulate most activities that affect water quality, the baseline condition includes a legacy of past actions. Johnson et al. (2013) frequently PCBs and DDT in juvenile salmon and salmon diet samples from the lower Columbia River and estuary. In some cases, concentrations in salmon were above estimated thresholds for effects on growth and survival. These chemicals have not been produced in the United States since the 1970s.

In a typical year in the United States, pesticides are applied at a rate of approximately 5 billion pounds of active ingredients per year (Kiely et al. 2004). Therefore, pesticide contamination in the nation’s freshwater habitats is ubiquitous and pesticides usually occur in the environment as mixtures.

The United States Geological Survey (USGS) National Water Quality Assessment (NAWQA) Program conducted studies and monitoring to build on the baseline assessment established during the 1990s to assess trends of pesticides in basins across the nation, including the Willamette River basin. More than 90 percent of the time, water from streams within agricultural, urban, or mixed-land-use watersheds had detections of two or more pesticides or degradants, and about 20 percent of the time they had detections of 10 or more. Fifty-seven percent of 83 agricultural streams had concentrations of at least one pesticide that exceeded one or more aquatic-life benchmarks at least one time during the year (68 percent of sites sampled during 1993 to 1994, 43 percent during 1995 to 1997, and 50 percent during 1998 to 2000) 2,4-D is one of the pesticides detected most frequently in streams (Gilliom et al. 2006). In the Willamette Basin, 34 herbicides were detected. Forty-nine pesticides were detected in streams draining predominantly agricultural land (Rinella and Janet 1998). In the lower Clackamas River basin, Oregon (2000 to 2005), USGS detected 63 pesticide compounds, including 33 herbicides. High-use herbicides such as glyphosate, triclopyr, 2,4-D, and metolachlor were frequently detected, particularly in the lower-basin tributaries (Carpenter et al. 2008).

In 2009, Oregon Department of Environmental Quality (ODEQ) frequently detected hexazinone, an herbicide used on Conservation Reserve Enhancement Program projects and on crops, rights-of-way, rangeland, etc. (ODA et al. 2009). They commonly detected sulfometuron-methyl from 2009 to 2011, but at low detection frequencies (ODA et al. 2011). The ODEQ currently monitors for 100 pesticides in streams in eight sub-basins through the Pesticide Stewardship Partnership program funded by a U.S. Environmental Protection Agency grant. The eight sub-basins include Hood River; Mill Creek and Fifteenmile Creek (in Wasco County); Walla Walla River; Clackamas River; Pudding River; Yamhill River (Yamhill Pesticide Stewardship Partnership for rural and urban areas, and South Yamhill River Pesticide Stewardship Partnership, for a forested area of the watershed); and the Amazon Creek watershed project in Eugene (ODEQ 2012).

An important dimension of pesticides and their degradants in the aquatic environment is their simultaneous occurrence as mixtures (Gilliom et al. 2006). Mixtures result from the use of different pesticides for multiple purposes within a watershed or groundwater recharge area. Pesticides generally occur more often in natural water bodies as mixtures than as individual compounds. Mixtures of pesticides were detected more often in streams than in ground water and at relatively similar frequencies in streams draining areas of agricultural, urban, and mixed land use.

More than 90 percent of the time, two or more pesticide or degradants were detected in streams in developed land use settings About 70 percent and 20 percent of the time, five or more and 10 or more pesticides or degradants were detected, respectively (Gilliom et al. 2006). Fish exposed to multiple pesticides at once may experience additive and/or synergistic effects. These effects are of particular concern when the pesticides share a mode of action. NAWQA's analysis of all detections indicates that more than 6,000 unique mixtures of five pesticides were detected in agricultural streams. Numbers of unique mixtures varied with land use (Gilliom et al. 2006).

2.4.3 Physical Barriers

ESA-listed species and critical habitat have been affected by the development and operation of the FCRPS as well as dams that are owned and operated by public utility districts and the BOR. Storage dams have eliminated spawning and rearing habitat and have altered the natural hydrograph, decreasing spring and summer flows and increasing fall and winter flows. This has virtually reversed the natural hydrograph on rivers such as the Yakima, Snake, and Columbia Rivers. Water storage for flood control and withdrawal for irrigation cause river elevations and flows to fluctuate, affecting fish movement through reservoirs, affecting riparian ecology, and stranding fish in shallow areas. The eight dams in the migration corridor of the Snake and Columbia Rivers alter salmonid smolt emigration and adult immigrations. Dams have also converted the once-swift river into a series of slow-moving reservoirs. Water velocities throughout the migration corridor now depend far more on volume runoff than before construction of the main-stem reservoirs.

While large dams block or impede migration on the mainstem rivers, improperly placed and under-sized culverts impair up- and downstream fish passage to spawning and rearing habitat in smaller streams. The USFS, Bureau of Land Management (BLM) and National Park Service have relatively up-to-date culvert inventories and are required to eventually replace or remove culverts that affect fish passage on federal lands, with the outcomes dependent of funding. The approved forestry Habitat Conservation Plans in Washington require prompt identification and replacement of culverts that prevent or impair fish passage on state and privately-owned timber lands, but that work is slower and more expensive in off-forest lands lower in each watershed. Revisions to state and federal roads and highways are extremely costly, especially in urban areas. Tide gates and water control structures that were installed to drain wetlands and floodplains for farming and development have resulted in the loss of nearly 90 percent of historic estuarine, off-channel, and wetland rearing habitats.

2.4.4 Estuarine and Nearshore Marine Habitat

An 1885 survey estimated that there were 267 square kilometers of tidal marsh and swamps bordering Puget Sound. Tidelands extended 20 km inland from the shoreline in the Skagit and Stillaguamish watersheds. Approximately 100 years later, only 55 square kilometers of intertidal marine or vegetated habitat are estimated to occur in the Puget Sound basin. This represents a decline of 80 percent across the region due to agricultural and urban modification of the lowland landscape. In heavily industrialized watersheds, such as the Duwamish/Green River system, intertidal habitat has been reduced by 98 percent (Shared Strategy for Puget Sound 2007).

An estimated 28 percent of the Puget Sound shoreline has been armored (PSP 2015), often combined with riparian vegetation removal to facilitate views of the water. Shoreline armoring has reduced natural sediment delivery to adjacent beaches, reducing material for longshore processes (drift cells) that maintain the beaches and infauna that live there, and reducing spawning substrate for forage fish (Cramer 2014). Tree removal along the shoreline results in few fallen trees in the intertidal zones. Large fallen trees provide shelter and, indirectly, forage opportunities for many juvenile fishes. Few Puget Sound beaches contain naturally high numbers of fallen large trees as most are removed.

Other activities that have contributed to degradation of Washington and Oregon estuaries and marine habitat include dredging, in-and over-water structures, stormwater discharge associated with impervious surfaces, industrial and municipal wastewater effluent, and construction of dikes and levees. Activities such as shoreline development and road building have added fill to estuaries and nearshore areas, reducing shallow water space, and impairing natural processes (e.g., erosion, longshore drift, eelgrass establishment) that contribute to the creation of complex habitats that juvenile salmonids use for resting, feeding, and predator avoidance.

The environmental baseline also includes the anticipated impacts of all federal actions in the action area that have already undergone formal consultation. For example, since implementation of the first USACE Fish Passage and Restoration Programmatic on August 1, 2008, the USACE approved 271 salmon habitat restoration and fish passage projects, averaging 45 projects per year. Under the Standard Local Operating Procedures for Endangered Species (SLOPES IV) programmatic consultation the USACE authorized 229 restoration actions and 223 other actions related to transportation features, over and in-water structures, and streambank stabilization, from 2008 through September 2011 (NMFS 2008b). The USACE, Bonneville Power Administration (BPA), and the BOR have also consulted on large water management actions, such as operation of the FCRPS, the Umatilla Basin Project, and the Deschutes Project. The USFS and BLM consult on federal land management throughout Oregon and Washington, including restoration actions, timber harvest, livestock grazing, and special use permits. After completing consultation, many ongoing actions, such as water management, have less impact on listed salmon and steelhead, while the restoration actions will improve the environmental baseline over time.

The precise project-level action area for each conservation activity is not yet known, so the current condition of fish or critical habitats in each project area, the factors responsible for that condition, and the conservation value of each site can only be partially described. Therefore, to complete the jeopardy and destruction or adverse modification of critical habitat analyses in this consultation, we made the following assumptions regarding the environmental baseline in each area that will eventually be chosen for an action:

1. The purpose of the NRCS program is for the conservation of natural resources, including aquatic habitat, and the actions are designed to have discountable, insignificant, or beneficial effects over the long term.
2. Each individual action area will be occupied by one or more populations of ESA-listed species.
3. Conservation projects will occur at sites where the biological requirements of ESA-listed species are not being fully met (e.g., due to impaired fish passage, streambank degradation, a disconnected flood plain, degraded channel and riparian conditions).

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Programmatic consultation is a tool enabling the review of many similar actions and works best when the outcomes of those actions can be readily anticipated and prescriptively addressed to ensure those outcomes meet the requirements of ESA section 7(a). When implementing the proposed program, the NRCS will include applicable conservation measures as practice implementation requirements for each project they authorize or fund. In addition, the NRCS will provide individual project notifications and annual monitoring reports to NMFS. These procedures ensure that individual projects covered by this opinion remain within the scope of effects considered here, and ensure that the aggregate or program-level effects of those individual projects do not exceed the extent of take analyzed and authorized in this opinion.

2.5.1 Effects to Species

ESA species presence in the Action Area. Due to the large geographic area covered under this programmatic, we assume that ESA-listed fish could be present within the action area of any given project. The NRCS will follow in-water work windows appropriate to each project location, which will greatly minimize the chances that ESA-listed fish, especially adults, will be present during construction. If an adult fish does happen to enter an action area during construction, it is likely to be able to avoid construction effects (Feist et al. 1996; Gregory 1988; Servizi and Martens 1991; Sigler 1988). In-water work windows will also be timed to avoid effects to fish eggs and alevins still in the gravel. Juvenile salmonids are the more likely life-stage to be present at the construction sites.

Salmon and Steelhead. Salmonids in the action area could experience harm from the following: work area isolation and fish salvage, temporary exclusion from rearing habitat, exposure to increased suspended sediment concentrations, reduced forage availability, and exposure to herbicides.

Work Area Isolation and Fish Salvage

Work area isolation and fish salvage conservation measures will help minimize effects from construction activities, but will require the handling and displacement of juvenile salmonids, causing adverse effects. During worksite dewatering, we assume that 50 percent of the fish will volitionally leave the sites as the water is slowly diverted (NMFS 2006b)[5]. The remaining fish will be salvaged (rescued) if possible (e.g., using dip nets), but some fish will evade capture. On some projects, electrofishing will be used to salvage fish during work area isolation, but some fish will still evade capture (McMichael et al. 1998). Therefore, on some projects, some fish will not be salvaged from the isolation area and will likely die (e.g., they will lack access to flowing water, will be injured by equipment, or will be buried). Some of the fish that are salvaged will also die directly or indirectly from handling stress and electrofishing injury. In Yakima River tributaries, McMichael et al. (1998) determined that an average of 5.1 percent of the *O. mykiss* they sampled were injured by the electrofisher.

Mainly juvenile fish will be salvaged during work area isolation. Adult salmonids are more likely to avoid humans and construction activities, and in-water work will occur when adults are least likely to be in the action area. We do not know how many fish will be salvaged for any given project; however, we can develop estimates based on monitoring reports from recent fish salvage activities for similar projects in the action area. A recent NMFS opinion reported an average of 132 juvenile salmonids were captured during salvage operations (NMFS 2013b)[6]. We estimate that 5 percent of the fish handled will be injured or killed (McMichael et al. 1998; Cannon 2008, 2012) and another 8 percent of the total fish salvaged will be stranded (NMFS 2006b). Thus, we estimate that an average of 17 juvenile ESA-listed salmonids will be injured or killed per salvage event. This is less than one adult equivalent per project, assuming a 0.02 average smolt to adult survival rate (Smoker et al. 2004; Scheuerell and Williams 2005). Many juveniles are likely to be captured as fry or parr, life history stages that have a lower survival rate to adult than smolts, which would further decrease the adult equivalent estimate. Also, because the salvaged fish on any given project may be from different populations within a species (including unlisted populations) that are similar to each other in appearance and life history (e.g., resident *O. mykiss*), the number of ESA-listed salmonids handled will sometimes be lower.

The above estimate indicates that the number of ESA-listed fish killed or injured by any single fish salvage event will not significantly affect the A&P of that local population.

To understand how fish salvage activities could affect fish populations at the program scale, we estimated the number of projects requiring fish salvage each year. The PROJECTS programmatic opinion (NMFS 2013b) reported that about 60 percent of the 2010-2012 projects

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[5] The NMFS (2006b) biological opinion cited personal communication from Tom Curet, Fisheries Biologist, Idaho Department of Fish and Game, who had experience with multiple dewatering projects. He estimated that approximately 50-75% of the fish at a proposed dewatering site voluntarily move downstream with an approximate 80% flow reduction. We used 50 percent in our calculations for this opinion to err conservatively on the side of the fish.

[6] NMFS (2013b) reported that the USFWS (in Oregon) and NOAA Restoration Center had an average capture of approximately 132 ESA-listed salmon and steelhead per project for 35 projects where isolation and dewatering was required (NMFS 2009c; NMFS 2009d). No eulachon were captured in these fish salvage operations.

completed under an earlier version of that programmatic required work area isolation, while the HIP III programmatic estimated that a maximum of 50 percent of projects each year would require work area isolation (NMFS 2013c). We used the 60 percent value to estimate that up to 493 NRCS projects per year will require fish salvage. Using equation (1) below, we estimate that 65,023 juvenile salmon and steelhead will be salvaged per year (i.e., 493 potential projects requiring fish salvage X 132 juveniles captured per project = 65,023).

Equation (1): A = n(pct), where:

> A = number of adult equivalents "killed" each year
> n = 493, i.e., estimated number of projects each year that will require fish salvage
> p = 132, i.e., estimated number of juveniles to be captured per project (NMFS 2013b)[7]
> c = 0.05, i.e., rate of juvenile injury or death caused by capture (including electrofishing) and release. Consistent with observations by Cannon (2008; 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 smaller than for smolts.

We estimate that 5 percent (3,251) of salvaged fish will be injured or killed, including by delayed mortality, and an additional 5,202 will be killed by stranding. This 8,453 juvenile total is 169 adult equivalents each year. Due to the large geography covered by this programmatic, it is unlikely that projects will be concentrated in the range of any single demographically independent population. We complete this analysis with the assumption that these 169 adult equivalents will be distributed evenly among each of the 217 independent populations occurring in Oregon and Washington. Therefore, we estimate that fish salvage will affect less than 1 adult equivalent per independent population per year. Even the aggregate, projects requiring fish salvage will not meaningfully affect abundance, productivity, spatial structure, or diversity of affected populations.

Based on projects implemented under other programmatic consultations, an adult salmonid will occasionally be encountered (e.g., handled or harmed) during NRCS' fish salvage activities. We expect these events will be rare, and will not affect more than one adult from any given independent population, in any given year. These infrequent events will not affect our above conclusion of no meaningful effects to the VSP parameters.

Exclusion from Rearing Habitat

During worksite isolation, fish that occupy the worksite (including those that will be salvaged and released) will be temporarily excluded from that habitat. Because juvenile fish in some of the project areas are already subject to stress as a result of degraded watershed conditions, it is likely

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[7] NMFS (2013b) reported that the USFWS (in Oregon) and NOAA Restoration Center had an average capture of approximately 132 ESA-listed salmon and steelhead per project for 35 projects where isolation and dewatering was required (NMFS 2009c; NMFS 2009d). No eulachon were captured in these fish salvage operations.

that a small number of those individuals will be harmed, for example, due to increased susceptibility to predation, or a reduced ability to obtain food necessary for growth and maintenance. Even in the aggregate, this slight, one-time decrease in juvenile abundance at each site will be too small and localized to affect long-term abundance, productivity, spatial structure, or diversity at the ESU or DPS scale.

Suspended Sediments

Activities in all six action categories have the potential to cause increases in suspended sediment concentrations. Any of the in-water activities (e.g., structure removal, headcut and grade stabilization, stream restoration) are likely to disturb the substrate such that fine sediments are entrained in the water column. Other construction activities (e.g., bank stabilization, plant removal in the riparian zone, road maintenance) will expose bare soil, temporarily increasing the risk of sediment delivery to the stream. The NRCS will implement conservation measures to limit the delivery and downstream movement of these suspended sediments, such as isolating the work area and ceasing project operations if turbidity parameters are exceeded. This will limit the amount of suspended sediments fish may be exposed to, and the duration of that exposure. But over the span of this programmatic, there will likely be influxes of sediment delivery to the stream at some sites (e.g., when removing work-site isolation barriers and large instream structures), where the increased concentration and duration of suspended sediments will adversely affect juvenile salmonids (Newcombe and Jensen 1996). These effects will include behavior changes (e.g., fish may seek clearer water while increasing their susceptibility to predation), or direct injury from sediment exposure (Newcombe and Jensen 1996).

Because the numbers and locations of activities that will increase suspended sediments enough to adversely affect fish will be unpredictable, and the densities of fish that could be exposed will vary depending on the location, we will not try to quantify those numbers here. Most projects will likely occur where habitat conditions are already impaired, so fish densities will be low. In addition most projects will have relatively small footprints, while proposed conservation measures will help minimize suspended sediment effects. Thus, turbidity is highly unlikely to extend more than 200 feet beyond each project footprint. Therefore, we infer that short-term increased suspended sediment concentrations will affect few fish at the local population level and, even in the aggregate, will have negligible effects on A&P at the independent population level.

Reduced Forage Availability

Benthic habitat disturbance during in-water work (e.g., engineered riffles, roughened channels, headcut and grade stabilization, fluvial channel reconstruction) will kill or displace benthic invertebrates, reducing available forage. In response, juvenile salmonids may have to re-locate to non-disturbed areas to forage, or spend more time foraging where the disturbance occurred.

Aquatic invertebrates could start recolonizing within days to months after construction (Miller and Golladay 1996, Paltridge et al. 1997, Fowler 2004, Korsu 2004). Some aquatic insect life cycles can extend up to 3 years (Pennak 1953, Hilsenhoff 1981), but most aquatic insects in the north temperate zone have an annual life cycle (Merritt and Cummins 1996). Thus, we estimate that recolonization of the disturbed areas will usually occur within a year.

Riparian vegetation removal activities (e.g., temporary roads, streambank protection, and invasive plant removal) will cause some loss of allochthonous input, such as leaf litter and terrestrial insect fallout. This will decrease forage availability directly (e.g., fewer terrestrial insects), or indirectly (e.g., less leaf and twig litter, which provide food and substrate for secondary producers and consumers, which ultimately provide juvenile salmonid forage).

In many streams, rearing salmonid densities are low, so a relatively small, temporary decrease in forage availability may not cause effects (i.e., forage is not a limiting factor). In some streams, juveniles will be affected. For example, food, related to degraded or reduced riparian vegetation, is one of the limiting factors in the lower mainstem and upper Yakima River (Conley et al. 2009). James' et al. (1999) data suggested that rainbow trout, spring-run Chinook salmon, mountain whitefish, and redside shiner were all competing for food, and Pearsons et al. (2001) concluded that food was limiting growth of rainbow trout and spring-run Chinook salmon.

For most Oregon and Washington streams inhabited by ESA-listed salmonids, we don't know if forage is a limiting factor. Over the life of this programmatic, we assume that occasionally, decreased forage availability due to the proposed action will adversely affect a few salmonid juveniles. In these cases, competition for food among salmonid juveniles will increase, requiring expenditure of extra energy, and thus slower growth. Slower-growing individuals will be more susceptible to predation and have decreased chances for overwinter survival. Juveniles forced to re-locate from their preferred rearing areas (including suitable cover) will also be more susceptible to predation. At sites where forage is reduced, we expect that the number of juveniles affected will be a small fraction of the local population and, even in the aggregate, will have negligible effects on A&P at the independent population level.

In cases of substrate disturbance, this effect will last about a year until benthic invertebrates recolonize the disturbed area. Times for recovery of riparian habitat will vary, but NRCS will ensure all disturbed areas are replanted promptly following construction, so we expect some vegetation starting to return by the next growing season, along with higher numbers and a larger diversity of terrestrial invertebrates.

Herbicides

To determine if herbicide applications will affect fish, we first analyze if herbicides will reach water inhabited by ESA-listed species. We then determine the potential concentrations that fish could be exposed to, and whether these concentrations will be high enough to cause adverse effects.

Herbicide Delivery Pathways to Streams

Below we discuss pathways which can deliver herbicides to streams. Many factors affect the mobility of pesticides in the environment, including the manner, amount, frequency, and timing of application, and the chemical properties of the pesticide. Other important factors are associated with climate, and with landscape characteristics, such as soil properties, slope, and the proximity to flowing water (Goss 1992; Fuhrer et al. 2004).

Direct Spray. The designated no-application buffers around wet and dry waterways will minimize the chance of higher risk herbicides being directly sprayed over water or a channel (Table 3).

Drift. Herbicide drift can include spray drift and vapor drift. Spray drift (primary drift) refers to the off-target deposition of droplets from spray-applied pesticides at the time of application. Vapor drift (secondary drift) is dependent on a chemical's volatility and refers to the redistribution of pesticides from plant and soil surfaces through volatilization and subsequent atmospheric deposition (NMFS 2011c). DiTomaso et al. (2006) reported that warm weather (above 80^o F) can cause ester formulations to volatilize and drift, and therefore, amine formulations of 2,4-D, dicamba, and triclopyr are more appropriate than ester forms. The NRCS will sometimes use ester formulations of 2,4-D and triclopyr, but will not broadcast spray these chemicals when air temperature exceeds 80^o Fahrenheit, and will not broadcast spray within 100 feet of OHWM, minimizing the opportunity for volatized drift to reach flowing or standing water (Table 3).

The likelihood of drift reaching aquatic habitat is influenced by the application method (e.g., nozzle height), spray droplet size, the proximity to the habitat, wind and air stability, humidity and temperature, physical properties of herbicides and their formulations (DiTomaso et al. 2006; NMFS 2011c). The NMFS (2011c) concluded that primary drift is a likely transport mechanism for pesticide applications that occur immediately adjacent to aquatic habitats including shallow floodplain habitats where juvenile salmonids rear and shelter.

Thistle et al. (2009) found that riparian buffers were effective at reducing herbicide drift deposition to stream surfaces by an average of 92 percent. The NRCS will establish no-application buffers to minimize drift reaching stream channels, ditches, and wetlands (Table 3). The additional proposed conservation measures will further help minimize the chances of spray or vapor drift reaching a waterway. However, due to sometimes unpredictable climatic conditions, it will be difficult to completely eliminate the chance of some spray or vapor drift occasionally reaching waterways.

Wind-Blown Soil. Soil erosion by wind is a potential means of transporting herbicides away from the target application site (Gaynor and MacTavish 1981; Glotfelty et al. 1989; Larney et al. 1999). These contaminated soils could potentially be blown into streams. Quantitative data are limited on the amount of herbicides that can be eroded by wind, but Gaynor and MacTavish (1981) estimated that a wind storm 8 days after application of granular simazine reduced the amount of simazine in the treated area to 57 percent of that applied. The herbicide was deposited up to 2.5 m downwind of the area of application. Larney et al. (1999) estimated that an average of 4.6 percent of four surface-applied herbicides was eroded away due to 13 wind events.

If timing is such that winds strong enough to erode soil occur shortly after herbicide application (e.g., before herbicides are absorbed by plants, or move downward into the soil), and those areas are close enough to stream channels, then some contaminated soil could reach the water.

Spills and Leakage. The proposed conservation measures for handling and mixing herbicides will make it unlikely that any chemical will reach water if a spill did occur. Some herbicide dripping from spray equipment could occur. The dyes proposed for use will help identify where or whether any herbicide has dripped, spilled or leaked, and allow for clean-up prior to exposure to fish.

Runoff and Leaching. Post-herbicide application rain events can mobilize herbicides via runoff and leaching. We define runoff as the movement of herbicide contaminated water across the ground, and leaching as the vertical movement of contaminated water through the soil. Both can deliver herbicides to surface waters (Spalding and Snow 1989, Squillace and Thurman 1992, Louchart et al. 2001; Voltz et al. 2003). Physical properties of the herbicides (i.e., movement in groundwater, soil half-life, water solubility, etc.) and environmental conditions (i.e., soil type, precipitation rates, wind, etc.) are the primary variables influencing herbicide movement from runoff.

In agricultural settings, the percent (by mass) of pesticides lost via runoff varied from less than 0.0005 to 5.43 percent (Flury 1996). In a southwest Oregon pasture, approximately 0.014 percent of the 2,4-D and 0.35 percent of the picloram applied to the watershed were discharged in stream water (Norris et al. 1982). Lennartz et al. (1997) documented that 1.71 percent, and 1.25 percent of the herbicides diruon and simazine, respectively were lost to runoff from an untilled site in a Mediterranean climate (i.e., hot, dry summer, similar to conditions in parts of Oregon and Washington).

Herbicide concentrations are typically higher during the first run-off event (first flush) following application (Xing et al. 2013). Aquatic organisms are likely to be exposed to a rapid spike in herbicide concentrations at the beginning of the first runoff event following herbicide application, followed by a sharp decline in concentrations as the runoff continues. Michael et al. (2006) observed that Oust® (sulfometuron-methyl) transported to streams in surface runoff occurred in pulses with maximum concentrations persisting for less than 15 minutes before dropping exponentially to lower levels.

Vegetated buffers can help reduce runoff delivery to streams (Neary et al. 1993; Klöppel et al. 1997; Berg 2004; Pinho et al. 2008; McBroom et al. 2013). For example, a 50 m wide buffer strip along a corn field treated with the herbicides atrazine and alachlor reduced concentrations averaging 34.1 µg/L and 9.1 µg/L respectively, at the field edge, to 1 µg/L or less as runoff neared the stream (Lowrance et al. 1997). In contrast, a 10 m buffer reduced experimental runoff concentrations of picloram by an average of only 5 percent (Pinho et al. 2008).

The amounts of pesticides leached below the root zone by worst case rainfall events can reach up to 5 percent of the applied mass (Flury 1996). Lowrance et al. (1997) found that herbicide concentrations in shallow groundwater in a buffer zone and at the field edge where herbicides were applied were generally at, or below detection limits. Battaglin et al. (2000) found no chlorsulfuron detections in 25 ground water samples they collected from wells in Iowa and Illinois. Squillace and Thurman (1992) found that the concentration of herbicides in a river when groundwater was the major flow component was less than 1.0 µg/L and averaged 0.2 µg/L. They reported that about 6 percent of the annual river load of atrazine was transported with the groundwater component, while 94 percent was transported with overland flow. They estimated that 1.5 to 5 percent of the atrazine applied during the year was transported from the basin. Louchart et al. (2001) found average concentrations of diuron and simazine in groundwater were about 1 μg/L or less in a Mediterranean Vineyard. They also reported that herbicide concentrations in ground water were one or more orders of magnitude less than in stream storm flows. However, leaching delivery may be more constant over time (Louchart et al. 2001), potentially resulting in chronic, low-level exposure.

The NRCS will plan for a post-application rain-free period according to herbicide label requirements. However, rain events can be localized and not always predictable, so it is likely they will occasionally cause runoff and leaching during the life of this programmatic. Also, herbicides can persist on the vegetation and in the soil for weeks or months after application, so can be susceptible to transport due to precipitation at any time during that period. Leaching will occasionally allow herbicides to reach groundwater, where it could be transported to streams in low concentrations.

To summarize, the pathways above will sometimes deliver herbicides to stream channels. Various ESA-listed salmonid species and life-stages occupy streams within the action area, so exposure is likely. Some individuals will be exposed to relatively high concentrations for shorter periods (e.g., minutes), as with runoff occurring shortly after application events. Some fish will be exposed to relatively small concentrations over longer periods (e.g., days to months), for example, from herbicides that leach into groundwater and are then transported to a stream channel.

Herbicide Exposure and Effects

Given their long residency period and use of freshwater, estuarine, and nearshore areas, juveniles and migrating adults have a high probability of exposure to herbicides that are applied near their habitats. Data on environmental concentrations, especially in the context of field trials, are limited. Data on toxicity to wild fish under natural conditions are also limited, with most studies conducted in the lab. Also, risk characterizations for aquatic species are limited by the relatively few species and herbicides for which data are available. Finally, test animals are typically exposed to only a single chemical in lab studies, while they may be exposed to multiple toxicants simultaneously in the wild, which can lead to additive or synergistic effects.

Potential herbicide concentrations fish could be exposed to is based on GLEAMS (Groundwater Loading Effects of Agricultural Management Systems) modeling. The GLEAMS model was developed to evaluate the impact of management practices on potential pesticide and nutrient leaching within, through, and below the root zone. It also estimates surface runoff and sediment losses from the field[8]. The standard application of the GLEAMS model and the use of the output from this model to estimate concentrations in ambient water (the expected environmental concentration [EEC]) are detailed in SERA (2004a). The modeled application site was assumed to consist of a 10-hectare square area that drained directly into a small pond or stream. As

[8] https://www.ars.usda.gov/plains-area/temple-tx/grassland-soil-and-water-research-laboratory/docs/gleams/

detailed in SERA (2004a) the standard GLEAMS modeling encompasses rainfall rates of 5 to 250 inches per year, assuming that the rainfall occurs uniformly on every tenth day, with the first rainfall event occurring on the day after pesticide application.

The recent Fish Passage and Restoration programmatic with the Corps (NMFS No. WCR-2014-1857), and the biological opinions for aquatic restoration activities (ARBO; NMFS No.:NWR-2013-9664) carried out by the USFS, BLM, and BIA evaluated the risk of adverse effects to listed salmonids and their habitat in terms of hazard quotient (HQ) values (NMFS 2008c; NMFS 2017b). Hazard quotient values are calculated by dividing the EEC by the effects threshold concentration. Adverse effect threshold concentration values for each species group are defined as either 1/20th of the LC50 value (the lethal concentration required to kill 50 percent of the population) for listed salmonids, 1/10th of the LC50 value for non-listed aquatic species, or the lowest acute or chronic "no observable effect concentration," whichever is lower. These values are found in Syracuse Environmental Research Associates, Inc. (SERA) risk assessments that were completed for the USFS for 2,4-D (USDA-Forest Service 2006), aminopyralid (SERA 2007), chlorsulfuron (SERA 2004b), clopyralid (SERA 2004c), dicamba (SERA 2004d), glyphosate (SERA 2011a), hexazinone (SERA and SRC 1997), imazapic (SERA 2004e), imazapyr (SERA 2011b), metsulfuron-methyl (SERA 2004f), picloram (SERA 2011c), sethoxydim (SERA 2001), sulfometuron-methyl (SERA 2004g), and triclopyr (SERA 2011d).

Adverse effects were determined to be likely for HQ values greater than 1. Generally, effect threshold values for listed salmonids were lower than values for other fish species groups, so values for salmonids were also used to evaluate potential effects to other listed fish. In the case of sulfometuron-methyl, threshold values for fathead minnow were lower than salmonid values, so threshold values for this minnow were used to evaluate effects to listed fish.

For our herbicide effects analysis, we refer to reported HQ values, and also incorporate data and information from the most recent literature.

2,4-D. For the acute toxicity of the dimethylamine (DMA) salt of 2,4-D, even at the highest application rate under normal conditions of exposure, the highest HQ is 0.02. In contrast, based on peak exposures anticipated in the normal use of 2,4-D esters, HQ values exceed 1 for sensitive fish species at both the typical and at the highest application rate (USDA-Forest Service 2006). In the direct application of 2,4-D esters to ponds for aquatic weed control, the HQ values range from 7 to 14 for sensitive fish species. For sensitive aquatic invertebrate species, the upper bound HQ is 23. These HQ values are based on LC50 values rather than NOEC values (USDA-Forest Service 2006). The USDA-Forest Service (2006) concluded that direct applications of 2,4-D esters to water may cause adverse effects on fish and on sensitive invertebrates. They also determined that, in non- accidental longer-term exposure scenarios, risks to sensitive aquatic macrophytes could occur at or near the upper range of the application rate—i.e., an HQ of 3 at an application rate of 4 lb a.e./acre.

In laboratory experiments, Folmar (1976) found rainbow trout fry avoided water with concentrations of 1 mg/L and 10 mg/L of 2,4-D, but not 0.1 mg/L. Crago et al. (2014) observed no concentration-dependent increase or decrease in the expression of vitellogenin (VTG) mRNA of juvenile male rainbow trout exposed to 2,4-D, a surfactant mixture, or a binary mixture of surfactants and 2,4-D compared with a control. Concentrations of 2,4-D tested were 16.4 and 1,640 µg/L. However, Xie et al. (2005) observed the induction of plasma VTG in juvenile rainbow trout treated with 2,4-D, and the response was enhanced by coexposure to a commercial surfactant mixture. Xie et al.'s (2005) concentration-response studies demonstrated that the lowest observed effect concentration (LOEC) for 2,4-D was 0.164 mg/L. Tierney et al. (2006a), found that 1 and 10 mg/L 2,4-D did not affect serine-evoked juvenile coho salmon electro-olfactograms (EOG), and concluded that acute pulses of this pesticide likely do not pose a specific olfactory risk.

Aminopyralid. SERA (2007) reported acute no observable effect concentration (NOEC) values of 50 mg a.e. (acid equivalent)/L for "sensitive" fish (based on rainbow trout data), to 100 mg a.e./L for "tolerant" fish (based on bluegill sunfish data). They also reported estimated peak concentrations in surface water of 46.8 µg/L. The upper bounds of the HQ for fish associated with expected (i.e., non-accidental) concentrations of aminopyralid in water after applications at the highest labeled rate are in the range of 0.002 to 0.02 (SERA 2007). They also summarized an unpublished study by Marino et al. (2003) on fathead minnow. This study showed that no fathead minnow larvae survived aminopyralid concentrations of 6.71 and 11.4 mg a.e./L. They determined 2.44 mg a.e./L as the least observable effect concentration (LOEC).

SERA (2007) reported acute NOEC values for algae in the range of 6 mg a.e./L to 23 mg a.e./L, and a NOEC of 44 mg a.e./L for duckweed (*Lemna gibba*), an aquatic macrophyte. None of the aquatic plant HQs exceeded 1. All of the studies reviewed by SERA (2007) were conducted on technical grade aminopyralid. No toxicity studies of fish are available on the TIPA formulation of aminopyralid.

Chlorsulfuron. No chlorsulfuron HQ exceedances occur for fish or aquatic invertebrates. HQ exceedances occur for algae at rainfall rates of 50 and 150 inches per year, and for aquatic macrophytes at rainfall rates of 15, 50, and 150 inches per year. The HQ values predicted for algae at 50 inches per year ranged from 0.002 to 2.8, and the HQ exceedance occurred at the maximum application rate on clay soils. The HQ values predicted for algae at 150 inches per year ranged from 0.02 to 5.0, and HQ exceedances occurred at both the typical (HQ of 1.1) and maximum (HQ of 5.0) application rates on clay soils. Application of chlorsulfuron adjacent to stream channels at the typical and maximum application rates, in rainfall regimes of 50 to 150 inches per year, is likely adversely affect algal production when occurring on soils with poor infiltration.

The HQ values predicted for aquatic macrophytes at 15 inches per year ranged from 0 to 64, and HQ exceedances occurred at both the typical and maximum application rates on clay soils. The HQ values for aquatic macrophytes at 50 inches per year ranged from 0.5 to 585, and ranged from 4.8 to 1,064 at 150 inches per year. The HQ exceedances at 50 and 150 inches per year occurred at both typical and maximum application rates, with lower HQ values occurring on loam soils, and the highest values on clay soils. Given the wide range of HQ values observed among soil types at a given rainfall rate, soil type is clearly a major driver of exposure risk for chlorsulfuron, with low permeability soils markedly increasing exposure levels. Application of chlorsulfuron adjacent to stream channels at the typical and maximum application rates, in rainfall regimes of 15 to 150 inches per year, is likely to adversely affect aquatic macrophytes.

Clopyralid. Application of clopyralid under the modeled scenario did not result in any HQ exceedances for any of the species groups (SERA 2004c). Stehr et al.(2009) observed no clear evidence of a toxic concentration–response relationship for zebrafish (*Danio rerio*) embryos for the pure form of clopyralid.

Dicamba. The SERA (2004d) risk characterization was limited by the available toxicity data, and they found no chronic toxicity studies in fish. SERA (2004d) concluded that "Within these very serious limitations, there is little basis for asserting that adverse effects in aquatic animals are plausible." For acute exposures, they reported HQ values in the range of 0.000003 to 0.0001. They also thought that the limited data indicated that salmonids are more sensitive than other freshwater fish to the acute toxicity of dicamba.

Drift from dicamba applications is common, especially from the ester formulation (DiTomaso et al. 2006). In looking at statewide trends across basins, Sargeant et al. (2013) found increasing concentrations at two or more sites for several pesticides, including dicamba I. They noted that dicamba I would be added to the Washington State Department of Agriculture's list of Pesticides of Concern. SERA (2004d) reported a peak estimated rate of contamination of ambient water associated with the normal application of dicamba of 0.003 (0.00006 to 0.01) mg/L at an application rate of 1 lb/acre.

Glyphosate (aquatic). Glyphosate HQ exceedances occurred for fish and algae at a rainfall rate of 150 inches per year, while no HQ exceedances occurred for aquatic invertebrates or aquatic macrophytes. The HQ exceedances occurred at the maximum application rates only. The HQ values for fish at 150 inches per year ranged from 1.5 to 3.6, and occurred within a narrow range on all soil types. The HQ values for algae at 150 inches per year ranged from 0.8 to 2.0 in sand (SERA 2011a).

Application of glyphosate adjacent to stream channels at application rates approaching the maximum, in rainfall regimes approaching 150 inches per year, on all soil types is likely to adversely affect listed salmonids. When glyphosate is applied adjacent to stream channels at rates approaching the maximum on sandy soils, in rainfall regimes approaching 150 inches per year, adverse effects to algal production will occur.

Folmar (1976) found no avoidance by rainbow trout fry of water with concentrations up to 10 mg/L of glyphosate. Folmar et al. (1979) documented that rainbow trout eyed-egg hatching success decreased significantly from a control at 10 and 20 mg/l of Roundup® (a formulation with glyphosate as the active ingredient), but not at 2 and 5 mg/l concentrations. Sac fry survival was lower than the control group at 5, 10, and 20 mg/l, but not at 2 mg/l.

In a lab study of rainbow trout, Morgan and Kiceniuk (1992) found no difference in foraging variables, length, weight, or number of gill lesions between treatment and control fish after 2 months of exposure to up to 45.75 µg/L of glyphosate. Also, livers from both treatment and control fish showed no evidence of tumors or melanomacrophages. They did determine differences in two agonistic behaviors between treatment and control fish at concentrations down to 4.25 µg/L, but the implications of these behavior differences was unknown. Topal et al. (2015)

reported that antioxidative enzyme activity, an indicator of oxidative stress in cells, was significantly induced in juvenile rainbow trout exposed to glyphosate concentrations down to 2.5 mg/L. They also documented harmful effects of glyphosate on the liver histology of juvenile rainbow trout, and documented declined swimming performance.

Roundup® significantly reduced EOG in rainbow trout after 2 minutes exposure to both 100 and 1000 µg/L active ingredient, but had no significant effect at 10 µg/L active ingredient (Tierney et al. 2007). L-histidine preference in rainbow trout was not altered with exposure to 10 µg/L AI Roundup® but was absent at 100 and 1000 µg/L (Tierney et al. 2007). However, Tierney et al. (2007) noted that trout activity level was lowered by 1000 µg/L AI Roundup® and so a behavioral olfactory response may have been missed.

Hexazinone. We are unaware of HQ values for Hexazinone. SERA and SRC (1997) summarized the literature for hexazinone and reported that most algal species are much more sensitive to hexazinone (EC_{50} values for growth inhibition of 0.003-10 mg/L) compared with fish and aquatic invertebrate (LC_{50} values generally greater than 100 mg/L). They determined that plausible levels of acute exposure in standing water and streams range from about 0.3 mg/L at an application rate of 1 lb a.i./acre to about 1.2 mg/L at an application rate of 4 lb a.i./acre. SERA and SRC (1997) reported an EC_{50} of 37.4 µg/L from a study on duckweed.

Wan et al. (1988) reported the 96 hour LC_{50} mean toxicities to juvenile Pacific salmonids were as follows (mg/L; ± SE): Pronone 10G 1686 ± 393, Velpar® L 904 ± 61, Hexazinone 276 ± 16. They found that Velpar® L is significantly ($p < 0.05$) more toxic to salmonids than Pronone lOG, and that Pronone lOG and Velpar® L are both significantly less ($p < 0.001$ for both) toxic to juvenile Pacific salmonids than just hexazinone. The carriers of both products are of low toxicity to salmonids, and appear to reduce the toxicity of hexazinone in the formulated materials (Wan et al. 1988). Hexazinone degrades in water to at least eight transformation products, but the toxic effect, if any, to juvenile Pacific salmonids is unknown (Wan et al. 1988).

Imazapic. Based on the typical application rate of 0.1 lb/acre, all of the HQ values for aquatic animals are extremely low, ranging from 0.00000001 (the lower range for longer term exposures in fish and invertebrates) to 0.00001 (the upper range for acute exposures for fish and invertebrates). At the maximum application rate of 0.1875 lb/acre, all of the hazard quotients would be increased by a factor of about 2. The HQ values for algae and macrophytes are also below 1, though with an HQ value of 0.8, aquatic macrophytes appear to be more sensitive to imazapic than unicellular algae (SERA 2004e). Stehr et al.(2009) observed no clear evidence of a toxic concentration–response relationship for zebrafish (*Danio rerio*) embryos for the pure form of imazapic, or for Plateau, a formulated product.

Imazapyr. SERA (2011b) used the acute no observable adverse effect concentration of 10.4 mg a.e./L for imazapyr as an Arsenal formulation to derive HQ values for sensitive fish species. Based on peak acute expected concentrations of imazapyr (i.e., non-accidental exposures) in surface water, the upper bound of the HQ is 0.03. For aquatic applications, the upper bound HQ based on non-accidental peak exposures is 0.02.

No HQ exceedances occurred for aquatic invertebrates. Imazapyr is labeled for aquatic macrophyte control and is highly toxic to aquatic macrophytes. Even for aquatic applications, risks to algae are not apparent with upper bound HQ values of 0.01 to 0.04 based on peak exposures and 0.003 to 0.02 based on longer-term exposures (SERA 2011b). Stehr et al.(2009) observed no clear evidence of a toxic concentration–response relationship for zebrafish (*Danio rerio*) embryos for the pure form of imazapyr, or for Habitat, a formulated product.

Metsulfuron methyl. Peak concentrations of metsulfuron methyl associated with runoff or percolation are estimated to be no more than 0.0003 mg/L. Even at the maximum application rate of 0.15 lb/acre, no HQ exceedances occurred for metsulfuron for fish, aquatic invertebrates, or algae. For acute exposures based on the peak concentrations of metsulfuron methyl, aquatic macrophytes appear to be at risk at the upper range of plausible exposures, with a hazard quotient of 2. Thus, there is some risk if metsulfuron methyl is applied near bodies of water containing aquatic macrophytes (SERA 2004f).

Picloram. Based on expected concentrations of picloram in surface water, all central estimates of the HQs are below the level of concern for fish, aquatic invertebrates, and aquatic plants. Upper bound HQs exceed the level of concern for longer-term exposures in sensitive fish species (HQ=3) and peak exposures in sensitive algae species (HQ=8) (SERA 2011c). Mayes et al. (1987) observed a reduction in growth in early life stages of rainbow trout exposed to 0.9 ppm (900 µg/L) picloram. Stehr et al.(2009) observed no clear evidence of a toxic concentration–response relationship for zebrafish (*Danio rerio*) embryos for the pure form of picloram, or for Tordon K, a formulated product.

Sethoxydim. No HQ exceedances occurred for sethoxydim for aquatic invertebrates, algae, or aquatic macrophytes. The HQ exceedances for fish occurred at rainfall rates of 50 and 150 inches per year, and ranged from 0.3 to 1.0, and from 1.1 to 3.0, respectively. The HQ exceedance at 50 inches per year occurred only at the maximum application rate on loam soils. The HQ exceedances at 150 inches per year occurred at the typical application rate on sand, and at the maximum application rate on loam soil (SERA 2001).

The HQ values for sethoxydim were calculated using the toxicity data for the Poast formulation, and incorporates the toxicity of naphtha solvent. The toxicity of sethoxydim alone for fish and aquatic invertebrates is much less than that of the formulated product (about 30 times less toxic for invertebrates, and about 100 times less toxic for fish). Since the naphtha solvent tends to volatilize or adsorb to sediments, using Poast formulation data to predict indirect aquatic effects from runoff leaching is likely to overestimate adverse effects (SERA 2001).

Sulfometuron-methyl. No HQ exceedances occurred for sulfometuron-methyl for fish, aquatic invertebrates, or algae. The HQ exceedance for aquatic macrophytes occurred at a rainfall rate of 150 inches per year on clay soils, and HQ values ranged from 0.007 to 3.8. (SERA 2004g) Considering the range of HQ values observed for sulfometuron at each rainfall level, soil type is an important factor in determining exposure risk, with low permeability soils markedly increasing exposure levels. In areas with a rainfall rate approaching 150 inches per year, application of metsulfuron adjacent to stream channels on soils with low permeability at application rates approaching the maximum is likely to adversely affect aquatic macrophytes. A slight decrease in forage availability for juvenile salmonids will result from adverse effects to aquatic macrophytes.

Triclopyr. SERA (2011d) reported that even at the highest application rate of 9 lb a.e./acre, the upper bound HQ would be 0.09 for the triethylamine salt (TEA) formulations of triclopyr. For ester (BEE) formulations of triclopyr, the upper bound HQ would reach a level of concern at an application rate of about 3 lb a.e./acre. They also reported that triclopyr BEE HQs for sensitive species of algae range from 0.0001 to 21. So, applications in areas where substantial drift or offsite movement in runoff is likely could affect algae. For both triclopyr TEA and triclopyr BEE terrestrial applications, risks to aquatic macrophytes are substantial (SERA 2011d).

In lab testing, Guilherme et al. (2015) documented genotoxicity in blood cells of the European eel (*Anguilla anguilla L.*) from triclopyr and from Garlon®, the commercial formulation herbicide which includes triclopyr as the active ingredient. They performed their tests with what they considered environmentally realistic concentrations (67.6 and 270.5 µg/L Garlon® and 30 and 120 µg/L triclopyr). Guilherme et al. (2015) also determined there was a higher effect of the Garlon® formulation vs straight triclopyr, which they felt might be related to the adjuvant (e.g., kerosene). Stehr et al.(2009) observed no developmental effects of zebrafish embryos at concentrations up to 10 mg/L for purified triclopyr alone or for the Garlon 3A and Renovate formulations, which contain the TEA form of triclopyr.

HQ values greater than 1 were estimated for 2,4-D, glyphosate, picloram, sethoxydim, sulfometuron-methyl, and triclopyr under certain concentrations, and rainfall and soil conditions, though some of these conditions may not be realistic for actual applications carried out by the NRCS (e.g., maximum application rates in areas receiving 150 inches of rain per year). Lab studies on at least 2,4-D, glyphosate, picloram, and triclopyr also indicate the potential for adverse effects to fish, including salmonids. NMFS (2011c) reported that 2,4-D and triclopyr are already detected frequently in freshwater habitats within the four western states where listed Pacific salmonids are distributed. Some of the agricultural areas where the NRCS will implement projects will likely have a baseline of measurable herbicides in the surface waters, and herbicide delivery from some NRCS projects will increase those concentrations at the point of delivery. Concentrations will usually be quickly diluted to the point where they will not cause harm.

In some cases, such as in shallow water with slow velocities, fish will be exposed to higher herbicide concentrations. Thus, over the life of this programmatic, there will be occasions when enough herbicides are delivered to habitat occupied by rearing ESA-listed salmonids to cause adverse effects to individuals in the immediate vicinity. We expect the number of fish affected will be minimal as the concentrations quickly dilute to background levels. Adverse effects will likely include behavioral changes, such as movements away from herbicide plumes or decreased swimming performance, making fish more susceptible to predation. These effects will cause a slight decrease in juvenile abundance for each cohort affected at each site but, even in the aggregate, will have negligible effects on A&P at the independent population level.

There could be additional sub-lethal adverse effects from any of the proposed herbicides, but there are limited or no data for most formulations. Scholz et al. (2000) and Laetz et al. (2015)

noted that most environmental exposures to pesticides are likely to be sub-lethal, and the lethal endpoint has little predictive value for assessing whether pesticide exposure will cause sub-lethal behavioral disorders in wild salmon. For example, other pesticides (not included in the proposed action) affect salmonid physiology and behavior, such as anti-predator and homing behavior (Scholz et al. 2000; Tierney et al. 2006b).

There is little known about the effects of pesticide mixtures, which occur commonly in aquatic habitats (Gilliom et al. 2006). Laetz et al. (2015) reported that exposures to pesticide mixtures are the rule rather than the exception in most aquatic habitats and assessments based on individual chemicals are likely to underestimate actual risk where mixtures occur. For example, using juvenile salmon, Laetz et al. (2009) showed that binary mixtures of organophosphate and carbamate insecticides are synergistic, producing greater acetylcholinesterase inhibition in vivo than predicted from concentration-addition. A 96-h exposure to an environmentally realistic concentration of a mixture made from the ten most frequently occurring pesticides in British Columbia's Nicomekl River reduced the olfactory sensory neuron responses of rainbow trout to a behaviorally relevant odorant. This study demonstrates that environmentally observed pesticide mixtures can injure salmon olfactory tissue (Tierney et al. 2008). Considering that the United States alone has nearly 17,000 pesticide products currently registered for use, it is generally impracticable to measure the toxicity of all possible mixture combinations for different aquatic species under different exposure conditions (Laetz et al. 2015).

There is also little known about the effects of adjuvants (e.g., surfactants), degradants, and other chemicals found in pesticide formulations. For example, some surfactants are toxic by themselves and have been documented to increase the toxicity of formulations in comparison to technical grade active ingredients (Folmar et al. 1979; Mitchell et al. 1987; Stark and Walthall 2003; SERA 2011a). Zoller (2006) reported that egg production by zebrafish, exposed to 75, 25 and 10 µg/L of a typical industrial alkylphenol ethoxylate was reduced up to 89.6 percent, 84.7 percent and 76.9 percent, respectively, between the 8th and 28th days of exposure. Xie et al. (2005) reported that a binary mixture of alkylphenol ethoxylate-containing surfactants with two aquatic pesticides (2,4-D and triclopyr) possessed greater than additive estrogenic responses in fish under laboratory conditions and in a field setting.

Due to the lack of data on the proposed herbicides, mixtures, and formulations, we will not speculate on additional effects. But, because there is no expiration date for this consultation, future pesticide research could warrant re-initiation of this consultation if new information changes our analysis of fish exposure or response.

Improved fish passage

Construction necessary for fish passage restoration projects will initially cause short-term adverse effects already discussed above (e.g., fish salvage, suspended sediments). In the long-term, improved fish passage will improve A&P by providing access to additional and better spawning and rearing habitat, and could also improve spatial structure and diversity.

Eulachon. Eulachon in the action area could experience harm from the following: work area isolation and fish salvage, exposure to increased suspended sediment concentrations, and exposure to herbicides.

It will be an uncommon event for any NRCS project to overlap in space and time with eulachon presence because there are few streams with eulachon, distribution is generally limited to the lower reaches of those streams, and in-water work windows will usually confine projects to times when eulachon are not present. Thus, it is unlikely a project will affect eulachon in any given year, but over the lifetime of this programmatic, there will be occasional events when eulachon will be exposed to individual project effects.

Eulachon eggs, larvae and adults could be susceptible to harm during work area isolation and fish salvage. We assume that 50 percent of the fish will volitionally leave the sites as the water is slowly diverted. Adults will have a higher potential to be salvaged compared to larvae because larvae will be difficult to see and collect due to their small size (0.2-0.3 inches long). Thus, any larvae that do not volitionally leave the work site will likely become stranded and die. Any eggs within the work area isolation footprint will also likely die.

Due to the limited data on eulachon densities and distribution within Oregon and Washington rivers, we will not attempt to estimate the number that will be harmed during isolation and fish salvage. We expect this number to be small because construction footprints will usually be small (e.g., usually 200 feet of stream or less), while local spawning populations are large. For example, preliminary estimates of the mean cumulative plankton flux of eulachon eggs and larvae in the Cowlitz River in 2015 was about 690 billion (eggs can drift downstream a short time before adhering to sand and small gravel, and can subsequently be moved downstream by the current) (NMFS 2017a). In the Naselle River, WA, mean eulachon egg and larval production was over 592 million in 2015, while the mean eulachon egg and larval outflow from the Chehalis River was estimated at 4.4 billion.

The NMFS (2017a) also reported estimates of 108 million adult eulachon in the Cowlitz River, 36,400 in the Naselle River, and 272,000 in the Chehalis River in 2015. Minimum estimated run sizes for the Columbia River sub-population ranged from 226,500 to 84,243,100 from 2000 through 2017. The maximum estimated run size was 323,778,300 in 2014 (NMFS 2017a). Thus, we infer that no individual isolation and salvage project will harm enough eulachon to affect abundance or productivity at the local population (i.e., river) level and, even in the aggregate, will not affect abundance or productivity at the sub-population (Columbia River) level. Likewise, the low number of fish harmed will have no effect on spatial structure or diversity at the population scale.

The NRCS will implement conservation measures to limit the delivery and downstream movement of suspended sediments, such as isolating the work area and ceasing project operations if turbidity parameters are exceeded. This will limit the area that eulachon could be exposed to suspended sediments. But over the span of this programmatic, there will likely be influxes of sediment delivery to the stream at some sites (e.g., when removing work-site isolation barriers and large instream structures), where the increased concentration and duration of suspended sediments will directly harm eulachon (Newcombe and Jensen 1996). However, these events will be rare. Following the analysis we used above for salvage effects on the local population, even in the aggregate, the number of eulachon harmed by increased suspended sediment concentrations will be too small to affect population abundance, productivity, spatial structure, or diversity.

Due to the restricted distribution of eulachon in Oregon and Washington, and the limited time they spend in any given stream (e.g., currents start transporting larvae to the estuaries as soon as they hatch), it is highly unlikely they will be exposed to herbicides resulting from an NRCS activity covered in this programmatic.

2.5.2 Effects to Critical Habitat

Salmon and steelhead critical habitat. The PBF characteristics (site attributes) that will be affected by the proposed action are substrate, water quality, water quantity, floodplain connectivity, forage, natural cover, and migration obstruction.

Substrate

Construction activities such as structure removal, headcut and grade stabilization, and stream restoration are likely to entrain fine sediments in the water column which will settle out downstream. In most cases, the conservation measures (e.g., worksite isolation) will minimize sediment transport so effects from downstream deposition will not be meaningfully measurable to spawning habitat.

Large pulses of fine sediment and larger substrate will also be transported downstream following the removal of structures which have caused sediment to accumulate upstream (e.g., dams, irrigation diversion structures). Downstream substrates will be scoured, buried by larger substrates, or become embedded with fine sediments. In some stream reaches, this will impair spawning habitat. Deposition of fine sediments can reduce egg incubation success (Bell 1991), interfere with primary and secondary production (Waters 1995; Spence et al. 1996), and degrade cover for juvenile salmonids (Bjornn and Reiser 1991). The removal of these structures will also allow for more normative bedload transport and more complex stream channel morphology. These processes will improve conditions for substrate sorting, providing additional spawning habitat and improving benthic conditions for primary and secondary production in the long-term. This will improve the substrate PBF over the long term.

Water Quality

Construction activities will increase suspended sediments. Adherence to the conservation measures will minimize suspended sediment concentrations and their duration (e.g., by work-site isolation). This will generally affect water quality during and immediately following construction, causing no long-term effects to critical habitat. Herbicide use will sometimes lead to an increase in herbicide concentrations in nearby surface waters temporarily impairing water quality. We expect this effect to be temporary and localized (due to quick dilution). Also, the conservation measures will limit herbicide use within any particular watershed. These temporary effects to the water quality PBF will not reduce the conservation value of critical habitat.

The NRCS will also fund or authorize irrigation water siphons. Natural stream channels are sometimes used to convey irrigation water, allowing any potential contaminants or temperature differences in the irrigation water to affect the stream's water quality. The siphons will allow the irrigation channel to bypass natural streams, protecting water quality for the long-term.

Water Quantity
At some sites, there will be brief reductions or changes in flow due to construction activities. The conservation measures will ensure these changes are minimal and short-term. In the long term, some irrigation and water delivery projects will increase instream flows, especially during late summer base flows, improving this PBF.

Floodplain Connectivity
Streambank protection can restrict normal river processes such as channel migration and floodplain access, preventing side channel formation, erosion of natural banks, and large wood recruitment. On most streambank protection projects, the NRCS' bioengineering techniques will help minimize (but not prevent) effects to floodplain connectivity. These projects will stop the erosion of fine sediments (e.g., from agricultural land), and will allow for the establishment of riparian vegetation. The projects involving riprap (i.e., flow control structure protection and roughened rock toes) will be limited to four projects per year and will include compensatory mitigation. Some existing bank stabilization structures will also be repaired or replaced, extending the life of those structures. However, required mitigation will slightly improve the habitat baseline at these sites, which were likely originally constructed with just riprap and no mitigation such as riparian plantings or incorporation of large wood.

Additional proposed activities will tend to increase floodplain connectivity in the long-term. These activities include the setback or removal of berms, dikes, and levees, stream and floodplain restoration, and beaver dam analog installation. Beaver dam analogues can increase the habitat quantity and complexity of juvenile salmonid rearing habitat, and have the potential to help aggrade incised channels, reconnecting the stream to its floodplain (Pollock et al. 2014; Bouwes et al. 2016). Although there will be some effects to floodplain attribute at a reach (e.g., individual project footprint) scale, we believe the required mitigation will help protect the conservation value of the critical habitat at the 6th field HUC scale.

Forage
Benthic habitat disturbance and riparian vegetation removal will kill or displace benthic invertebrates and will decrease allochthonous input, reducing available forage. On a stream reach or watershed scale, these habitat disturbances will be small and will not be permanent, with recovery expected to begin within a year of construction. Some of the proposed activities will improve aquatic and riparian habitat (e.g., stream habitat improvement; riparian planting), resulting in long-term increases in forage production. Overall, there will be a net improvement in this PBF attribute, with no decrease in the conservation value of the critical habitat.

Natural Cover
Most of the proposed activities are designed to conserve, if not improve, both aquatic and riparian habitat. There will be some short-term construction disturbances, but a net improvement in natural cover in the long term. For example, large wood will be incorporated into bank protection and stream habitat improvement projects. Numerous authors have highlighted the importance of large wood to lotic ecosystems (Bilby 1984; Keller et al. 1985; Lassettre and

Harris 2001; Spence et al. 1996; Roni and Quinn 2001). The NRCS' installation of wood and boulders will increase stream habitat complexity, overhead cover, food and substrates for aquatic invertebrates, and will help reestablish natural hydraulic processes. Large wood can also trap spawning gravel, create pools, and increase the connection with floodplain vegetation.

Migration Obstruction
Fish passage restoration is one of the main action categories proposed. For example, the NRCS will fund or authorize the removal of barriers such as dams and the retrofitting of structures (e.g., tide gates) to make them passable to fish. Long-term benefits will include access to more spawning and rearing habitat, and restoration of natural stream channel processes such as bedload movement in streams, and tidal influence in estuarine areas. There will be an improvement to this PBF attribute.

In summary, there will be adverse effects to several PBF's at the local reach scale. The extent of these effects will be minimized by the proposed conservation measures including compensatory mitigation. Even in the aggregate, effects will not be significant at the 6^{th} field HUC scale due to the minimal number of projects expected within any given 6^{th} field HUC, the generally small project footprints, and offsetting beneficial effects (e.g., projects which improve the current baseline such as removal of levees and fish passage barriers). Therefore, the proposed action will not decrease the conservation value of critical habitat at the 6^{th} field HUC scale.

Eulachon critical habitat. The PBF site attributes that will be affected include water quality and substrate.

Water Quality
Construction activities will increase suspended sediments. Adherence to the conservation measures will minimize suspended sediment concentrations and their duration (e.g., by work-site isolation). This will generally affect water quality during and immediately following construction, causing no long-term effects to critical habitat. Herbicide use will sometimes lead to an increase in herbicide concentrations in nearby surface waters, temporarily impairing water quality. We expect this effect to be temporary and localized (due to quick dilution). Also, the conservation measures will limit herbicide use within any particular watershed.

Substrate
Construction activities such as structure removal, headcut and grade stabilization, and stream restoration are likely to entrain fine sediments in the water column which will settle out downstream. In most cases, the conservation measures (e.g., worksite isolation) will minimize sediment transport so effects from downstream deposition will not be meaningfully measurable to eulachon spawning habitat. Large pulses of fine sediment and larger substrate will also be transported downstream following the removal of structures which have caused sediment to accumulate upstream (e.g., dams, irrigation diversion structures). Downstream substrates will be scoured, buried by larger substrates, or become embedded with fine sediments. In some stream reaches, this will impair spawning habitat. The removal of these structures will also allow for more normative bedload transport and more complex stream channel morphology. These processes will improve conditions for substrate sorting, providing additional spawning habitat in the long-term, and improving the substrate PBF.

Even in the aggregate of all projects, effects to the water quality and substrate PBF's will not reduce the conservation value of eulachon critical habitat at the watershed scale.

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). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The economic and environmental significance of natural resource-based economy (e.g., timber harvest, agriculture, mining, shipping, energy development) 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 evidence 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 Oregon may be declining, general resource demands are increasing with growth in the size and standard of living of the local and regional human population. The percentage increase in population growth may provide the best estimate of general resource demands because as local human populations grow, so does the overall consumption of local and regional natural resources. From April 1, 2010 to July 1, 2016, the population of Oregon grew by 6.8 percent and the population of Washington State grew by 8.4 percent[9]. The population is expected to continue to grow at a similar rate. The NMFS assumes that private and state actions that have routinely occurred in the past will continue within the action area, increasing as population rises.

Similarly, demand for cultural and aesthetic amenities continues to grow with human population, and is reflected in decades of concentrated effort by Tribes, states, and local communities to restore an environment that supports flourishing wildlife populations, including populations of species that are now ESA-listed (CRITFC 1995; NWPCC 2012). Reduced economic dependence on traditional resource-based industries has been associated with growing public appreciation for the economic benefits of river restoration, and growing demand for the cultural amenities that river restoration provides. Thus, many non-federal actions have become responsive to the recovery needs of ESA-listed species. Those actions included efforts to ensure that resource based industries adopt improved practices to avoid, minimize, or offset their adverse impacts.

Similarly, many actions focused on completion of river restoration projects specifically designed to broadly reverse the major factors now limiting the survival of ESA-listed species at all stages

[9] https://www.census.gov/data/tables/2016/demo/popest/state-total.html

of their life cycle. Those actions have improved the availability and quality of estuarine and nearshore habitats, floodplain connectivity, channel structure and complexity, riparian areas and large wood recruitment, stream substrates, stream flow, water quality, and fish passage. In this way, the goal of ESA-species recovery has become institutionalized as a common and accepted part of the State's economic and environmental culture. We expect this trend to continue into the future as awareness of environmental and at-risk species issues increases among the general public.

It is not possible to predict the future intensity of specific non-federal actions related to resource-based industries at this program scale due to uncertainties about the economy, funding levels for restoration actions, and individual investment decisions. However, the adverse effects of resource-based industries in the action area are likely to continue in the future, although their net adverse effect is likely to decline slowly as beneficial effects spread from the adoption of industry-wide standards for more protective management practices. These effects, both negative and positive, will be expressed most strongly in rural areas where these industries occur, and therefore somewhat in contrast to human population density. The future effects of river restoration are also unpredictable for the same reasons, but their net beneficial effects may grow with the increased sophistication and size of projects completed and the additive effects of completing multiple projects in some watersheds.

In summary, resource-based activities will continue to influence freshwater and estuarine habitat quality in the action area. However, the adoption of industry-wide standards to reduce environmental impacts, and the shift away from resource extraction to a mixed manufacturing and technology based economy should decrease this influence over time. Continuing population increases with associated increased natural resource consumption, and residential and commercial development will cause localized degradation of freshwater and estuarine habitat. Concurrently, we expect peoples' environmental awareness and stewardship, and support of habitat restoration actions to continue increasing as well.

This will lead to localized improvements to freshwater and estuarine habitat. When these influences are considered collectively, we expect trends in habitat quality to remain stable or improve gradually over time. This will, at best, have positive influence on population A&P for the species affected by this consultation. In a worst cases scenario, we expect cumulative effects would have a relatively neutral effect on population abundance trends.

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 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 diminishes the value of designated or proposed critical habitat for the conservation of the species.

2.7.1 Species

Salmon and steelhead. The status of salmon and steelhead species addressed by this consultation varies from moderate risk (e.g., MCR steelhead) to high risk (e.g., endangered UCR spring-run Chinook salmon). These species have declined due to numerous factors, but the effects of freshwater habitat degradation have likely affected them all. This degraded status and environmental baseline is reflective of human development in the Pacific Northwest, and habitat improvement is identified by salmon and steelhead recovery plans as a priority for species recovery. We expect that cumulative effects will, at worst, have a neutral effect on population abundance trends. The NRCS' habitat conservation actions will be implemented to improve spawning and rearing habitat, improve fish passage and access to suitable habitat, and improve riparian function. Tidegate upgrades will reconnect estuaries, improving habitat function for salmonid smolts.

Individual salmon and steelhead will be harmed due to work area isolation and fish salvage, temporary exclusion from rearing habitat, exposure to increased suspended sediment concentrations, reduced forage availability, and exposure to herbicides. We estimated that 8,453 juvenile salmonids (169 adult equivalents) will be injured or killed each year for aggregated fish salvage events. With the assumption that these adult equivalents will be distributed evenly among each of the 217 independent populations occurring in Oregon and Washington, we estimate fish salvage projects will affect less than 1 adult equivalent per independent population per year. Fish salvage will likely affect more individuals than all of the other sources of harm combined. Thus, even in the aggregate of all individual projects, the small number of fish affected for any given population will not affect the VSP parameters at any of the ESU or DPS levels. With consideration of the impaired status of the populations, the environmental baseline, and expected cumulative effects in the action area, the number of ESA-listed fish that will be injured or killed under the proposed action will not affect the survival of the ESU's or DPS', or the species' probability of recovery.

Eulachon. Southern eulachon population abundance in the Columbia River has declined significantly since the early 1990s and there is little evidence to date of their returning to former population levels. There was an improvement in abundance during 2013-2015, but declines again in 2016 and 2017. Climate change impacts on ocean conditions is the most serious threat to the persistence of eulachon in all four subpopulations of the DPS, followed by climate change impacts on freshwater habitat and eulachon bycatch in offshore shrimp fisheries. Eulachon face the same degraded environmental baseline as salmon and steelhead, but the effects to species status appear more correlated with climate, especially in the ocean. Thus, in terms of cumulative effects, climate change, as a potential indirect result of continued human population growth, may play a larger role in eulachon recovery.

Individual eulachon, including eggs, will be harmed due to work area isolation and fish salvage, and by increased suspended sediment concentrations, though these events will be rare. These rare events, along with the small fraction of the local population that we expect could be harmed during any single event, led us to conclude that eulachon abundance, productivity, spatial structure or diversity would not be affected at the local population level. Even in the aggregate of all projects, eulachon abundance, productivity, spatial structure and diversity will not be affected at the sub-population level (i.e., the Columbia River sub-population). Therefore, even in consideration of the impaired status of the DPS, the environmental baseline, and expected cumulative effects, the number of eulachon that will be injured or killed under the proposed action will not affect the survival of the DPS, or the species' probability of recovery.

2.7.2 Critical Habitat

Salmon and steelhead.

The proposed action will cause adverse effects to the substrate, water quality, water quantity, floodplain connectivity, forage, natural cover, and migration obstruction attributes of the PBF's. These effects will be mostly short term. Those actions having long-term effects (bank armoring to protect infrastructure, roughened toes) will include compensatory mitigation, which will minimize those effects. Because there will be no decline in conservation value of critical habitat at the 6th field HUC scale, and most projects will have a neutral or positive benefit on PBF's in the long term, the conservation value of critical habitat at the designation scale will not be meaningfully decreased for any of the ESUs or DPSs.

Eulachon.

The proposed action will cause adverse effects to the water quality and substrate attributes of the PBF's. In most cases, these will be short-term, localized effects. Long-term effects will include spawning substrate impairment at a localized scale. These occurrences will be rare, and there is no indication that spawning habitat is a limiting factor for eulachon. Because effects at the watershed scale will be minimal, and effects will be confined to the Columbia River sub-population, the conservation value of critical habitat at the designation scale will not be meaningfully decreased.

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, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon, LCR Chinook salmon, UWR spring-run Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, HC summer chum salmon, CR chum salmon, LCR coho salmon, OC coho salmon, SONCC coho salmon, LO sockeye salmon, PS steelhead, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, and southern DPS eulachon, or destroy or adversely modify designated critical habitats.

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). For this consultation, we interpret “harass” as to “create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering”. 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

The NMFS determined that the proposed action is likely to cause harm to salmon, steelhead, and eulachon species considered in this opinion as a result of:

- Work area isolation and fish salvage
- Temporary exclusion from rearing habitat
- Short-term impacts to water quality (suspended sediments)
- Reduced forage availability
- Short-term impacts to water quality due to herbicide applications

Juvenile life stages are most likely to be affected, although adults will sometimes be exposed to certain effects (e.g., herbicide effects).

Work area isolation and fish salvage. Juvenile fish will be captured during work area isolation necessary to minimize construction-related disturbance of streambank and channel areas. Some of those fish will be injured or killed. It is possible to estimate a numeric amount of take.

In our effects section above, we estimated how many fish will be injured or killed each year, based on data from previous consultations, the number of projects the NRCS estimates they will authorize or fund each year, and some assumptions (e.g., stranding rates). We estimated that 3,251 salvaged fish will be injured or killed, including by delayed mortality, and an additional 5,202 will be killed by stranding. Thus, the threshold for reinitiating consultation is 8,453 juvenile salmonids per year. This juvenile estimate is 169 adult equivalents which we assumed will be distributed evenly among each of the 217 independent populations occurring in Oregon and Washington. Therefore, we estimated that fish salvage will affect less than 1 adult equivalent per independent population per year. Rounding up this estimate, the extent of take indicator for fish salvage by independent population will be one adult equivalent per year. In addition, we estimated that no more than one adult per independent population would be handled or harmed per year, which will serve as the extent of take indicator for these expected rare events.

Harm to eulachon during work area isolation and fish salvage events will be rare because their presence will typically not overlap in time or space with project effects. In the rare instances when eulachon are exposed to work area isolation and fish salvage, life stages could include eggs, larvae, or adults. Due to the limited data on eulachon, we did not attempt to estimate the number that will be harmed during isolation and fish salvage, but assumed that number for any given project would be a small fraction of the local population. Because we assume these will be rare events, there will not be enough projects affecting the same local population (i.e., river) in any year to meaningfully decrease abundance. In order to track this assumption, the threshold for reinitiating consultation will be met if adult eulachon are harmed or handled during fish salvage events on three projects affecting the same local population within a year.

Habitat-related Effects. Take caused by the habitat-related effects of this action cannot be accurately quantified as a number of fish because 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. These biotic and environmental processes interact in ways that may be random or directional and operate across far broader temporal and spatial scales than will be affected by the proposed action. Thus, the distribution and abundance of fish within each action area cannot be predicted precisely based on existing habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be harmed or harassed if their habitat is modified or degraded by the proposed action. In such circumstances, NMFS uses the causal link established between the activity and the likely changes in habitat conditions affecting the listed species to describe the extent of take as a numerical level of habitat disturbance.

Exclusion from rearing habitat

During worksite isolation, fish will be temporarily excluded from that habitat and a small number of those individuals will be harmed, for example, due to increased susceptibility to predation, or a reduced ability to obtain food necessary for growth and maintenance. The proposed action may be much localized (e.g., culvert replacement), or much larger in scope (e.g., channel reconstruction). Because we do not want to limit the scope of beneficial conservation and restoration projects, the extent of take is best identified by the maximum number of projects requiring worksite isolation and in-water construction in any given year, which we estimated in the effects section above will be 493 projects. Therefore, implementation of more than 493 projects per year that require worksite isolation and in-water construction is a threshold for reinitiating consultation.

Suspended sediment

Similar to the *exclusion from rearing habitat* threshold, the extent of take is best identified by the maximum number of projects requiring worksite isolation and in-water construction in any given year. Implementation of more than 493 projects per year that require worksite isolation and in-water construction is a threshold for reinitiating consultation.

In addition, we assume that an increase in suspended sediment (turbidity plume) will be visible for a distance downstream of construction, and that distance will be proportionate both to the size of the disturbance and to the width of the wetted stream and amount of tidal or coastal scour. Therefore, a further threshold for reinitiating consultation is a visible increase in suspended sediment:

1. More than 50 feet from the downstream-most construction disturbance in streams that are 30 feet wide or less.
2. More than 100 feet from the downstream-most construction disturbance in streams between 30 and 100 feet wide.
3. More than 200 feet from the downstream-most construction disturbance in streams greater than 100 feet wide.

4. More than 300 feet from the construction disturbance for areas subject to tidal or coastal scour.

If an exceedance of the appropriate threshold occurs, the project sponsor must modify the activity and continue to monitor every two hours. If an exceedance over the background level continues after the second monitoring interval, the activity must stop until the turbidity levels return to background. Exceeding either the total linear stream feet limit or any of the suspended sediment limits at the second monitoring interval for more than two projects a year will trigger the reinitiation provisions of this opinion.

Reduced Forage Availability

The best available indicator for the extent of incidental take associated with benthic habitat disturbance and riparian vegetation removal activities is the total length of stream and riparian habitat that will be modified each year. Thresholds for reinitiating consultation include (per Table 2):

1. More than 35 miles of stream are treated under *Stream Restoration and Management* activities.
2. More than 2,800 acres are treated by *Floodplain and Wetland Restoration and Management* activities.
3. More than 15 miles of stream or riparian zone are affected by *Road Maintenance, Erosion Control, and Decommissioning* activities.

Herbicides

For herbicide application, the extent of take is best identified by the total number of riparian (i.e., within 100 feet of surface water) acres treated each year. The NRCS shall reinitiate consultation if they treat more than 10 percent of riparian habitat acreage within a 6th-field HUC within a year.

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).

Full application of conservation measures included as part of the proposed action, together with use of the RPMs and terms and conditions described below, are necessary and appropriate to minimize the likelihood of incidental take of ESA-listed fish due to the proposed action.

The NRCS shall minimize incidental take by:

1. Ensuring that all projects fully implement the conservation measures described in this opinion, as appropriate.

2. Ensuring completion of a comprehensive monitoring and reporting program regarding all projects implemented under this programmatic and the extent of take indicators.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the NRCS or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The NRCS 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. The following terms and conditions implement RPM 1:
    a. Every action funded or authorized under this opinion will be administered by the NRCS consistent with the activity descriptions, conservation measures, and design report documentation identified in the proposed action.

2. The following terms and conditions implement RPM 2:
    a. The following notifications and reports shall be submitted to NMFS for each project to be completed under this opinion. Notifications and reports are to be submitted electronically to NMFS at nrcs.wcr@noaa.gov.
        i. PNF at least 30-days before start of construction (Appendix 1).
        ii. PCF within 60-days of end of construction (Appendix 2).
        iii. Fish Salvage Form within 60-days of end of construction for any project requiring work area isolation with fish salvage (Appendix 3).
    b. The NRCS shall provide an annual monitoring report to NMFS which summarizes the projects implemented under this programmatic during the past year. The report will include the following information:
        i. The number of projects implemented by category and activity type.
        ii. For at least the first three years of programmatic implementation, a summary analysis to evaluate whether or not take thresholds identified in this ITS were exceeded. If thresholds are not being exceeded, NMFS and NRCS can decide on the frequency of subsequent summary analyses.
        iii. For at least the first three years of programmatic implementation, a summary analysis showing that projects were not concentrated within the range of any single population or ESU, which could lead to larger effects to abundance, productivity, spatial structure, or diversity than what were analyzed in our jeopardy analysis. If no evidence of project concentration, NMFS and NRCS can decide on the frequency of subsequent summary analyses.
    c. If requested, the NRCS will meet with NMFS to discuss the annual monitoring report and any actions that will improve conservation under this programmatic, or make the program more efficient or more accountable.

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). The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the NRCS:

- The effectiveness of some types of stream conservation and restoration actions are not well documented, partly because decisions about which actions deserve support do not always address the underlying processes that led to habitat impairment or loss. NMFS recommends that the NRCS prioritize funding or authorizing projects that address processes that limit fish recovery as identified in species' recovery plans.

Please notify NMFS if the NRCS carries out these recommendations so that we will be kept informed of actions that minimize or avoid adverse effects and those that benefit the listed species or their designated critical habitats.

2.11 Reinitiation of Consultation

This concludes formal consultation for the NRCS Oregon-Washington Conservation Program. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the 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 agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

NMFS does not anticipate the proposed action will result in take of SR sockeye salmon, southern DPS of green sturgeon, or SRKW.

2.12.1 SR Sockeye Salmon Determination

Within Washington, SR sockeye salmon are found only in the main-stem Columbia and Snake Rivers, and only in the main-stem Columbia River in Oregon. They use these rivers as migration corridors to and from natal habitat in Idaho. Columbia and Snake River reaches where SR sockeye salmon migrate are so large and flows so voluminous, that any conservation actions occurring in tributaries or even at the mainstem river margins would be discountable or insignificant to migrating fish. For example, a few fish could be exposed to some construction-generated suspended sediment, but it would be diluted so fast that exposure would be minimal, thus effects would be insignificant.

2.12.2 Southern DPS Green Sturgeon Determination

Two DPSs have been defined for green sturgeon: a northern DPS (spawning populations in the Klamath and Rogue rivers) and a southern DPS (spawners in the Sacramento River). The southern DPS of green sturgeon was listed as threatened in 2006, and includes all naturally-spawned populations of green sturgeon that occur south of the Eel River in Humboldt County, California. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea. Although it is commonly observed in bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, the distribution and timing of estuarine use are poorly understood.

Critical habitat for the southern DPS of green sturgeon was designated in 2009, and the designation includes coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington. Within the action area, this includes the lower Columbia River estuary and certain coastal bays and estuaries in Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) (USDC 2009).

Large estuaries are clearly important habitats for green sturgeon (Lindley et al. 2011). Southern green sturgeon subadults and adults may enter the action area for non-breeding, non-rearing purposes. Tagged adults and subadults in the San Francisco Bay Estuary occupied shallow depths during directional movements but stayed close to the bottom during non-directional movements, presumably because they were foraging in depths as shallow as 1.7 m (Kelly et al. 2007). However, information from fisheries-dependent sampling suggests that green sturgeon only occupy large estuaries during the summer and early fall, and would not be present during the in-water work period (Moser and Lindley 2007), which is generally late fall to spring in Oregon estuaries (ODFW 2008).

NMFS does not expect green sturgeon to be present in the vicinity of most of the actions covered by this opinion. Most restoration projects authorized or carried out under this opinion will occur in the upper reaches and tributaries of the larger rivers, or in riparian and wetland areas along the water's edge for estuarine and coastal areas. Green sturgeon congregate in deeper mid-channel areas. Potential projects in estuaries might include fish passage projects, such as tide gate removals, or the removal or setback of existing berms, dikes, and levees. While these projects may release a small amount of suspended sediment temporarily, the long-term effects on water quality are beneficial.

Because of their age, location, and life history, green sturgeon individuals are relatively distant from, and insensitive to, the effects of the actions described above, and those effects are unrelated to the principal factor for the decline of this species, i.e., the reduction of its spawning area in the Sacramento River. Adult and subadult green sturgeon are likely to be far less sensitive to suspended sediment and deposition than salmonids, and will not be present in the tributaries where the vast majority of the activities will occur. The NMFS is also reasonably certain that elevated suspended sediment concentrations will result in insignificant behavioral and physical responses in green sturgeon due to its higher tolerance of these effects, since green sturgeon usually inhabit much more turbid environments than salmonids.

NMFS believes that it is unlikely that green sturgeon will be encountered during work area isolation and fish salvage for implementation of these projects based on: 1) monitoring information from previous fish salvage operations associated with similar projects; 2) the large size of subadult and adult southern green sturgeon; and 3) the type and location of projects typically authorized or funded.

Effects to green sturgeon would primarily result from impacts associated with general disturbance related to in-water construction. However, green sturgeon are unlikely to occur in the vicinity of any projects implemented under this opinion, and are accustomed to the level of background activity associated with the proposed action. NMFS does not expect impacts to accrue from the other activities considered in this opinion.

Based on this analysis, NMFS finds that the effects of the proposed action are expected to be insignificant or discountable (depending on the project location), and thus are not likely to adversely affect the southern DPS of green sturgeon or their critical habitat.

2.12.3 Southern Resident Killer Whale Determination

SRKWs spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and typically move south into Puget Sound in early autumn (NMFS 2008a). Pods make frequent trips to the outer coast during this season. In the winter and early spring, SRKWs move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California, including coastal Oregon and off the Columbia River, although they do not have critical habitat designated in Oregon (NMFS 2008a).

No documented sightings exist of SRKWs in coastal bays, and there is no documented pattern of predictable Southern Resident occurrence along the outer coast, and any potential occurrence would be infrequent and transitory.

SRKWs primarily eat salmon and prefer Chinook salmon (Hanson et al. 2010; NMFS 2008a). The program proposed by NRCS will decrease the number of juvenile salmon, but by such small numbers that the effect on adult equivalent prey resources for SRKW will be insignificant. Other effects described in Section 2.5 above will be discountable for SRKW and their 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 NRCS and descriptions of EFH for Pacific Coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council (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 proposed project action area includes EFH for various life-history stages of groundfish, coastal pelagic species, Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), and PS pink salmon (*O. gorbuscha*). Habitat areas of particular concern within the action area include estuaries, marine and estuarine submerged aquatic vegetation, complex channel and floodplain habitat, and spawning habitat.

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided in the BA, associated communications, and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will adversely affect EFH designated for Chinook and coho salmon.

Specifically, NMFS has determined that the action will adversely affect EFH in the short-term as follows:

1. Exclusion from rearing habitat.
2. Water quality will be affected by increases in suspended sediments and herbicides.
3. Removal of riparian vegetation will decrease cover and allochthonous input (potential forage).
4. In-water activities will disturb, displace, and kill aquatic invertebrates (forage).

The proposed action will also result in long-term benefits to EFH, including improved access to, and function of estuarine areas through improved tide gate installations. Improved fish passage in freshwater will allow more access to spawning and rearing habitat. Enhanced riparian zones will provide shade, overhead cover, and allochthonous input, and reduce fine sediment delivery. Some projects will also result in slightly higher in-stream flows. The long-term result will be improved EFH in many localized areas.

3.3 Essential Fish Habitat Conservation Recommendations

We provide the following conservation recommendation:

> The effectiveness of some types of stream conservation and restoration actions are not well documented, partly because decisions about which actions deserve support do not always address the underlying processes that led to habitat loss. NMFS recommends that

the NRCS prioritize funding or authorizing projects that address habitat issues that limit fish recovery, for example as identified in PFMC (2014) and in species' recovery plans.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the federal agency 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 (OMB), 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 NRCS 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 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 user of this opinion is the NRCS. Individual copies of this opinion were provided to the NRCS. This opinion will be posted on the Public Consultation Tracking System website (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' OMB Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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Appendix I – Project Notification Form

PROJECT NOTIFICATION FORM INSTRUCTIONS

Instructions for NRCS (Action Agency)

Contact NMFS (see the list of NMFS AREA OFFICE CONTACTS FOR PROJECT IMPLEMENTATION UNDER THE NRCS CONSERVATION PROGRAMMATIC on the previous two pages for contact information). We suggest you call first before submitting a Project Notification Form (PNF), because contacts and their emails will change over the course of this programmatic.

NRCS must submit a completed PNF for each project to be implemented under this programmatic, 30 days prior to start of work.

- Obtain documentation of approval from the NMFS engineer via email and submit with the PNF, if the project requires early NMFS review.
- Identify the expected project effects to listed species and their habitat, and how these effects will be minimized (in words specific to your project; please do not just list reference pages in the biological opinion), in the project description box.
- Describe the proposed change, and how potential effects to species or habitat will be consistent with all effects considered in the biological opinion, for Minor Project Modification requests.
- **When applicable, specify "Minor Project Modification Request" in the email subject line when submitting the form to NMFS.**
- Email the form (and a copy of the NMFS engineer's early review certification, when applicable) to nrcs.wcr@noaa.gov.

The PNF will be returned as invalid, if the form is not fully completed.

Instructions for NMFS Programmatic Administrator

Return the PNF as invalid, if the form is not fully completed.

Log the project into PCTS, upon receipt of the PNF.

Check every form to see if there is a Minor Project Modification Request. Forward the PNF to the appropriate branch chief (based on the project location). Inform the branch chief if there is a Minor Project Modification request, and remind him or her to respond to the request by a specified date (10 days after NMFS' receipt of the PNF).

Make sure the email subject line states "Minor Project Modification Request" when applicable.

Instructions for NMFS Branch Chief

Email responses to Minor Project Modification requests to NRCS within 10 business days of NMFS' receipt of the request (the NMFS Programmatic Administrator will provide the due date). If no response is sent, the request is accepted by default.

Copy the NMFS Programmatic Administrator on email responses to Minor Project Modification requests.

Review the project description. Contact the NRCS within 10 business days of NMFS receipt of the PNF, if you have concerns about the project.

Project Notification Form (PNF)[1]

Oregon and Washington NRCS Conservation Programmatic Implementation[2]

See instructions on last page

USFWS TRACKING #: 01EOFW00-2017-F-0501	NMFS TRACKING #: WCR-2017-7216

Date of Request			
Statutory Authority	☐ ESA-Only	☐ EFH-Only	☐ ESA & EFH Combined
NRCS Contact Information	**Field Office:**	**Name:**	
	Phone:	**Email:**	
NMFS Branch Office and Contact Information	**Branch Office:**	**Name:**	
	Phone:	**Email:**	
Project Name			
6th field HUC (12-digit) & Name			
Latitude/Longitude (WGS84)			
Proposed Construction Period	**Start Date:**	**End Date:**	
Are work area isolation and fish salvage anticipated?	☐ **Yes**	☐ **No**	
Proposed length of stream to be treated under Stream Restoration and Management activities (feet):	______________ **feet**	☐ **N/A**	
Proposed number of acres to be treated under Floodplain and Wetland Restoration and Management activities:	______________ **acres**	☐ **N/A**	
Proposed acres of herbicide application within 100 feet of surface water for each 6th field HUC:	______________ **acres**	☐ **N/A**	

☐	Early NMFS review required (see Type of Action and NMFS Review Requirements below). Attach early review certification and submit with the PNF (see end of form for list of NMFS contacts).

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[1] NRCS must submit the completed form to nrcs.wcr@noaa.gov 30 days prior to starting work.
[2] Upon receipt of this form, if NMFS does not respond within 10 business days, the project (including either of the minor project modification requests) is automatically approved.

<u>Project Description</u>

Identify the expected project effects to listed species and their habitat, and how these effects will be minimized (in words specific to your project; please do not just list reference pages in the biological opinion).

Minor Project Modifications *Check the appropriate box if requesting a Minor Project Modification.*			
☐	Variance to the timing of in-water work	☐	Location of staging/refueling area where applicant cannot meet the required distance due to site constraints
Justification for Minor Project Modification Request *1) Tell why the minor project modification is necessary* *2) Describe how the effects of the modification will either provide a conservation benefit or, at a minimum, will not cause additional adverse effects beyond those analyzed in the biological opinion:*			

Category & Subcategory of Activity (Check all that apply)

Agriculture
- ☐ Erosion Control
- ☐ Irrigation
- ☐ Pesticide
- ☐ Roads
- ☐ Water Diversion Fish Screen

Forestry
- ☐ Prescribed Burning
- ☐ Vegetation (Juniper tree removal)

Restoration
- ☐ Estuary
- ☐ Fish Passage
- ☐ Riverine
- ☐ Marshes (saltwater)
- ☐ Wetland (freshwater)

Transportation
- ☐ Bridge
- ☐ Culvert
- ☐ Road/Highway

Waterway
- ☐ Channel Reconstruction
- ☐ Dam
- ☐ Streambank Stabilization
- ☐ Wetland

<u>Type of Action and NMFS Review Requirements</u>: *Check the Activities that are proposed.*

Category		Activities	Requirements for NMFS Review
Fish Passage Restoration	☐	Structure Removal	Greater than 3 vertical feet of grade control proposed in engineering design
	☐	Irrigation Diversion Improvement	Complete Replacement
			Water operation modification affecting fish passage
			Point of diversion is moved
			Greater than 3 vertical feet of grade control proposed in engineering design
	☐	Headcut and Grade Stabilization	Structures, roughened channels and grade control structures with greater than 3 vertical feet of grade control proposed in engineering design
	☐	Fish Passage at Existing Structure	All projects except maintenance of existing structures
	☐	Bridge and Culvert Removal or Replacement	No review required
	☐	Stream Crossing Improvement	No review required
Tide and Flood Gate Removal, Replacement, or Retrofit	☐	Tide and Flood Gate Removal, Replacement, or Retrofit	All projects require review
Stream, Floodplain, and Wetland Restoration and Management	☐	Restore Wetlands and Secondary Channels	No review required
	☐	Setback or Removal of Existing Berms, Dikes, and Levees	No review required
	☐	Bioengineering for Streambank Protection	No review required
	☐	Stream Habitat Improvement with Natural Materials	No review required
	☐	Riparian and Wetland Vegetation Planting	No review required
	☐	Fluvial Channel Reconstruction	All projects require review
	☐	Beaver Dam Analogues	All projects require review
Vegetation Management	☐	Physical Co9	No review required
	☐	Herbicide	No review required
	☐	Juniper Tree Removal	No review required
	☐	Prescribed Burning	No review required
Road Maintenance, Erosion Control, and Decommissioning	☐	Road Maintenance and Erosion Control	No review required
	☐	Road Decommissioning	No review required
Irrigation and Water Delivery and Management	☐	Irrigation Efficiency Improvement	No review required
	☐	Water Conveyance Improvement	No review required
	☐	Conversion of Instream Diversions to Groundwater Wells	No review required
	☐	Irrigation Water Siphons	No review required
	☐	Livestock Watering Facilities	No review required
	☐	Fish Screens	Fish screens for surface water diversion by gravity or by pumping at a rate exceeding 3 cfs.
	☐	Pump Station Diversions	No review required

<u>Species/Critical Habitat/EFH Species Present in Action Area:</u> *Check (X) the relevant boxes for the species, critical habitats (CH), and/or essential fish habitat (EFH) present in the project action area:*

Listed Species*	Species Presence	Critical Habitat	EFH Species
NRCS' Effect Determination for species below are LAA (Species)/LAA (CH); NMFS' Final Determinaton is LAA (Species)/LAA (CH).			
PS Chinook salmon	☐	☐	☐ Salmon, Chinook
LCR Chinook salmon	☐	☐	☐ Salmon, coho
UWR spring-run Chinook salmon	☐	☐	☐ Salmon, Puget Sound pink
UCR spring-run Chinook salmon	☐	☐	☐ Coastal Pelagics
SR spring/summer-run Chinook salmon	☐	☐	☐ Groundfish
SR fall-run Chinook salmon	☐	☐	
HC summer-run chum salmon	☐	☐	
CR chum salmon	☐	☐	
LCR coho salmon	☐	☐	
OC coho salmon	☐	☐	
SONCC coho salmon	☐	☐	
LO sockeye salmon	☐	☐	
NRCS' Effect Determination for species below are LAA (Species)/LAA (CH); NMFS' Final Determinaton is NLAA (Species)/NLAA (CH).			
SR sockeye salmon	☐	☐	
PS steelhead	☐	☐	
LCR steelhead	☐	☐	
UWR steelhead	☐	☐	
MCR steelhead	☐	☐	
UCR steelhead	☐	☐	
SRB steelhead	☐	☐	
Southern DPS eulachon	☐	☐	
NRCS' Effect Determination for species below are NLAA (Species)/NLAA (CH); NMFS' Final Determinaton is NLAA (Species)/NLAA (CH).			
Southern green sturgeon	☐	☐	
Southern resident killer whale	☐	☐	

* PS=Puget Sound, LCR=Lower Columbia River, UWR=Upper Willamette River, UCR=Upper Columbia River, SR=Snake River, HC=Hood Canal, CR=Columbia River, OC=Oregon Coast, SONC=Southern Oregon/Northern California, LO=Lake Ozette, DPS=Distinct Population Segment, LAA=Likely to Adversely Affect, NLAA=Not Likely to Adversely Affect.

NMFS AREA OFFICE CONTACTS FOR PROJECT IMPLEMENTATION UNDER THE NRCS CONSERVATION PROGRAMMATIC

Email Project Notification Forms (PNF), Project Completion Forms (PCF), and Fish Salvage Forms (FSF) to: nrcs.wcr@noaa.gov

NMFS Engineers

Aaron Beavers
1201 NE Lloyd Boulevard, Suite 1100
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aaron.beavers@noaa.gov

Jeff Brown
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jeffrey.brown@noaa.gov

NMFS Oregon-Washington Coastal Offices

<u>Oregon Coast Branch [Roseburg, OR]</u>
Ken Phippen, Chief
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Interior Columbia Basin Offices

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Northern Snake Branch [Boise, ID] (e.g. covers the Palouse, Asotin, and Tucannon Drainages)
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Southern Snake Branch [Boise, ID] (e.g. covers the Grande Ronde and Imnaha Drainages)
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Appendix II – Project Completion Form

Project Completion Form (PCF)

Oregon and Washington NRCS Conservation Programmatic Implementation

Within 60 days of completing all work below ordinary high water mark (OHWM) as part of a project completed under this programmatic, submit this completed form to NMFS at: nrcs.wcr@noaa.gov

Start and End Dates of In-water Work:	***Start***:	***End***:
Did work area isolation and fish salvage occur? If yes, submit the Fish Salvage Form.	☐ Yes	☐ No
What was the as-built length of stream treated under Stream Restoration and Management activities (feet):	_____________ feet	
Number of acres treated under Floodplain and Wetland Restoration and Management activities:	_____________ acres	
Acres of herbicide application within 100 feet of surface water for each 6th field HUC:	_____________ acres	
Was a turbidity plume visible beyond the thresholds identified in the Incidental Take Statement (ITS) of the biological opinion?	☐ Yes Describe below the steps taken to reduce the turbidity plume back to pre-threshold levels (per the ITS).	☐ No
Steps taken to reduce the turbidity plume:		

Appendix III – Fish Salvage Form

Fish Salvage Form (FSF)

Oregon and Washington NRCS Conservation Programmatic Implementation

Within 60 days of completing a fish salvage event under the NRCS Conservation Programmatic, submit this completed form to NMFS at: nrcs.wcr@noaa.gov

Project Name:	
Date(s) of Fish Salvage Operation(s):	
Supervisory Fish Biologist:	
Affiliation and Address:	
Phone Number and email:	

Describe methods that were used to isolate the work area, and to remove and relocate fish. Also, please note what you would do different next time to minimize effects to fish:

Fish Salvage Data

Date:	
Project Name:	
Stream Name:	
6th field Hydrologic Unit Code (HUC):	
State (OR or WA):	
Water Temperature:	
Air Temperature:	
Time of Day:	

ESA-Listed Species[1]	**Number Handled**		**Number Injured**		**Number Killed**	
	Juvenile	**Adult**	**Juvenile**	**Adult**	**Juvenile**	**Adult**
Lower Columbia River Chinook salmon						
Upper Columbia River spring-run Chinook salmon						
Snake River spring/summer run Chinook salmon						
Snake River fall-run Chinook salmon						
Puget Sound Chinook salmon						
Hood Canal summer-run chum salmon						
Columbia River chum salmon						
Lower Columbia River coho salmon						
Lower Columbia River steelhead						
Middle Columbia River steelhead						
Upper Columbia River steelhead						
Snake River Basin steelhead						
Puget Sound steelhead						
Lake Ozette sockeye salmon						
Eulachon						
Unidentified salmon						
Unidentified steelhead/rainbow trout						
Unidentified Salmonidae						

[1] Fish should be identified to the degree possible. When the Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS) species is in doubt, enter the numbers in one of the last 3 rows of the table.