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

November 30, 2016

Heather Medina Sauceda
Acting Assistant State Conservationist for Programs
Natural Resource Conservation Service
1201 NE Lloyd Blvd.
Portland, Oregon 97232

Re: Endangered Species Act section 7 responsibilities for the South Yamhill River Bridge Replacement Project

Dear Ms. Sauceda:

Your agency has inquired about its Endangered Species Act section 7 responsibilities with respect to the South Yamhill River Bridge replacement project and, in particular, the applicability of an existing programmatic section 7 consultation we completed with the Federal Highways Administration (FHWA) to that project.

Our programmatic consultation with FHWA covers certain transportation projects funded by FHWA and typically carried out by the Oregon Department of Transportation. Our understanding is that FHWA will cover the proposed South Yamhill River Bridge replacement project under this programmatic consultation. In a programmatic biological opinion dated November 28, 2012 (refer to the Federal Aid Highway Program opinion, NMFS No. NWR-2011-2095), we concluded that the FHWA program, as proposed, was not likely to jeopardize the continued existence of 17 anadromous fish species or result in the destruction or adverse modification of designated critical habitat for those species.

The Natural Resource Conservation Service (NRCS) owns a Wetland Reserve Program conservation easement on both sides of the South Yamhill River Bridge. NRCS proposes to approve a modification of the easement rights to allow the Oregon Department of Transportation to replace the bridge. This is purely an administrative action that will have no additional impacts on listed species or critical habitat. Consequently, all effects on listed species and critical habitats from the proposed bridge replacement have been analyzed in our 2012 programmatic biological opinion to FHWA. We have considered whether any additional Reasonable and Prudent Measures or Terms and Conditions would be necessary and appropriate in relation to the Natural Resource Conservation Service. We have concluded that the answer is no; the Reasonable and Prudent Measures and Terms and Conditions set out in the Incidental Take Statement in relation to the FHWA are equally applicable to the Natural Resource Conservation Service and no additional measures or conditions are necessary or appropriate.

The programmatic biological opinion to the FHWA is enclosed, including the Incidental Take Statement. If you have questions regarding this consultation, please contact Marc Liverman, Chief, Willamette Branch, at (503) 231-2336 or marc.liverman@noaa.gov.

Sincerely,

Marc Liverman /for

Kim W. Kratz
Assistant Regional Administrator
Oregon Washington Coastal Office

Enclosure: November 28, 2012 Federal Aid Highway Program opinion

cc: Karen Fullen, NRCS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to NMFS No:
2011/02095

November 28, 2012

Phillip Ditzler
Oregon Division Administrator
Federal Highways Administration
530 Center Street, Suite 420
Salem, Oregon 97301

Re: Endangered Species Act Programmatic Biological Opinion and Magnuson-Stevens Act Essential Fish Habitat Response for the Federal-Aid Highway Program in the State of Oregon

Dear Mr. Ditzler:

The enclosed document contains a programmatic biological opinion (opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the Oregon Division of the Federal Highways Administration's proposal to use the Federal Aid Highway Program to fund, in whole or in part, capital improvements of the transportation system in the State of Oregon, including aquatic habitat restoration and fish passage projects, through a system of Federal grants that are apportioned by legislative formulas, at the discretion of the FHWA, or by Congressional earmark, as governed by Title 23 of the United State Code.

During this consultation, NMFS concluded that the proposed program and projects funded under that program are not likely to adversely affect the Eastern distinct population segment of Steller sea lions (*Eumetopias jubatus)* or southern resident killer whales (*Orcinus orca*). Steller sea lions and southern resident killer whales do not have critical habitat designated in the program action area. NMFS also concluded that the proposed program is not likely to jeopardize the continued existence of the following 17 species, or result in the destruction or adverse modification of their designated critical habitats, except for LCR coho salmon, for which critical habitat has not been proposed.

1. Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*)
2. Upper Willamette River (UWR) Chinook salmon
3. Upper Columbia River (UCR) spring-run Chinook salmon
4. Snake River (SR) spring/summer run Chinook salmon
5. SR fall-run Chinook salmon
6. Columbia River (CR) chum salmon (*O. keta*)
7. LCR coho salmon (*O. kisutch*)
8. Oregon Coast (OC) coho salmon
9. Southern Oregon/Northern California Coasts (SONCC) coho salmon
10. SR sockeye salmon (*O. nerka*)
11. LCR steelhead (*O. mykiss*)

12. UWR steelhead
13. MCR steelhead
14. UCR steelhead
15. Snake River Basin (SRB) steelhead
16. Southern green sturgeon (*Acipenser medirostris*)
17. Eulachon (*Thaleichthys pacificus*)

As required by section 7 of the ESA, NMFS is providing an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this program. The ITS also sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal action agency must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of the listed species considered in this opinion, including eulachon.

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

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

Please direct questions regarding this opinion to Marc Liverman, Central Oregon Branch Chief, in the Oregon State Habitat Office (503.231.2336).

Sincerely,

Michael Tehan for

William W. Stelle, Jr.
Regional Administrator

cc: Cidney Bowman, NOAA Liaison, Oregon Department of Transportation
Cindy Callahan, Federal Highways Administration
Tom Loynes, NOAA Liaison, Oregon Department of Transportation
Paul Wirfs, Geo-Environmental Section, Oregon Department of Transportation

Endangered Species Act Programmatic Biological Opinion
and
Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Response
for the

Federal-Aid Highway Program in the State of Oregon

NMFS Consultation No.: 2011/02095

Action Agency: Oregon Division, Federal Highway Administration

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?
Lower Columbia River Chinook salmon	T	Yes	No	No
Upper Willamette River 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	N/A
Oregon Coast coho salmon	T	Yes	No	No
Southern Oregon/Northern California coasts coho salmon	T	Yes	No	No
Snake River sockeye salmon	E	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	Yes	No	No
Eulachon	T	Yes	No	No
Steller sea lion	T	No	N/A	N/A
Sothern Resident Killer Whale	E	No	N/A	N/A

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

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Issued By:

for William W. Stelle, Jr.
Regional Administrator

Date: November 28, 2012

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LIST OF ACRONYMS

BMP	Best Management Practice
CFR	Code of Federal Regulations
cfs	cubic foot per second
CHART	Critical Habitat Analytical Review Team
CMZ	Channel migration zone
dB	Decibel
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FAHP	Federal-aid Highway Program
FHWA	Federal Highway Administration
FR	Federal Register
HAPC	Habitat Area of Particular Concern
HUC	Hydraulic Unit Code
LCR	Lower Columbia River
MCR	Middle Columbia River
MSA	Magnuson Stevens Act
NMFS	National Marine Fisheries Service
NOAARC	NOAA Restoration Center
OHW	Ordinary High Water
PAH	Polycyclic aromatic hydrocarbons
PCE	Primary constituent element
Re: 1µPa	Reference 1 MicroPascal
RPM	Reasonable and prudent measure
SEL	Sound exposure level
SR	Snake River
SRB	Snake River Basin
STIP	Statewide Transportation Improvement Plan
TRT	Technical Review Team
UCR	Upper Columbia River
U.S.C.	United States Code
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WLC	Willamette/Lower Columbia

GLOSSARY

For purposes of this consultation --

Abutment means part of a bridge structure that supports the end of a span and often supports and retains the approach embankment.

Active channel width means the stream width measured perpendicular to stream flow between the ordinary high water lines, or at the channel bankfull elevation if the ordinary high water lines are indeterminate. This width includes the cumulative active channel width of all individual side- and off-channel components of channels with braided and meandering forms, and measure outside the area influence of any existing stream crossing, e.g., five to seven channel widths upstream and downstream. Compare bankfull width – bankfull width is typically measured between bankfull elevations and therefore is wider than active channel width.

Bankfull discharge means the streamflow level when the water just begins to leave the channel and spread onto the floodplain; an event that returns approximately every 1.1 to 1.2-years in western Oregon, and every 1.4 to 2.6-years in eastern Oregon.

Bankfull elevation means the elevation at which a stream first reaches the top of its natural banks and overflows, and is indicated by the topographic break from a vertical bank to a flat floodplain or the topographic break from a steep slope to a gentle slope.

Bankfull width means the stream width measured perpendicular to stream flow between the bankfull elevations. Compare active channel width – bankfull width is typically measured between ordinary high water marks and therefore narrower than active channel width.

Bent means part of a bridge substructure that supports a vertical load and is placed transversely to the length of a structure; an end bent is the supporting frame forming part of an abutment.

Best management practice means those practices, such as schedules of activities, treatment requirements, prohibitions of practices, and maintenance procedures that result in the best practical environmental outcome by avoiding or reducing the discharge of pollutants or other adverse environmental impacts.

Biofiltration means the use of amended soils, compost, and vegetation to remove pollutants from stormwater by maximizing contact between the stormwater and vegetation and media. Biofiltration is used in flow-through treatment systems, such as bio-swales and amended soil filter strips, and in facilities that pond the stormwater, also known as bioretention facilities.

Bioretention means the use of biofiltration to remove pollutants from stormwater in facilities that retain water for cycling primarily through evapotranspiration, though underdrains may be used to disperse treated water.

Bioslope, or ecology embankment, means a linear flow-through stormwater runoff treatment facility that can be sited along highway side-slopes, medians, borrow ditches, or other linear depressions, and consists of four basic components: a gravel no-vegetation zone, a vegetated filter strip, the ecology-mix bed, and a gravel-filled underdrain trench.

Bridge means a structure including supports erected over a depression or an obstruction, such as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20-feet between under copings of abutments or spring lines of arches, or extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

Capital improvement means the addition of a permanent structural improvement or the restoration of some aspect of a transportation feature to increase its function or useful life.

Channel migration zone means the area where a stream or river is susceptible to channel erosion, and often include typically encompass floodplains and some portions of terraces.

Channel-forming discharge, see bankfull discharge.

Contraction scour, in a natural channel or at a bridge crossing, means erosion of material from the bed and banks across all or most of the channel width. This component of scour results from a contraction of the flow area at the bridge which causes an increase in velocity and shear stress on the bed at the bridge. The contraction can be caused by the bridge or from a natural narrowing of the stream channel.

Contributing impervious area means all impervious surfaces associated with pubic highways, roads, streets, roadside areas, and auxiliary features (*e.g.*, rest areas, roadside parks, viewpoints, heritage markers, park and ride facilities, pedestrian and bicycle facilities) that occur within the project area, or are contiguous to the project area, and that discharge runoff into the project area, before being discharged directly or indirectly into a stream, wetland, or subsurface water through a ditch, gutter, storm drain, dry well, other underground injection system.

Culvert means a structure, as distinguished from bridges, with a span of less than 20-feet measured perpendicular to the centerline of the hydraulic opening that is usually covered with embankment, including pipes, arches, box culverts, and rigid frames.

Design life means the projected life (in years) of a new structure or structural component under normal loading and environmental conditions before replacement or major rehabilitation is expected.

Discharge facility means the end post-treatment runoff conveyance that discharges to an upland, a regulated water body, a wetland, or an underground injection control.

Earthwork means excavation, ditching, backfilling, embankment construction, augering disking, ripping, grading, leveling, borrow, and other earth-moving work.

Effective discharge, see bankfull discharge.

Effectively isolated from the active stream means an area that is inaccessible to fish and does not allow a visible release of pollutants or sediment into the water.

Entrenchment ratio means the ratio between the flood prone width and bankfull channel width; streams with a ratio that is less than 1.4 have a relatively small floodplain while streams with a ratio greater than 2.2 have high floodplain connectivity.

Fish capture and removal means capturing fish inside an area that is to be isolated from the active stream and releasing them in a safe place.

Fishery biologist means a person that has an ecological education, thorough knowledge of aquatic biology and fish management, and is professionally engaged in fish research or management activities; a supervisory fishery biologist is professionally responsible for the supervision of biologists and technical staff engaged in fish research or management.

Flood frequency zone means an area that has a probability of flooding, expressed as an average interval in years.

Flood prone area means the active floodplain and the low terrace, and is often estimated to be at an elevation equal to (a) two times the maximum bankfull depth, (b) three times the average bankfull depth, or (c) 2.2 times the average bankfull width.

Flood prone width means the horizontal distance along transect, measured perpendicular to stream flow, from the flood prone elevation on one side of the floodplain to flood prone elevation on the opposite side of the floodplain.

Functional floodplain means an area that is interconnected with the main channel through physical and biological processes such as periodic inundation, the erosion, transport and deposition of bed materials, nutrient cycling, groundwater recharge, hyporheic flows, the production and transport of large wood, aquatic food webs, and fish life history. Together, these processes interact to create and maintain geomorphic features such as alcoves, backwaters, backwater deposits, braided channels, flooded wetlands, groundwater channels, meander scrolls, natural levees, overflow channels, oxbows or oxbow lakes, point bars, ponds, sand splays, side channels, and sloughs, although these features may be difficult to distinguish on smaller streams, where floodplain deposits are subject to rapid removal and alteration. These permanent or intermittent geomorphic features are extensions of the main stream channel and are critical to the survival and recovery of ESA-listed salmon and steelhead. The functional floodplain area is often assumed to be coincident with the flood prone area, if the entrenchment ratio is less than 2.2, or 2.2 times the active channel width if entrenchment ratio is greater than 2.2. This area may also be reduced by the presence of geomorphic features, flow regulation, or encroachment of built infrastructure.

General scour means a lowering of the streambed across the stream or waterway at the bridge. This lowering may be uniform across the bed or non-uniform. That is, the depth of scour may be deeper in some parts of the cross section. General scour may result from contraction scour which involves removal of material from the bed across all or most of the channel width (see above), or other general scour that may cause a non-uniform lowering of the bed due to conditions such as changes in flow around a bend, at the confluence of two tributaries, downstream of a bar or island, or short-term (daily, weekly, yearly, or seasonal) changes in the downstream water surface elevation that control backwater.

General scour depth, or general scour elevation, means a cross section reference line showing the probable vertical distance that a streambed will be lowered by general scour below a reference elevation during the scour design discharge or scour check discharge, whichever is more severe, including commonly accepted minimum safety factors.

General scour prism means all floodplain, bank, and streambed material above the general scour depth or general scour elevation.

Hazardous material means any chemical or substance which, if released into an aquatic habitat, could harm fish, including, but not limited to, petroleum products, radioactive material, chemical agents, and pesticides.

Heavy-duty vehicles and equipment means vehicles or equipment that are designed primarily for carrying out construction tasks, most often involving earth moving.

Infiltration means the flow or movement of water through the soil surface and into the ground.

In-water work includes any part of an action that occurs within the wetted channel when water is present, e.g., excavation of streambed materials, fish capture and removal, flow withdrawal, streambank protection, and work area isolation.

Large wood means a tree, log, rootwad, or engineered logjam that is large enough to dissipate stream energy associated with high flows, capture bedload, stabilize streambanks, influence channel characteristics, and otherwise support aquatic habitat function, given the slope and bankfull channel width of the stream in or near which the wood occurs.

Local scour means removal of material from the channel bed or banks which is restricted to a relatively minor part of the width of a channel, such as scour in a channel or on a floodplain that is localized at a pier, abutment, or other obstruction to flow. Local scour is caused by the acceleration of the flow and the development of a vortex system induced by the obstruction to the flow and does not include the additional scour caused by any contraction, natural channel degradation, or bendway.

Low impact development means to site design to minimize stormwater runoff based on natural features and decentralized, micro-scale controls that intercept, evaporate, transpire, filter, or infiltrate precipitation to avoid or minimize off-site discharge.

Maintenance means to perform work on a planned, routine basis, or to respond to specific conditions and events, as necessary to maintain and preserve the condition of a transportation feature at an adequate level of service.

Meander scroll means an arc-shaped feature that can occur on either side of meander bends but are common on the concave side of bends formed as the channel migrated laterally down valley and toward the concave bank.

Modernization means projects that typically add function by increasing capacity or making other improvements consistent factors like safety, multimodal and intermodal integration, congestion.

Natural levee means raised berms or crests above the floodplain surface beside the channel, usually containing coarser materials deposited as flood flows over the top of the stream bank - more frequently found on concave banks; where most of the sediment load in transit is fine grained, natural levees may be absent or nearly imperceptible.

Ordinary high water elevation means the elevation to which the high water ordinarily rises annually in season, excluding exceptionally high water levels caused by large flood events.

Ordinary high water is indicated in the field by one or more of the following physical characteristics: (a) a clear natural line impressed on the bank or shore; (b) destruction of terrestrial vegetation; (c) change in vegetation from riparian to upland; (d) textural change of depositional sediment or changes in the character of the substrate, e.g., from sand to cobbles, or alluvial material to upland soils; (e) the elevation below which no needles, leaves, cones, seeds, or other fine debris occurs; (f) the presence of litter and debris, water-stained leaves, water lines on tree trunks; or (g) other appropriate means that consider the characteristics of the surrounding areas. The ordinary high water elevation is typically below the bankfull elevation. The ordinary high water elevation is considered equivalent to the bankfull elevation if the ordinary high water lines are indeterminate.

Oregon climate zones means climate zones as determined by the Oregon Climate Service, Oregon State University, Corvallis.

Oxbow, or oxbow lake, means the cutoff portion of a stream meander bend.

Partially spanning weir means a low-profile structure consisting of loosely arranged boulders that does not exceed 25% of the cross-sectional area of the low flow channel; used to protect streambanks by redirecting the flow away from the bank, increase aquatic habitat diversity, and provide refuge for fish during high flows.

Pavement expansion means total rebuilding of the pavement and subgrade of an existing roadway and construction of additional through travel lanes or, in some cases, construction of an entirely new roadway on a new alignment. The existing roadway may or may not be rebuilt. Substantial new or additional right of way may be required, and horizontal alignment may change such that the old and new right-of-way are no longer contiguous.

Pavement preservation means actions to maintain or rehabilitate pavement in good condition and before the onset of serious damage, including routine and preventative maintenance and minor rehabilitation using non-structural enhancements to correct age-related, top-down surface cracking due to environmental exposure.

Pavement reconstruction means replacement of the entire pavement structure by the placement of equivalent of increased pavement structure. Major elements may include flattening of hills and grades, improvement of curves, and widening of the roadbed. Normally, this either changes the location of the existing subgrade shoulder points, or removes all of the existing pavement and base course 50% or more of the project length. Additional right-of-way is normally required.

Pavement replacement means structural improvement to the subgrade of an existing roadway, or removal of the total thickness of all existing layers of concrete and asphalt paving from an existing roadway and providing a new paved surface without changing the subgrade or location of shoulder points. This generally does not improve capacity or geometrics, or increase roadbed width. Additional right-of-way is not normally required.

Pavement resurfacing means placing a new surface, or overlay, on an existing roadway to provide a better all-weather surface, a better riding surface, and to extend or renew the pavement life. The overlay must be placed directly on top of existing pavement, with no intervening base course, no change in the subgrade shoulder points, and no improvement in capacity or geometrics. Resurfacing may include some elimination or shielding of roadside obstacles, culvert replacements, signals, marking, signing and intersection improvements.

Pile, or piling, means a long column driven into the ground to form part of a foundation or substructure.

Point bar means areas of deposition typically on the concave side of river curves.

Preconstruction means all surveying activities necessary to plan the work required to complete the action.

Preservation means to restore a transportation feature that is still in good condition to almost original condition.

Rehabilitation means projects that restore a transportation feature that is encountering age-related deterioration when total replacement is not warranted – "minor rehabilitation" is non-structural improvement to extend service life and is similar to preservation; "major rehabilitation" means structural repair, replacement, or improvement to extend service life or increase capacity of a transportation feature after its usefulness has become limited by structural deficiency or functional obsolescence.

Repair means maintenance.

Restoration means rehabilitation.

Riparian area means the geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it, including the floodplain, woodlands, and all areas within a horizontal distance of approximately 150-feet from ordinary high water or the shoreline of a standing body of water.

Riparian zone means terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial or intermittent water, associated high water tables, soils that exhibit some wetness characteristics, and distinctly different vegetation than adjacent areas, or vegetation that is similar to adjacent areas but more vigorous or robust.

Riprap means rock or stones used as a part of a foundation or revetment, or to construct with or strengthen with rock or stones, either loose or fastened with mortar.

Roadway means the part of a highway or local road, including shoulders, that is for vehicular use. A divided highway has two or more roadways.

Sand splay means deposits of flood debris usually of coarser sand particles in the form of splays or scattered debris.

Scope of the action means the range of actions and impacts to be considered in the analysis of effects.

Scour means the displacement and removal of channel bed material due to the erosive action of flowing water which excavates and carries away material from the channel bed, usually considered as being localized as opposed to general bed degradation or headcutting. For information on scour analysis and delineation of scour depth, scour elevation, and scour prism (Lagasse *et al.* 2001; Lagasse *et al.* 2012; ODOT 2011b; Richardson and Davis 2001).

Shoulder means the paved or unpaved portion of the roadway that is contiguous with the traveled way for accommodating stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Slough means an area of dead water formed in a meander scroll depression or along the valley wall as flood flows move directly down valley, scouring beside the valley walls.

Sound exposure level means a measure of sound energy dose that is defined as the constant sound level acting for one second that has the same acoustic energy as the original sound (Hastings and Popper 2005). SEL is calculated by summing the cumulative pressure squared over time as decibels re 1 micropascal^2-second.

Span, used as a verb, means to extend over or across, and used as a noun means the horizontal space between two supports of a bridge or to the bridge itself.

Stormwater, or runoff, means surface water runoff that originates as precipitation on a particular site, basin, or watershed.

Stream-floodplain corridor means the main stream channel and its functional floodplain.

Stream-floodplain system, see stream-floodplain corridor.

Streambank toe means the part of the streambank below ordinary high water.

Streamflow means the rate at which a volume of water flows past a point over a unit of time.

Subgrade means the roadway grade established in preparation for top surface of asphalt, concrete, gravel, or other material.

Toe, see streambank toe.

Total scour elevation, or total scour depth, means a cross section reference line showing the probable vertical distance that a streambed will be lowered by total scour below a reference elevation during the scour design discharge or scour check discharge, whichever is more severe, including commonly accepted minimum safety factors.

Total scour prism means all floodplain, bank, and streambed material above the total scour elevation or depth.

Vacant structure is an unused, unnecessary, or abandoned piece of a roadway or bridge that no longer fulfills its intended purpose.

Vegetated riprap means riprap in which the voids have been filled with soil and planted using seed, plant cuttings or rooted plants.

Water quality, or quantity, design storm means the depth of rainfall predicted from a storm event of a given frequency used to size water quality treatment and flow control facilities.

Watershed means a designated hydrologic unit, or drainage area, typically at the 5th or 6th field, for identification and hierarchical cataloging purposes.

Working adequately means erosion controls that do not allow ambient stream turbidity to increase by more than 10% above background 100-feet below the discharge, when measured relative to a control point immediately upstream of the turbidity-causing activity.

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 programmatic biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (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.

The opinion, incidental take statement, and EFH conservation recommendations are each in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1) *et seq*.) and they underwent pre-dissemination review.

For purposes of this consultation, the proposed action is the Oregon Division of the Federal Highways Administration's proposal to use the Federal Aid Highway Program (FAHP) to fund, in whole or in part, capital improvements of the transportation system in the State of Oregon, including aquatic habitat restoration and fish passage projects. The aquatic habitat restoration and fish passage projects are intended to mitigate the adverse impact of transportation projects, help to meet ecological stewardship goals related to the conservation of ESA-listed species, or serve as an initial step toward development of a conservation or wetland mitigation bank. The Oregon Division is one of 52 such offices, and is responsible for administrating the FAHP to help maintain the integrity and safety of roads and bridges in the State of Oregon. The FAHP consists of Federal grants apportioned to states by legislative formulas, at the discretion of the FHWA, or by Congressional earmark. The program is governed by Title 23 of the United State Code.

In 2011, the Oregon Division allocated about $444,800,000. More than 90% of those funds were spent on pavement preservation, bridge repair, modernization, safety improvements, and operations, although less than 4% of all the transportation or restoration projects funded were likely to affect ESA-listed species considered in this opinion. The Oregon Department of Transportation (ODOT) is the primary recipient of all FAHP funds in Oregon, although a limited amount is passed through ODOT to local agencies, metropolitan planning organizations, universities, or other organizations throughout the state for highway and bridge survey, design and construction, planning, research, transit capital projects, and various other studies.

In addition to having an ESA nexus with FAHP funding, the transportation and restoration projects considered in this consultation often have a second nexus with the Portland District of the U.S. Army Corps of Engineers (Corps) based on its regulatory authority under section 404 of the Clean Water Act.

By mutual agreement between FHWA and the Corps, the Corps used to assume the lead role for most ESA consultations on the effects of FAHP projects on species considered in this consultation under a series of biological opinions issued by NMFS (NMFS 2008a; NMFS 2008e). The opinions issued to the Corps were not limited to transportation or restoration projects funded through FAHP, but the Corps did use those opinions to authorize about 45 transportation or restoration projects each year that were completed by ODOT or local transportation agencies that were at least partially funded through the FAHP.

The FHWA recently determined that the Corps' jurisdiction does not provide an adequate nexus to ensure ESA compliance for all FAHP projects, including those which only affect ESA-listed species or critical habitats through post-construction stormwater runoff. Moreover, FHWA presumes that serving as the lead action agency for ESA consultation on all FAHP projects will provide it with more opportunities to improve environmental streamlining and stewardship. Stepping back from the lead action role for these consultations will also result in a considerable workload reduction for the Corps. Thus, with the Corps agreement, the Corps intends to discontinue its role as lead action agency for ESA consultation on most or all future FAHP projects, and the FHWA will now consult with NMFS as the principal action agency for those actions (Turaski 2012).

1.2 Consultation History

On October 12, 2011, the FHWA requested formal consultation on the effects of transportation or restoration projects that FHWA is likely to fund through the FAHP, including projects that will be completed by ODOT and local transportation agencies (Ditzler 2011). That request came after extensive early coordination with NMFS and included a programmatic biological assessment (ODOT and FWHA 2011). After several follow-up contacts between the FHWA, ODOT and NMFS, the FHWA provided a revised biological assessment on December 12, 2011. NMFS initiated formal consultation with FHWA based on the information in that revised programmatic biological assessment.

The FHWA determined that the proposed program and projects funded under that program "may affect, but are not likely to adversely affect" the Eastern distinct population segment of Steller sea lions (*Eumetopias jubatus)* or southern resident killer whales (*Orcinus orca*). NMFS concurred with that finding in section 2.11 of the opinion that follows. Steller sea lions and southern resident killer whales do not have critical habitat designated in the program action area. The FHWA also concluded that the proposed program and funded projects "may affect, and are likely to adversely affect" 17 ESA-listed species and their designated critical habitats (Table 1), and "would adversely affect" areas designated by the Pacific Fisheries Management Council as EFH for Pacific salmon (PFMC 1999), groundfish (PFMC 2005), and coastal pelagic species (PFMC 1998), including estuarine areas designated as Habitat Areas of Particular Concern (HAPCs).

Table 1. 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 under the ESA; 'E' means listed as endangered.

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 spring-run	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
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
Coho salmon *(O. kisutch)*			
Lower Columbia River	T 6/28/05; 70 FR 37160	1/10/11; 76 FR 1392*	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)*			
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
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

*Advance notice of proposed rulemaking; request for information.

On May 7, 2012, NMFS gave FHWA a partial draft of the biological opinion for review and comment. FHWA shared the draft with ODOT. Both agencies provided their comments on the draft to NMFS during an interagency meeting on May 18. On June 1, 2012, NMFS gave a second, more complete draft of the opinion to FHWA for review and comment. FHWA and ODOT provided comment on that draft at a meeting held in Salem on July 11, 2012. Additional drafts were provided for FHWA review on August 8, August 15, and October 3, 2012, to show changes that were made based on discussions of earlier drafts. Due to the number of comments received from the action agency and amount of time spent revising our opinion in response to those comments, we were unable to meet the 135 day statutory timeframe for formal consultation for this action.

On June 7, 2012, NMFS mailed a letter to the Columbia River Inter-Tribal Fish Commission and member Tribes pursuant to the Secretarial Order on American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act (June 5, 1997), to notify them about this consultation and to invite them to initiate technical-level meetings that could lead to formal government-to-government consultation (Tehan 2012). Further, NMFS explained that under the current system, individual FAHP project proposals are reviewed quarterly, with participation by tribal representatives, as part of the Statewide Transportation Improvement Program (STIP) managed by ODOT (2012b), and that this ESA consultation will not alter or affect the STIP project selection process in anyway. The tribes did not provide an official response to that letter.

This opinion is based on information provided in the revised assessment and other sources of information described herein. A complete record of this consultation is on file at this office.

1.3 Proposed Action

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

The proposed action is the Oregon Division's proposal to use the FAHP program to fund capital improvements of the transportation system in the State of Oregon, including aquatic habitat restoration and fish passage projects, through Federal grants apportioned by legislative formulas, at the discretion of the FHWA, or by Congressional earmark, as governed by Title 23 of the United State Code. The aquatic habitat restoration and fish passage projects to be funded in this way are intended to mitigate for the adverse impact of transportation projects, to meet ecological stewardship goals related to the conservation of ESA-listed species, or as an initial step toward development of a conservation or wetland mitigation bank.

To help determine the number, distribution, and nature of the transportation and restoration projects that the Oregon Division is likely to fund through the FAHP, and that are also likely to affect ESA-listed species and designated critical habitats, the Division completed a spatial analysis of transportation construction projects in the Oregon STIP (ODOT 2012a) (ODOT 2012a). NMFS used that information with additional data based on the number of similar transportation and restoration projects authorized by the Corps since 2001 and for the number of stormwater only projects likely to be covered by the FAHP's broader nexus with ESA, to estimate that number of transportation or restoration projects likely to be funded by the Oregon Division using the FAHP, and their distribution by Recovery Domains (Table 2). However, the number of projects completed each year may decline in the short term (due to declining gas tax revenues), until at least 2015, when transportation revenues and expenditures are expected to approach half of current levels (ODOT 2011a).

Table 2. Number of transportation and restoration projects likely to be funded by the Oregon Division of FHWA using the FAHP each year (n=67), by NMFS recovery domain. "WLC" means Willamette/Lower Columbia; "IC" means Interior Columbia; "OC" means Oregon Coast; "SONCC" means Southern Oregon California Coasts.

Project Type	Recovery Domains			
	WLC n=29	IC n=13	OC n=16	SONCC n=9
Transportation	24	10	13	6
Restoration	5	3	3	3

As discussed in section 2.4, the effects of each transportation or restoration project will vary depending on whether the project is intended to restore habitat function, prolong the useful service life of roadway or bridge, or to correct a functional or structural deficiency related to safety, convenience, or overall performance of the traffic network. The duration of construction required to complete each project will normally be less than one year although significant bridge repair or replacement projects may require two or three years of in-water work, and three to four years of upland work to complete. In rare cases, construction schedules may take longer.

Thus, an individual transportation project may be narrowly defined by a single construction element, such as a pavement preservation whose sole purpose is to extend the life of the driving surface for a distinct road segment. However, most projects will consist of several elements as described below and about 10% are likely to be for modernization, which may combine as many elements as necessary to address complex safety, infrastructure, or congestion needs, including integration of the traditional highway system with alternatives such as public transit or rail.

Regardless of their complexity, many of these projects will occur far outside the stream channel or riparian area and therefore will only have post-construction stormwater runoff as a nexus or pathway for adverse effects to ESA-listed species or critical habitats.

The following elements are typical elements of transportation projects that will be funded through the FAHP:

- **Bicycle and pedestrian facilities** to encourage safe, convenient alternatives to motor vehicle transportation, including bikeways and separated walkways.
- **Bridge repair** to correct structural or functional deficiencies, collision damage, material deterioration, scour problems, cleaning and painting, and other actions to ensure that bridges remain safe and reliable for their intended use.
- **Bridge replacement** to replace roadway bridges that have been determined to be deficient because of structural deficiencies, physical deterioration or functional obsolescence.

- **Culvert extension/repair** to ensure that culverts remain functional when roadways or road shoulders are widened, and to correct problems due to blockage, erosion, scour, deterioration, or condition of the roadway or embankment.
- **Culvert replacement**, when a culvert or overlying pavement is severely deteriorated, or alignment is causing irreparable problems related to erosion, scour, or fish passage.
- **Intersection safety** to modify intersection alignment, ramps, roadway bottlenecks, railroad crossings, and traffic control elements to improve safety performance.
- **Pavement maintenance** to maintain or rehabilitate existing pavement in good condition and before the onset of serious damage, including routine and preventative maintenance and minor rehabilitation to extend pavement life by treatments at or near the surface, but without making structural improvements or changes to road capacity or geometry.
- **Pavement replacement** to provide structural improvement to the subgrade of an existing roadway, or removal of the total thickness of all existing layers of concrete and asphalt paving from an existing roadway and providing a new paved surface without changing the subgrade or location of shoulder points. This generally does not improve capacity or geometrics, or increase roadbed width but may include elimination or shielding of roadside obstacles, culvert replacements, signals, signing, and intersection improvements. Additional right-of-way is not normally required.
- **Pavement reconstruction** to replace the entire pavement structure. Normally this changes the location of the existing subgrade shoulder points or removes all of the existing pavement and base course 50% or more of the project length, and may include changes in grades and geometry, of curves, and widening of the roadbed. Additional right-of-way is normally required.
- **Roadside development** applies to all lands managed by ODOT, or the affected local agency, and may extend beyond right-of-way boundaries and refers primarily to visual resource management outside the traveled way, e.g., unpaved median strips, rest areas, roadside parks, viewpoints, heritage markers, wetlands and associated buffers, stormwater treatment areas, park and ride lots, and quarry and pit sites.
- **Rockfall/slide mitigation** to repair damage caused by a slide or fall of debris, earth, or rock, such as a blocked bridge, road, culvert or other drainage feature, or stream.
- **Signals/signs** to install temporary or permanent traffic signals, beacons, ramp meters, weigh station instruments, striping and pavement markings, and sign and illumination supports such as sign bridges, cantilevers, poles and other structures.
- **Widening/adding lanes** to improve traffic safety and mobility by adding, widening, or lengthening auxiliary lanes, climbing lanes, safety ramps, travel lanes, shoulders, or turning roadways.

As with transportation projects, the effects of a restoration project will vary depending on nature and scale of the initiative, and whether the project will affect riparian vegetation, streambanks, channels, or wetlands. The Oregon Division is proposing to use the FAHP to fund the following types of fish passage and aquatic restoration projects to mitigate for the adverse impacts of transportation projects or to meet ecological stewardship goals related to the conservation of ESA-listed species:

- **Fish Passage Restoration** to improve fish passage by installing or improving fish ladders at an existing facility; removing, replacing or improving culverts; or stream channel modifications to remove or reduce fish passage barriers.
- **Invasive and Non-native Plant Control** to improve the composition and abundance of native riparian plant communities through manual, mechanical, biological, and chemical methods.
- **Off- and Side-Channel Habitat Restoration** to reconnect historical stream channels with floodplains by restoring or modifying hydrologic and other essential habitat features of historical river floodplain swales, abandoned side channels, and floodplain channels..
- **Set-back or Removal of Existing Berms, Dikes, or Levees** to reconnect stream channels with floodplains, increase habitat diversity and complexity, moderate flow disturbances, and provide refuge for fish during high flows by increasing the distance that existing berms, dikes or levees are set back from active streams or wetlands.
- **Stormwater retrofits** to install a new highway runoff treatment facility where no treatment currently exists, upgrade an existing water quality facility, restore or add additional water quality treatment function, or plant trees.
- **Streambank Restoration** to restore eroding streambanks by bank shaping and installation of coir logs or other soil reinforcements as necessary to support riparian vegetation, or by planting or installing large wood, trees, shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats.
- **Water Control Structure Removal** to reconnect stream corridors, reestablish wetlands, improve fish passage, and restore more natural channel and flow conditions by removing earthen embankments, subsurface drainage features, spillway systems, tide gates, outfalls, pipes, instream flow redirection structures (*e.g.*, drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels.
- **Wetland Restoration** to restore degraded wetland by excavation and removal of fill materials, contouring to reestablish more natural topography, setting back existing dikes, berms and levees, reconnecting historical tidal and fluvial channels, or planting native wetland species.

For purposes of this opinion, the FHWA is not proposing to fund any transportation project with the following elements as part of this consultation, although these types of project may be the subject of an individual consultation in the future:

- Tide gate installation, maintenance or replacement.
- Any project requiring an environmental impact statement.
- Any project solely related to mass transit or rail transportation systems.
- A new permanent road within the riparian zone that is not a bridge approach.
- In-water work in the Willamette River downstream of Willamette Falls between Dec 1 and Jan 31.
- Any project with new general purpose lanes, new interchanges, or new lanes from interchange to interchange, which result in or contribute to other land use changes that trigger effects, including indirect effects, not considered in this biological opinion.
- A new bridge or culvert that does not replace an existing stream crossing, except as may be necessary as part of an action to restore an historic stream channel.

- Drilling or other earthwork at an EPA-designated Superfund Site, a state-designated clean-up area, or in the likely impact zone of a significant contaminant source, as identified by historical information or the FHWA's best professional judgment.

The Oregon Division presented an extensive list of impact avoidance and minimization measures with its request for this consultation, including many reiterations of ODOT standard specifications, manuals, technical bulletins, policy memos and other guidance (ODOT and FWHA 2011). While those all contribute to an agency culture based on constraining the environmental impact of the transportation and restoration projects, it is impractical and unnecessary to reiterate all those measures here. Instead, the measures below, referred to for purposes of this consultation as "design criteria," are those that were identified by FHWA and NMFS during consultation as essential to minimize the range of adverse effects due to transportation and restoration projects that are likely to result in incidental take. Unless and until additional information becomes available through monitoring or from other sources, NMFS presumes that these design criteria are necessary and sufficient to complete a jeopardy analysis, and an analysis of actions that are necessary and appropriate to minimize the impact of incidental take.

Measures described under "Program Administration" apply to the Oregon Division itself, as it manages the FAHP. The Oregon Division will ensure that the design criteria described under "Erosion and Pollution Control, Fish Passage, Site Restoration" and "General Construction" will be applied by FHWA or their designees who carry out an element of any transportation or restoration project that is funded, at least in part, through the FAHP.

1.3.1 Program Administration

1. **Initial rollout.** FHWA must cooperate with NMFS to provide an initial rollout of this opinion to ensure that these conditions are considered at the onset of each project, incorporated into all phases of project design, and that any constraints such as site suitability, right-of-way, maintenance needs, compensatory mitigation, or cost are resolved early on and not under-designed as add-on features.
2. **Failure to report may trigger reinitiation.** NMFS may recommend reinitiation of this consultation if FHWA fails to provide full reports or attend the annual coordination meeting.
3. **Full implementation required.** Failure to comply with all applicable conditions for a specific project may invalidate protective coverage of ESA section 7(o)(2) regarding "take" of listed species, and may lead NMFS to a different conclusion regarding the effects of that project.
4. **Review and approval.** FHWA must review each project to be covered under this opinion to ensure that:
    a. The project is:
        i. Likely to adversely affect one of the 17 endangered or threatened species considered in this opinion, or their designated critical habitat.[1]

[1] If the FHWA determines that a project "may affect, but is not likely to adversely affect" an ESA-listed considered in this opinion, or its designated critical habitat, the FHWA must initiate informal consultation with NMFS to determine whether formal consultation or a conference is required. If, during informal consultation, NMFS concurs

ii. The effects are likely to be within the range of effects considered in this opinion.
iii. ODOT and other transportation agencies receiving FAHP funds will comply with all of the following conditions, including obtaining NMFS review and approval, as appropriate.

b. NMFS will review and approve any project with any of the following elements, including any additional conservation measures necessary to ensure that the effects of those projects are within range of effects considered in this opinion:
   i. Restoration measures
      1. Compensatory mitigation.
      2. Fish passage restoration, including any culvert replacement or retrofit.
      3. Fishway intended to attract, collect, exclude, guide, transport, or release an ESA-listed fish under NMFS' jurisdiction including, but not limited to, a culvert retrofit, a pool-riffle structure, or a roughened chute.
      4. Restoration of a historic stream channel.
      5. Set-back or removal of an existing berm, dike, or levee.
      6. Water control structure removal.
      7. Wetland restoration.
   ii. Construction measures
      1. Blasting.
      2. Instream flow control structure, e.g., stream barbs, non-porous partially spanning weirs, full-spanning weirs.
      3. Modification or variance of any requirement.
      4. Permanent stream crossing replacement in a tidally-influenced area, large river delta, or other area with a wide, expansive floodplain that is significantly larger than 2.2 times the active channel width.
      5. Stormwater flow management in a watershed that is less than 100 mi^2.

c. The project will <u>not</u>:
   i. Make the program exceed the amount or extent of take described in the incidental take statement issued with this opinion.
   ii. Install, replace or repair a tide gate.
   iii. Require an environmental impact statement.
   iv. Be solely related to mass transit or rail transportation systems.
   v. Result in a new permanent road within the riparian zone that is not a bridge approach, except as necessary to restore a historic stream channel.
   vi. Require in-water work in the Willamette River downstream of Willamette Falls between Dec 1 and Jan 31.
   vii. Construct any new general purpose lanes, new interchanges, or new lanes from interchange to interchange, which result in or contribute to other land

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in writing that the project is not likely to adversely affect listed species or critical habitat, consultation for that project will be complete, and no further action will be necessary.

use changes that trigger effects, including indirect effects, not consider in this biological opinion.

viii. Construct a new bridge or culvert that does not replace an existing stream crossing, except as necessary to restore an historic stream channel.

ix. Drilling or other earthwork at an EPA-designated Superfund Site, a state-designated clean-up area, or in the likely impact zone of a significant contaminant source, as identified by historical information or the FHWA's best professional judgment.

5. **Salvage notice.** The FHWA must require that each project completed under this opinion provide this notice in writing to the supervisor of each project completed under this opinion.

    If a sick, injured, or dead specimen of a threatened or endangered species is found in the project area, the finder must notify NMFS through the contact person identified in the transmittal letter for this opinion, or through the NMFS Office of Law Enforcement at 1-800-853-1964, and follow any instructions. If the proposed action may worsen the fish's condition before NMFS can be contacted, the finder should attempt to move the fish to a suitable location near the capture site while keeping the fish in the water and reducing its stress as much as possible. Do not disturb the fish after it has been moved. If the fish is dead, or dies while being captured or moved, report the following information: (a) NMFS consultation number; (b) the date, time, and location of discovery; (c) a brief description of circumstances and any information that may show the cause of death; and (d) photographs of the fish and where it was found. The NMFS also suggests that the finder coordinate with local biologists to recover any tags or other relevant research information. If the specimen is not needed by local biologists for tag recovery or by NMFS for analysis, the specimen should be returned to the water in which it was found, or otherwise discarded.

6. **Site access.** FHWA must retain the right of reasonable access to each project site to monitor the use and effectiveness of these conditions.
7. **Monitoring and reporting.** FHWA must submit the following notifications and reports to NMFS for each project to be completed under this opinion. All notifications and reports are to be submitted electronically through a mutually agreeable file transfer protocol:
    a. Project notification within 60-days before start of construction.
    b. Project completion within 60-days of end of construction.
    c. Fish salvage within 60-days of work area isolation.
    d. Site restoration/mitigation within 60-days of site stabilization.
    e. Program report by March 15 each year.
8. **Annual coordination meeting.** FHWA must attend an annual coordination meeting with NMFS by March 31 each year to discuss the annual report and any actions that can improve conservation under this opinion, or make the program more efficient or accountable.

1.3.2 Conservation Measures

9. **Compensatory mitigation.** The following project impacts must be offset using compensatory mitigation:
    a. Stormwater treatment deficit.
    b. A net increase in fill, or abandoned fill, in the functional floodplain.
    c. Riprap above the streambank toe (*i.e.*, ordinary high water; OHW)
    d. Unvegetated riprap.
    e. Instream flow control structures.
10. **Construction discharge water.** All discharge water created by concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids, or other construction work must be treated using the best management practices (BMPs) applicable to site conditions for removal of debris, nutrients, sediment, petroleum products, metals 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) to ensure that no pollutants are discharged from the construction site.
11. **Erosion and pollution control.** An effective erosion and pollution control plan must be carried out at any project site that involves drilling or other earthwork likely to cause soil erosion, or requires use of hazardous or toxic substances (e.g., construction debris, drilling fluid, herbicides, motor fuel, oil), including BMPs to:
    a. Limit vegetation removal and soil disturbance to the minimum area necessary to complete the project.
    b. Inventory, store, handle, monitor, and contain and control a spill of, any hazardous products or materials that must be stored or used on site.
    c. Confine, remove and dispose of any excess cement, concrete, and grout and other mortars or bonding agents, including washout facilities.
    d. Prevent construction debris from dropping into any waterbody, and to remove any material that does drop with a minimum of disturbance.
    e. Avoid or minimize erosion and pollution at all roads, stream crossings, drilling sites, construction sites, borrow pits, equipment and material storage sites, fueling operations and staging areas.
    f. Stabilize exposed disturbed soils a minimum of one day before expected precipitation, and at the end of each day during wet periods.
    g. Avoid or minimize resource damage if the action area is inundated by precipitation or high streamflow.
    h. Drilling or other earthwork at an EPA-designated Superfund Site, a state-designated clean-up area, or in the likely impact zone of a significant contaminant source, as identified by historical information or the FHWA's best professional judgment, is not approved.
12. **Fish capture and removal.** Fish capture and removal must be completed in any area that is to be isolated from the active channel.
    a. A fish biologist with the experience and competence to ensure the safe capture, handling and release of all fish must supervise this process, and complete the fish salvage report that must be submitted with the project completion report.

   b. A reasonable effort must be made to capture ESA-listed fish known or likely to be present in an in-water isolated work area using methods that minimize the risk of injury, then released at a safe release site.
   c. If electrofishing must be used, the NMFS (2000) guidelines (or most recent version) must be followed.

13. **Fish screens.** A fish screen installed, operated, and maintained on every temporary water withdrawal as follows (NMFS 2011e):
    a. An automated cleaning device with (i) a minimum effective surface area of 2.5 square feet per cubic foot per second (cfs), and a nominal maximum approach velocity of 0.4 fps, or (ii) no automated cleaning device, a minimum effective surface area of 1 square foot per cubic foot per second, and a nominal maximum approach rate of 0.2 foot per second.
    b. A round or square screen mesh that is no larger than 2.38 mm (0.094") in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069") in the narrow dimension.
14. **Fish passage.** Provide passage for adult and juvenile fish that meets NMFS' criteria (NMFS 2011e) or most recent version, during construction, unless fish passage did not exist before construction and except as necessary to deploy work area isolation, and after construction.
15. **High flow conditions.** Cease work when high flows may inundate the project area, except for efforts to avoid or minimize resource damage.
16. **In-water work period.** Complete all work within the active channel in accordance with the Oregon guidelines for timing of in-water work to protect fish and wildlife resources (ODFW 2008), or the most recent version. Notwithstanding the Oregon guidelines:
    a. Hydraulic and topographic measurements and encased geotechnical drilling may be completed at any time, if a fish biologist determines that the affected area is not occupied by adult fish congregating for spawning, or where redds are occupied by eggs or alevins.
    b. The winter work period between Dec 1 and Jan 31 for the Willamette River downstream of Willamette Falls is not approved.
17. **Invasive and non-native plant control.**
    a. ***Non-herbicide methods.*** Limit vegetation removal and soil disturbance within the riparian zone by limiting the number of workers there to the minimum necessary to complete manual and mechanical plant control (*e.g.*, hand pulling, clipping, stabbing, digging, brush-cutting, mulching or heating with radiant heat, pressurized hot water, or heated foam).
    b. ***Herbicide Label.*** Herbicide applicators must comply with all label instructions.
    c. ***Power equipment.*** Gas-powered equipment with tanks larger than 5 gallons will be refueled in a vehicle staging area placed 150-feet or more from any natural waterbody, or in an isolated hazard zone such as a paved parking lot.
    d. ***Maximum herbicide treatment area.*** The total area treated with herbicides within riparian areas will not exceed 10-acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6-mile reach of a stream, per year.
    e. ***Herbicide applicator qualifications.*** Herbicides will be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that will cause the least impact. The applicator will be

responsible for preparing and carrying out and the herbicide transportation and safely plan, as follows.

f. ***Herbicide transportation and safety plan.*** The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, to take remedial actions in the event of spills, and to fully report the event.

g. ***Herbicides.*** The only herbicides proposed for use under this opinion are (some common trade names are shown in parentheses):[2]

   i. aquatic imazapyr (*e.g.*, Habitat)
   ii. aquatic glyphosate (*e.g.*, AquaMaster, AquaPro, Rodeo)
   iii. aquatic triclopyr-TEA (*e.g.*, Renovate 3)
   iv. chlorsulfuron (*e.g.*, Telar, Glean, Corsair)
   v. clopyralid (*e.g.*, Transline)
   vi. imazapic (*e.g.*, Plateau)
   vii. imazapyr (*e.g.*, Arsenal, Chopper)
   viii. metsulfuron-methyl (*e.g.*, Escort)
   ix. picloram (*e.g.*, Tordon)
   x. sethoxydim (*e.g.*, Poast, Vantage)
   xi. sulfometuron-methyl (*e.g.*, Oust, Oust XP)

g. ***Herbicide adjuvants.*** The only adjuvants proposed for use under this opinion are as follows, with mixing rates described in label instructions (Table 3). Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (*e.g.*, Roundup) will not be used.

Table 3. Herbicide adjuvants, trade names, and application areas.

Adjuvant Type	Trade Name	Application Areas
Surfactants	Agri-Dex	Riparian
	LI 700	Riparian
Drift Retardants	41-A	Riparian
	Vale	Upland

h. ***Herbicide carriers.*** Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil. Use of diesel oil as an herbicide carrier is prohibited.

i. ***Herbicide mixing.*** Herbicides will be mixed more than 150-feet from any natural waterbody to minimize the risk of an accidental discharge.

j. ***Dyes.*** A non-hazardous indicator dye (*e.g.*, Hi-Light or Dynamark) is required to be used with herbicides within 100-feet of live water. 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

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

spraying a plant or area more than once, and minimize over-spraying (SERA 1997).

k. ***Spill Cleanup Kit.*** 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.

l. ***Herbicide application rates.*** Herbicides will be applied at the lowest effective label rates.

m. ***Herbicide application methods.*** Liquid or granular forms of herbicides will be applied as follows:

    i. Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms.
    ii. Spot spraying – hand held nozzles attached to back pack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants using.
    iii. Hand/selective – wicking and wiping, basal bark, fill ("hack and squirt"), stem injection, cut-stump.
    iv. Triclopyr – will not be applied by broadcast spraying.
    v. Keep the spray nozzle within 4-feet of the ground; 6-feet for spot or patch spraying more than 15-feet of the high water mark (HWM) if needed to treat tall vegetation.
    vi. Apply spray in swaths parallel towards the project area, away from the creek and desirable vegetation, i.e., the person applying the spray will generally have their back to the creek or other sensitive resource.
    vii. Avoid unnecessary run off during cut surface, basal bark, and hack-squirt/injection applications.

m. ***Washing spray tanks.*** Spray tanks shall be washed 300-feet or more away from any surface water.

l. ***Minimization of herbicide drift and leaching.*** Herbicide drift and leaching will be minimized as follows:

    i. Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour.
    ii. Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind.
    iii. Keep boom or spray as low as possible to reduce wind effects.
    iv. Increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents.
    v. Do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit.
    vi. Wind and other weather data will be monitored and reported for all broadcast applications.

b. ***Rain.*** 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 the NOAA National Weather Service or other similar forecasting service within 48 hours following application. Soil-activated herbicides can be applied as long as label is followed. Do not conduct hack-squirt/injection applications during periods of heavy rainfall.

m. ***Herbicide buffer distances.*** The following no-application buffers, which are measured in feet and are based on herbicide formula, stream type, and application method, will be observed during herbicide applications (Table 5). Herbicide applications based on a combination of approved herbicides will use the most conservative buffer for any herbicide included. Buffer widths are in feet, measured as map distance perpendicular to the bankfull elevation for streams, the upland boundary for wetlands, or the upper bank for roadside ditches. Before herbicide application begins, the upland boundary of each applicable herbicide buffer will be flagged or marked to ensure that all buffers are in place and functional during treatment.

Table 5. Herbicide buffer distances by herbicide formula, stream type, and application method.

Herbicide	No Application Buffer Width (feet)					
	Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams, Dry Intermittent Wetlands, Dry Roadside Ditches		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
aquatic glyphosate	100	waterline	waterline	50	none	none
aquatic imazapyr	100	15	waterline	50	none	none
aquatic triclopyr-TEA	**Not Allowed**	15	waterline	**Not Allowed**	none	none
Low Risk to Aquatic Organisms						
Imazapic	100	15	bankfull elevation	50	None	none
Clopyralid	100	15	bankfull elevation	50	None	none
metsulfuron-methyl	100	15	bankfull elevation	50	None	none
Moderate Risk to Aquatic Organisms						
Imazapyr	100	50	bankfull elevation	50	15	bankfull elevation
sulfometuron-methyl	100	50	5	50	15	bankfull elevation
Chlorsulfuron	100	50	bankfull elevation	50	15	bankfull elevation
High Risk to Aquatic Organisms						
Picloram	100	50	50	100	50	50
Sethoxydim	100	50	50	100	50	50

18. Off- and side-channel habitat restoration.

a. Reconnection of historical off- and side-channels habitats that have been blocked includes the removal of plugs, which impede water movement through off- and side-channels, and excavation within historical channels that does not exceed the thalweg depth in the main channel. The purpose of the additional sediment removal is to provide unimpeded flow through the side-channel to minimize fish entrapment.
b. Excavation depth may not exceed the maximum thalweg depth in the main channel.
c. 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.
d. Data requirements and analysis that must be submitted to NMFS with a request for approval of off- and side-channel habitat restoration include evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, and remote sensing information.

19. Set-back existing berm, dike, or levee.

a. 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.
b. 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.
    i. Breaches shall be equal to or greater than the active channel width.
    ii. In addition to other breaches, the berm, dike, or levee shall always 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, thus minimizing fish entrapment.
    iii. When necessary, loosen compacted soils once overburden material is removed.
    iv. Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that does not impede floodplain function.

20. Site preparation.

a. Flag the boundaries of clearing limits associated with site access and construction to prevent ground disturbance of critical riparian vegetation, wetlands, areas below ordinary high water, and other sensitive sites beyond the flagged boundary.
b. All temporary erosion controls must be in-place and appropriately installed downslope of project activity until site restoration is complete.
c. During site preparation, attempt to conserve native materials for restoration, including large wood, vegetation, topsoil and channel materials (gravel, cobble and boulders).
d. Whenever possible, leave native materials where they are found.
e. In areas to be cleared, clip vegetation at ground level to retain root mass and encourage reestablishment of native vegetation.

21. **Site restoration.** Any significant disturbance of riparian vegetation, soils, streambanks, or stream channel must be cleaned up and restored after the action is complete. Although no single criterion is sufficient to measure restoration success, the intent is that the following features should be present in the upland parts of the project area, within reasonable limits of natural and management variation:
    a. Human and livestock disturbance, if any, are confined to small areas necessary for access or other special management situations.
    b. Areas with signs of significant past erosion are completely stabilized and healed, bare soil spaces are small and well-dispersed.
    c. Soil movement, such as active rills and soil deposition around plants or in small basins, is absent or slight and local.
    d. Native woody and herbaceous vegetation, and germination microsites, are present and well distributed across the site.
    e. Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy and dominant over undesired competing vegetation.
    f. Plant litter is well distributed and effective in protecting the soil with little or no litter accumulated against vegetation as a result of active sheet erosion ("litter dams").
    g. A continuous corridor of shrubs and trees appropriate to the site are present to provide shade and other habitat functions for the entire streambank.
22. **Stormwater management.**
    a. Provide stormwater management for any project that will:
        i. Increase the contributing impervious area within the project area.
        ii. Construct new pavement that increases capacity or widens the road prism.
        iii. Reconstructs pavement down to subgrade.
        iv. Rehabilitate or restore a bridge to repair structural or functional deficiencies that are too complicated to be corrected through normal maintenance, except for seismic retrofits that make a bridge more resistant to earthquake damage (e.g., external post-tensioning, supplementary dampening) but do not affect the bridge deck or drainage.
        v. Replace a stream crossing
        vi. Change stormwater conveyance
    b. Stormwater management is not required for the following pavement actions: minor repairs, patching, chip seal, grind/inlay, overlay or resurfacing (i.e., non-structural pavement preservation, a single lift or inlay).
    c. Stormwater management consists of:
        i. Low impact development.
        ii. Water quality (pollution reduction) treatment for post-construction stormwater runoff from all contributing impervious area.
        iii. Water quantity treatment
            a. Water quantity (flow) management for runoff from all contributing impervious area that will discharge into an intermittent or perennial water body in a watershed that is smaller than 100 mi^2, unless the outfall discharges directly into a lake, reservoir, or estuary.

            OR

b. Water quantity (flow) management for runoff from all contributing impervious area that will discharge more than 0.5 cfs during the 2-year, 24-hour storm into an intermittent or perennial water body in a watershed smaller than 100 mi^2, unless the outfall discharges directly into a lake, reservoir, or estuary.

d. Stormwater management plans must:
   i. Explain how highway runoff from all contributing impervious area that is within or contiguous with the project area will be managed using site sketches, drawings, specifications, calculations, or other information commensurate with the scope of the action.
   ii. Identify the pollutants of concern.
   iii. Identify all contributing and non-contributing impervious areas that are within and contiguous with the project area.
   iv. Describe the BMPs that will be used to treat the identified pollutants of concern, and the proposed maintenance activities and schedule for the treatment facilities.
   v. Provide a justification for the capacity of the facilities provided based on the expected runoff volume, including, e.g., the design storm, BMP geometry, analyses of residence time, as appropriate.
   vi. Include the name, email address, telephone number of a person responsible for designing the stormwater management facilities so that NMFS may contact that person if additional information is necessary.

e. All stormwater quality treatment practices and facilities must be designed to accept 50% of the cumulative rainfall from the 2-year, 24-hour storm for that site, except as follows: climate zone 4 – 67%; climate zone 5 – 75%; and climate zone 9 – 67%. (ESA-listed species considered in this opinion are unlikely to occur in Zones 5 or 9.) A continuous rainfall/runoff model may be used instead of the above runoff depths to calculate water quality treatment depth.

f. Use low impact development practices to infiltrate or evaporate runoff to the maximum extent feasible. For runoff that cannot be infiltrated or evaporated and therefore will discharge into surface or subsurface waters, apply one or more of the following specific primary treatment practices, supplemented with appropriate soil amendments:
   i. Bioretention cell
   ii. Bioslope, also known as an "ecology embankment"
   iii. Bioswale
   iv. Constructed wetlands
   v. Infiltration pond
   vi. Media filter devices with demonstrated effectiveness
   vii. Porous pavement, with no soil amendments and appropriate maintenance

g. All stormwater flow control treatment practices and facilities must be designed to maintain the frequency and duration of flows generated by storms within the following end-points:
   i. Lower discharge endpoint, by USGS flood frequency zone:
      1. Western Region = 42% of 2-year event

2. Eastern Region
   a. Southeast, Northeast, North Central = 48% of 2-year event
   b. Eastern Cascade = 56% of 2-year event

ii. Upper discharge endpoint
   1. Entrenchment ratio <2.2 = 10-year event, 24-hour storm
   2. Entrenchment ratio >2.2 = bank overtopping event

h. When conveyance is necessary to discharge treated stormwater directly into surface water or a wetland, the following requirements apply:
   i. Maintain natural drainage patterns.
   ii. To the maximum extent feasible, ensure that water quality treatment for highway runoff from all contributing impervious area is completed before commingling with offsite runoff for conveyance.
   iii. Prevent erosion of the flow path from the project to the receiving water and, if necessary, provide a discharge facility made entirely of manufactured elements (*e.g.*, pipes, ditches, discharge facility protection) that extends at least to ordinary high water.

23. Streambank Restoration.[3]

a. Without changing the location of the bank toe, restore damaged streambanks 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.
b. Complete all soil reinforcement earthwork and excavation in the dry. Whenever feasible, use soil layers or lifts that are strengthened with biodegradable fabrics and penetrable by plant roots.
c. Include large wood in each streambank restoration action when appropriate to the system, and to the maximum extent feasible.
d. Large wood must be intact, hard, and undecayed to partly decaying, and should 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. Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
e. Rock will not be used for streambank restoration, except as ballast to stabilize large wood.
f. Use a diverse assemblage of species native to the action area or region and appropriate to the project area, including trees, shrubs, and herbaceous species.
g. Do not use noxious or invasive species.
h. Do not apply surface fertilizer within 50-feet of any stream channel.
i. Install fencing as necessary to prevent access to revegetated sites by livestock or unauthorized persons.

[3] For additional information on methods and design for bank shaping; installation of coir logs and soil reinforcements; anchoring and placement of large wood; woody plantings; and herbaceous cover, see Cramer (2012).

24. **Water control structure removal.** This includes removal of small dams that are less than 16.4-feet high, do not impound contaminated sediments, and are not likely to initiate head-cutting; channel-spanning weirs; subsurface drainage features; tide gates; or instream flow redirection structures.
    a. Data requirements and analysis for structure removal include:
        i. A longitudinal profile of the stream channel thalweg for 20 channel widths upstream and downstream of the structure shall be used to determine the potential for channel degradation.
        ii. A minimum of three cross-sections – one downstream of the structure, one through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure) to characterize the channel morphology and quantify the stored sediment.
        iii. Sediment characterization to determine the proportion of coarse sediment (>2mm) in the reservoir area.
        iv. A survey of any downstream spawning areas that may be affected by sediment released by removal of the water control structure. Reservoirs with a d35 greater than 2 mm (*i.e.*, 65% 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% 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.

1.3.3 General Construction Measures

25. **Barge use.** Any barge used as a work platform to support construction must be:
    a. Large enough to remain stable under foreseeable loads and adverse conditions.
    b. Inspected before arrival to ensure vessel and ballast are free of invasive species.
    c. Secured, stabilized and maintained as necessary to ensure no loss of balance, stability, anchorage, or other condition that can result in release of a contaminant or construction debris.
26. **Bridge, culvert, and road maintenance.** Routine bridge, culvert and road surface maintenance activity may be completed in accordance with design criteria in this opinion or, as applicable, with procedures described in the Oregon Department of Transportation Routine Road Maintenance: Water Quality and Habitat Guide Best Management Practices (ODOT 2009), or the most recent version approved by NMFS.
27. **Drilling and boring.** All drilling equipment, drill recovery and recycling pits, and any associated waste or spoils must be completely isolated from surface waters, off-channel habitats and wetlands.
    a. All waste or spoils must be covered, unless fully contained, if precipitation is imminent or falling.
    b. Make a reasonable effort to recover all drilling fluids for recycling or disposal to prevent water contact.

c. When drilling is complete, remove as much remaining drilling fluid as possible from the casing (*e.g.*, by pumping) to reduce turbidity when the casing is removed.
d. If a drill boring case breaks and drilling fluid or waste is visible in water or a wetland, make all possible efforts to contain the waste and contact NMFS within 48 hours.

28. **Heavy-duty vehicles and equipment.** All heavy-duty vehicles and equipment for construction tasks must be selected and cared for as follows:
    a. Select and operate heavy equipment to minimize adverse environmental effects, e.g., minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicles, temporary mats or plates within wet areas or sensitive soils.
    b. Store, fuel and maintain all equipment in a staging area 150-feet or more from any waterbody, or in an isolated hard zone such as a paved parking lot.
    c. Inspect each piece of equipment daily for fluid leaks before leaving the staging area for operation.
    d. Steam-clean each piece of equipment before operation below OHW, and as often as necessary during operation to remain free of external oil, grease, mud, and other visible contaminants.
    e. Generators, cranes and other stationary heavy equipment operated within 150-feet of any waterbody must be maintained and protected as necessary to prevent leaks and spills from entering the water.

29. **Painting and coating.**
    a. Whenever practicable, ensure that painting, coating or other chemical applications are conducted at an approved off-site facility or within a designated staging area.
    b. The area where any painting or coating is done onsite must be isolated and contained as necessary to prevent dirt, rust, scale, solvent, paint, or other debris from entering aquatic and riparian habitat during pre-painting preparation, painting, coating, or any other activity that may have similar water quality effects.
    c. All lead-based paint, blasting abrasive, solvents, or other hazardous waste material must be contained in an enclosure, collected and disposed of according to an appropriate hazardous waste treatment plan, including use of the best available technology to prevent fugitive emissions of any hazardous dust.
    d. No lead-based paint may be newly-applied to any structure.

30. **Pesticide-treated wood.**[4] Wood treated or preserved with pesticidal compounds may not be used below OHW. Pesticide-treated wood also may not be used above OHW to

[4] Examples of PTW include chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), alkaline copper quat (ACQ-B and ACQ-D), ammoniacal copper citrate (CC), copper azole (CBA-A), copper dimethyldithiocarbamate (CDDC), borate preservatives, and oil-type wood preservatives, such as creosote, pentachlorophenol, and copper naphthenate. For alternatives sources of structural lumber and pilings designed for industrial and marine applications, but not based on pesticide-treated wood, including silica-based wood preservation, improved recycled plastic technology, and environmentally safe wood sealer and stains, see, *e.g.*, American Plastic Lumber (Shingle Springs, California) and Resco Plastics (Coos Bay, Oregon) for structural lumber from recycled plastic; Plastic Pilings, Inc. (Rialto, California) for structurally reinforced plastic marine products; Timbersil (Springfield, Virginia) for structural lumber from wood treated with a silica-based fusion technology; and Timber Pro Coatings (Portland, Oregon) for non-petroleum based wood sealer and stains. The use of trade, firm, or corporation names in this Opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any

construct an overwater or in-water structure, unless the treated wood is adequately sealed and maintained using a non-toxic sealant such that no part of the treated wood is exposed to leaching by precipitation, overtopping waves, or submersion (e.g., treated wood stringers or decking of a timber bridge that are covered by a wearing surface that covers the entire roadway width), and all elements of the structure that are constructed using the treated wood are designed to avoid or minimize impacts or abrasion that could create treated wood debris or dust.

a. Treated wood installation.
   i. Treated wood shipped to the project area must be stored out of contact with standing water and wet soil, and protected from precipitation.
   ii. Each load and piece of treated wood must be visually inspected and rejected for use in or above aquatic environments if visible residue, bleeding of preservative, preservative-saturated sawdust, contaminated soil, or other matter is present.
   iii. Use prefabrication whenever possible to minimize cutting, drilling and field preservative treatment.
   iv. When field fabrication is necessary, complete all cutting, drilling, and field preservative treatment of exposed treated wood above OHW to minimize discharge of sawdust, drill shavings, excess preservative and other debris.
   v. Use tarps, plastic tubs or similar devices to contain the bulk of any fabrication debris, and wipe off any excess field preservative.
b. Treated wood removal.
   i. Evaluate all wood construction debris removed during a project, including pilings, to ensure proper disposal of treated wood.
   iv. Ensure that no treated wood debris falls into the water or, if debris does fall into the water, remove it immediately.
   v. After removal, place treated wood debris in an appropriate dry storage site until it can be removed from the project area.
   vi. Do not leave any treated wood debris in the water or stacked on the streambank at or below OHW.

31. Pile use.

a. Pile installation where a Steller sea lion may be present: If the action area is between Bonneville Dam and the mouth of the Columbia River, or outside of the Columbia River but within 10 nautical miles of a Steller sea lion haul-out,[5] the following conditions apply:
   i. A biologist qualified in marine mammal identification will be on site during all pile driving and will notify the operator to cease operations if a Steller sea lion enters the 1,200 foot radius of the pile.
   ii. Pile driving may not begin if a Steller sea lion is within 1,200-feet of the pile being driven.
   iii. Pile driving must cease if a Steller sea lion approaches within 1,200-feet of the pile being driven.

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product or service to the exclusion of others that may be suitable.

[5] Haul outs are at Three Arches Rock, Orford Reef, Rogue Reef, Sea Lion Caves, Cape Arago State Park, Oregon Islands National Wildlife Refuge and South Jetty Columbia River

b. Pile installation. The following measures apply when ESA-listed fish are known or likely to be present during pile installation.
    i. Piles may be installed or replaced with concrete, steel round pile 24-inches in diameter or smaller, steel H-pile designated as HP24 or smaller, or untreated wood.
    ii. Whenever possible, use a vibratory hammer to install pile; an impact hammer may not be used when juvenile ESA-listed fish weighing less than 2 grams are likely to be present.
    iii. When using an impact hammer to drive or proof steel piles, one of the following sound attenuation methods must be used to effectively dampen sound
        1. Completely isolate the pile from flowing water by dewatering the area around the pile.
        2. If water velocity is 1.6 fps or less, surround the pile being driven with a bubble curtain, as described in NMFS and USFWS (2006), that must distribute small air bubbles around 100% of the pile perimeter for the full depth of the water column.
        3. If water velocity is greater than 1.6 fps, surround the pile being driven by a confined bubble curtain that must distribute air bubbles around 100% of the pile perimeter for the full depth of the water column.

c. Pile removal. Whenever possible, use a vibratory hammer to remove pile; when attempting to pull pile up directly with a crane, vibrate or wiggle the pile with the crane (referred to as "waking up" the pile) to loosen the adhering sediments before extraction.
    i. To remove a non-creosote pile, make every attempt short of excavation to remove each piling.
        1. If a pile in uncontaminated sediment is intractable or breaks, cut the pile or stump off at least 3-feet below the surface of the sediment.
        2. If a pile in contaminated sediment is intractable or breaks, cut the pile or stump off at the sediment line or, if it breaks within contaminated sediment, make no further effort to remove it and cover the hole with a cap of clean substrate appropriate for the site.
        3. If dredging is likely where broken piles are buried, use a global positioning system (GPS) device to note the location of all broken piles for future use in site debris characterization.
    ii. To remove a creosote pile, use the following steps to minimize creosote release, sediment disturbance and total suspended solids.
        1. Install a floating surface boom to capture floating surface debris.
        2. Keep all equipment (e.g., bucket, steel cable, vibratory hammer) out of the water, grip piles above the waterline, and complete all work during low water and low current conditions.
        3. Dislodge the piling with a vibratory hammer, when possible – never intentionally break a pile by twisting or bending.

4. Slowly lift the pile from the sediment and through the water column.
5. Place the pile in a containment basin[6] on a barge deck, pier, or shoreline without attempting to clean or remove any adhering sediment.
6. Fill the hole left by each pile with clean, native sediments immediately after removal.
7. Dispose of all removed piles, floating surface debris, any sediment spilled on work surfaces, and all containment supplies at a permitted upland disposal site.

32. Stream crossings.

a. New bridges that do not replace an existing bridge are not approved, except as necessary to restore a historic stream channel.
b. When a temporary stream crossing is necessary, a fish biologist must be consulted to ensure the proposed crossing will not interfere with spawning behavior, eggs or preemergent juveniles in an occupied redd, or native submerged aquatic vegetation.
    i. Whenever possible, ensure that temporary crossings are perpendicular to the riparian area and main channel, and take other steps as necessary to ensure that streamflow will not be diverted out of the channel and down the road if the crossing fails.
    ii. When a crossing is no longer needed, block the area, obliterate the route, and restore the soils and vegetation.
c. All permanent stream crossing replacements must provide for a fully functional floodplain as follows:
    i. Maintain a clear unobstructed opening above the general scour prism; streambank and channel stabilization may be applied below the general scour elevation.
    ii. For a single span structure, including culverts, the necessary opening is presumed to be 1.5 times the active channel width, or wider.
    iii. For a multiple span structure, the necessary opening is presumed to be 2.2 times the active channel width, or wider, except for piers or interior bents.
    iv. Install relief conduits, as necessary, within existing road fill at potential flood flow pathways based on analysis of flow patterns or floodplain topography.
    v. Remove all other artificial constrictions within the functional floodplain that are not otherwise a component of the final design:
        1. Remove vacant bridge supports below total scour depth, unless the vacant support is part of the rehabilitated or replacement stream crossing.
        2. Remove existing roadway fill, embankment fill, approach fill, or other fill.

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[6] A containment basin for the removed piles and any adhering sediment may be constructed of durable plastic sheeting with sidewalls supported by hay bales or another support structure to contain all sediment and return flow which may otherwise be directed back to the waterway.

vi. Reshape exposed floodplains and streambanks to match upstream and downstream conditions.

33. **Surface water withdrawal.** Streamflow may be temporarily withdrawn for construction purposes only if developed sources (e.g., municipal supplies, reservoirs, tank trucks) are unavailable or inadequate. When surface water must be diverted:
    a. Water must be taken be from the alternative with the greatest flow available.
    b. Do not to exceed 10% of the available flow at any given time – for streams with less than 5 cfs, do not draft more than 0.03 cfs (*i.e.*, 18,000 gallons per day).
    c. Include a temporary fish screen that meets criteria above.
34. **Streambank or channel stabilization.** The following streambank stabilization methods may be used individually or in combination:
    a. Streambank restoration methods described in the streambank restoration section, above.
    b. Biotechnical streambank stabilization methods, an engineered log jam, or avulsion prevention techniques may be used without restriction.
    c. Vegetated riprap with large wood may be used where a qualified engineer determines that biotechnical streambank stabilization methods will not provide an acceptable factor of safety.
    d. The amount of rock used must be limited to the minimum necessary to protect the integrity of the structure and, whenever feasible, include soil and woody vegetation as a covering and throughout the structure.
    e. Unvegetated riprap may be used where necessary to:
        i. Fill a local scour threatening a culvert, road, or bridge foundation.
        ii. Stabilize a footing, facing, head wall, or other structure necessary to prevent scouring, downcutting, fill slope erosion, or other failure at an existing culvert or bridge.
    f. Stream barbs, non-porous partially spanning weirs, full-spanning weirs and other instream flow control structures are not allowed under this opinion without compensatory mitigation.
35. **Temporary access roads.** Whenever possible, use existing routes that will minimize soil disturbance and compaction within 150-feet of any waterbody.
    a. Do not build temporary access routes on steep slopes, where grade, soil, or other features suggest a likelihood of excessive erosion (*e.g.*, rills or gullies) or failure.
    b. When the action is completed, obliterate all temporary access routes, stabilize the soil and restore the vegetation.
    c. Restore temporary routes in wet or flooded areas before the end of the applicable in-water work period.
    d. Whenever possible, eliminate the need for an access road by walking a tracked drill or spider into a survey site, or lower drilling equipment to a survey site using a crane.
36. **Utility lines.**
    a. Design utility lines and stream crossings in the following priority:
        i. Aerial lines, including lines hung from existing bridges.
        ii. Directional drilling, boring and jacking that spans the channel migration zone and any associated wetland.

iii. Trenching – this method is restricted to intermittent streams and may only be used when the stream is naturally dry, all trenches must be backfilled below the ordinary high water line with native material and capped with clean gravel suitable for fish use in the project area.

b. Align each crossing as perpendicular to the watercourse as possible, and for drilled, bored or jacked crossings, ensure that the line is below the total scour prism.

c. Any large wood displaced by trenching or plowing must be returned as nearly as possible to its original position, or otherwise arranged to restore habitat functions.

37. **Work area isolation.** The in-water work area must be effectively isolated from the active channel for any project element that involves substantial excavation, backfilling, embankment construction, or similar work below OHW where adult or juvenile fish are reasonably certain to be present, or 300-feet or less upstream from spawning habitats.

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

For this consultation, the program-level action area includes all areas within the State of Oregon where the Oregon Division may use the FAHP to fund transportation projects and that are also within the present or historic range of the 17 species or their designated critical habitats considered in this opinion (Table 1). This includes 12 of the 18 river basins that occur in Oregon: North Coast, Mid Coast, Umpqua, South Coast, Rogue, Willamette, Sandy, Hood, Deschutes, John Day, Umatilla (including part of the Walla Walla River), and Grande Ronde. Five river basins in Oregon are not included because those basins have natural or artificial barriers that preclude anadromous migration, thus making them inaccessible to species considered in this opinion: Goose and Summer Lakes, Harney, Owyhee, Malheur, and Powder. The Klamath River Basin is also not included, although ESA-listed Klamath River coho salmon occur there, because that species is under jurisdiction of NMFS' Southwest Region. Moreover, any FAHP project that the Oregon Division may fund within the Klamath Basin will not affect any area outside that basin.

Each individual transportation project that the Oregon Division proposes to fund as part of the FAHP will have a project-level action area that exists within the program action area. Each project-level action area will include all upland, riparian, and instream habitat within the project's construction footprint, plus upstream aquatic habitat to the extent that the effects of the project impair or improve fish passage by the construction site, and downstream aquatic habitat where sediment and pollutants from construction runoff and post-construction highway runoff are redistributed and eventually discharged into river mouths, bays, estuaries, and coastal waters where they impact aquatic habitat, fish populations, and other coastal resources. The physical impact of each project measured as linear feet of bank impact will also vary, but averages about 200-feet per project.[7]

[7] This estimate is based on an evaluation of 81 transportation projects of different types, with impacts ranging from 0 to 922.5 linear feet, and averaging 189.4 linear feet (ODOT and FWHA 2011)(at p.63).

The precise number of projects that the Oregon Division will fund using the FAHP is not known but, as explained in section 1.2 and Table 1, the Oregon Division estimates that each year it will fund up to 53 transportation projects and 14 restoration actions, with 29 in the Willamette Valley and Lower Columbia Recovery Domain (Willamette, Sandy, Hood), 13 in the Interior Columbia Recovery Domain (Deschutes, John Day, Umatilla, and Grande Ronde, Walla Walla), 16 in the Oregon Coast Recovery Domain (North Coast, Mid Coast, Umpqua, South Coast), and 9 in the SONCC Recovery Domain (Rogue).

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. Section 7(a)(2) of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS), NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

2.1 Approach to the Analysis

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts on the conservation value of designated critical habitat.

To jeopardize the continued existence of a listed species" means 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).

This opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[8]

In this programmatic consultation, the Federal action is the Oregon Division's proposal to use the Federal Aid Highway Program to fund, in whole or in part, capital improvements of the transportation system in the State of Oregon, including aquatic habitat restoration and fish

[8] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

passage projects. The exact number and location of the projects to be funded is uncertain, therefore we adapted the traditional assessment framework to ensure that the decision-making process that the Oregon Division will use to administer the FAHP is likely to ensure that the specific projects that are funded through the program will comply with the requirements of section 7(a)(2). In this analysis, we consider the effects of the projected number of individual projects as well as the aggregate impact of all projects to be implemented under this consultation. We will use the following approach to determine whether the proposed program is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed program.
- Describe the environmental baseline in the program-level action area.
- Analyze the effects of the proposed program, and the types of individual projects that will be funded under that program, on both species and their habitat.
- Describe any cumulative effects in the program-level action area.
- Integrate and synthesize the above factors to assess the risk that the proposed program poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed program.

2.2 Rangewide Status of the Species and Critical Habitat

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

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large is climate change.

2.2.1 Status of the Species

For Pacific salmon, steelhead, and other relevant species NMFS commonly uses four parameters to assess the viability of the populations that, together, constitute the species: spatial structure, diversity, abundance, and productivity (McElhany *et al.* 2000). These "viable salmonid population" (VSP) criteria therefore 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. These attributes are influenced by survival, behavior, and experiences throughout a species' entire life cycle, and these characteristics, in turn, are influenced by habitat and other environmental conditions.

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

The summaries that follow describe the status of the 17 ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed program and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 1).

Climate change is likely to play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early-spring will be less affected. Low-elevation areas are likely to be more affected. During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas. Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F. Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

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

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

The earth's oceans are also warming, with considerable interannual and inter-decadal variability superimposed on the longer-term trend (Bindoff *et al.* 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005; USGCRP 2009; Zabel *et al.* 2006). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al.* 2006).

The status of species and critical habitat sections below are organized under four recovery domains (Table 6) to better integrate recovery planning information that NMFS is developing on the conservation status of the species and critical habitats considered in this consultation. Recovery domains are the geographically-based areas that NMFS is using to prepare multi-species recovery plans.

Southern distinct population segment (DPS) green sturgeon are under the jurisdiction of NMFS' Southwest Region. The first meeting of the recovery team for this species was announced to be held in December, 2009. A recovery team has not yet been convened for southern DPS eulachon, a species under the jurisdiction of NMFS' Northwest Region. Southern green sturgeon and eulachon are not confined to a single recovery domain. Southern green sturgeon occur in the WLC, OC and SONCC recovery domains, and eulachon occur in the WLC and OC recovery domains. However, the status of those two species is only described once, with other species in the WLC domain.

Table 6. Recovery planning domains identified by NMFS and their ESA-listed salmon and steelhead species.

Recovery Domain	Species
WLC	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
IC	UCR spring-run Chinook salmon SR spring/summer-run Chinook salmon SR fall-run Chinook salmon SR sockeye salmon UCR steelhead MCR steelhead SRB steelhead
OC	OC coho salmon
SONCC	SONCC coho salmon

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

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

The A&P score considers the TRT's estimate of a populations' minimum threshold population, natural spawning abundance and the productivity of the population. Productivity over the entire life cycle and factors that affect population growth rate provide information on how well a

9 For Pacific salmon, NMFS uses its 1991 ESU policy, that states that a population or group of populations will be considered a Distinct Population Segment if it is an Evolutionarily Significant Unit. An ESU represents a distinct population segment of Pacific salmon under the Endangered Species Act that 1) is substantially reproductively isolated from conspecific populations and 2) represents an important component of the evolutionary legacy of the species. The species *O. mykiss* is under the joint jurisdiction of NMFS and the Fish and Wildlife Service, so in making its listing January, 2006 determinations NMFS elected to use the 1996 joint FWS-NMFS DPS policy for this species.

population is "performing" in the habitats it occupies during the life cycle. Estimates of population growth rate that indicate a population is consistently failing to replace itself are an indicator of increased extinction risk. The four metrics (abundance, productivity, spatial structure, and diversity) are not independent of one another and their relationship to sustainability depends on a variety of interdependent ecological processes (Wainwright *et al.* 2008).

Integrated SS/D risk combines risk for likely, future environmental conditions, and diversity (Ford 2011; McElhany *et al.* 2007; McElhany *et al.* 2000). Diversity factors include:

- Life history traits: Distribution of major life history strategies within a population, variability of traits, mean value of traits, and loss of traits.
- Effective population size: One of the indirect measures of diversity is effective population size. A population at chronic low abundance or experiencing even a single episode of low abundance is at a higher extinction risk because of loss of genetic variability, inbreeding and the expression of inbreeding depression, or the effects of mutation accumulation.
- Impact of hatchery fish: Interbreeding of wild populations and hatchery origin fish are a significant risk factor to the diversity of wild populations if the proportion of hatchery fish in the spawning population is high and their genetic similarity to the wild population is low.
- Anthropogenic mortality: The susceptibility to mortality from harvest or habitat alterations will differ depending on size, age, run timing, disease resistance or other traits.
- Habitat diversity: Habitat characteristics have clear selective effects on populations, and changes in habitat characteristics are likely to eventually lead to genetic changes through selection for locally adapted traits. In assessing risk associated with altered habitat diversity, historical diversity is used as a reference point.

Overall viability risk scores (high to low) and population persistence scores are based on combined ratings for the abundance and productivity (A&P) and spatial structure and diversity[10] (SS/D) metrics (Table 7) (McElhany *et al.* 2006). Persistence probabilities, which are provided here for Lower Columbia River salmon and steelhead, are the complement of a population's extinction risk (*i.e.*, persistence probability = 1 – extinction risk) (NMFS 2012b). The IC-TRT has provided viability criteria that are based on McElhany (2000) and McElhany (2006), as well as the results of previous applications in other TRTs and a review of specific information available relative to listed IC ESU populations (Ford 2011; IC-TRT 2007).

10 The WLC-TRT provided ratings for diversity and spatial structure risks. The IC-TRT provided spatial structure and diversity ratings combined as an integrated SS/D risk.

Table 7. Population persistence categories from McElhany *et al.* (2006). A low or negligible risk of extinction is considered "viable" (Ford 2011). Population persistence categories correspond to: 4 = very low (VL), 3 = low (L), 2 = moderate (M), 1 = high (H), and 0 = very high (VH) in Oregon populations, which corresponds to "extirpated or nearly so" (E) in Washington populations (Ford 2011).

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

The boundaries of each population were defined using a combination of genetic information, geography, life-history traits, morphological traits, and population dynamics that indicate the extent of reproductive isolation among spawning groups. To date, the TRTs have divided the 19 species of salmon and steelhead considered in this opinion into a total of 304 populations, although the population structure of PS steelhead has yet to be resolved. The overall viability of a species is a function of the VSP attributes of its constituent populations. Until a viability analysis of a species is completed, the VSP guidelines recommend that all populations should be managed to retain the potential to achieve viable status to ensure a rapid start along the road to recovery, and that no significant parts of the species are lost before a full recovery plan is implemented (McElhany *et al.* 2000).

The size and distribution of the populations considered in this opinion generally have declined over the last few decades due to natural phenomena and human activity, including climate change (as described in Section 2.2), the operation of hydropower systems, over-harvest, effects of hatcheries, and habitat degradation. Enlarged populations of terns, seals, California sea lions, and other aquatic predators in the Pacific Northwest may be limiting the productivity of some Pacific salmon and steelhead populations (Ford 2011).

Viability status or probability or population persistence is described below for each of the populations considered in this opinion. Although southern DPS green sturgeon and eulachon are part of more than one recovery domain structure, they are presented below for convenience as part of the WLC recovery domain.

Willamette-Lower Columbia Recovery Domain. Species in the WLC recovery domain include LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UWR steelhead, southern DPS green sturgeon, and eulachon. The WLC-TRT has identified 107 demographically independent populations of Pacific salmon and steelhead (Table 8). These populations were further aggregated into strata, groupings above the population level that are connected by some degree of migration, based on ecological subregions. All 107 populations use parts of the mainstem of the Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

Table 8. Populations in the WLC recovery domain. Combined extinction risks for salmon and steelhead based on an analysis of Oregon populations.

Species	Populations
LCR Chinook salmon	32
UWR Chinook salmon	7
CR chum salmon	17
LCR coho salmon	24
LCR steelhead	23
UWR steelhead	4

Status of LCR Chinook Salmon

Spatial Structure and Diversity. This species includes all naturally-spawned populations of Chinook salmon in the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River; the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River; and progeny of seventeen artificial propagation programs.[11] LCR Chinook populations exhibit three different life history types base on return timing and other features: fall-run (a.k.a. "tules"), late-fall-run (a.k.a. "brights"), and spring-run. The WLC-TRT identified 32 historical populations of LCR Chinook salmon— seven in the coastal subregion, six in the Columbia Gorge, and 19 in the Cascade Range (Table 9). Spatial structure has been substantially reduced in several populations. Low abundance, past broodstock transfers and other legacy hatchery effects, and ongoing hatchery straying may have reduced genetic diversity within and among LCR Chinook salmon populations. Hatchery-origin fish spawning naturally may also have reduced population productivity (Lower Columbia Fish Recovery Board 2010; ODFW 2010). Out of the 32 populations that make up this ESU, only the two late-fall runs—the North Fork Lewis and Sandy—are considered viable. Most populations (26 out of 32) have a very low probability of persistence over the next 100 years (and some are extirpated or nearly so) (Ford 2011; Lower Columbia Fish Recovery Board 2010; ODFW 2010). Five of the six strata fall significantly short of the WLC-TRT criteria for viability; one stratum, Cascade late-fall, meets the WLC TRT criteria (NMFS 2012b).

[11] In 2009, the Elochoman tule fall Chinook salmon program was discontinued and four new fall Chinook salmon programs have been initiated. In 2011, NMFS recommended removing the Elochoman program from the ESU and adding the new programs to the ESU (NMFS 2011b).

Table 9. LCR Chinook salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine overall net persistence probability of the population (NMFS 2012b). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

Abundance and Productivity. A&P ratings for LCR Chinook salmon populations are currently "low" to "very low" for most populations, except for spring Chinook salmon in the Sandy River, which are "moderate" and late-fall Chinook salmon in North Fork Lewis River and Sandy River, which are "very high" (NMFS 2012b). Low abundance of natural-origin spawners (100 fish or fewer) has increased genetic and demographic risks. Other LCR Chinook salmon populations have higher total abundance, but several of these also have high proportions of hatchery-origin spawners. Particularly for tule fall Chinook salmon populations, poor data quality prevents precise quantification of population abundance and productivity; data quality has been poor because of inadequate spawning surveys and the presence of unmarked hatchery-origin spawners (Ford 2011).

Limiting Factors include (NMFS 2012b; NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects
- Hatchery-related effects
- Harvest-related effects on fall Chinook salmon
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- 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 strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

Status of UWR Chinook Salmon.

Spatial Structure and Diversity. This species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River; in the Willamette River and its tributaries above Willamette Falls, Oregon; and progeny of seven artificial propagation programs. All seven historical populations of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 10). The McKenzie River population currently characterized as at a “low” risk of extinction and the Clackamas population has a “moderate” risk. (Ford 2011). Consideration of data collected since the last status review in 2005 has confirmed the high fraction of hatchery origin fish in all of the populations of this species (even the Clackamas and McKenzie rivers have hatchery fractions above WLC-TRT viability thresholds). All of the UWR Chinook salmon populations have “moderate” or “high” risk ratings for diversity. Clackamas River Chinook salmon have a “low” risk rating for spatial structure (Ford 2011).

Table 10. Scores for the key elements (A&P, diversity, and spatial structure) used to determine current overall viability risk for UWR Chinook salmon (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

Abundance and Productivity. The Clackamas and McKenzie river populations currently have the best risk ratings for A&P, spatial structure, and diversity. Data collected since the BRT status update in 2005 highlighted the substantial risks associated with pre-spawning mortality. Although recovery plans are targeting key limiting factors for future actions, there have been no significant on-the-ground-actions since the last status review to resolve the lack of access to historical habitat above dams nor have there been substantial actions removing hatchery fish from the spawning grounds. Overall, the new information does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting Factors include (NOAA Fisheries 2011; ODFW and NMFS 2011):

- Significantly reduced access to spawning and rearing habitat because of tributary dams
- Degraded freshwater habitat, especially floodplain connectivity and function, channel structure and complexity, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development
- Degraded water quality and altered temperature as a result of both tributary dams and the cumulative impacts of agriculture, forestry, and urban development
- Hatchery-related effects
- Anthropogenic introductions of non-native species and out-of-ESU races of salmon or steelhead have increased predation on, and competition with, native UWR Chinook salmon
- Ocean harvest rates of approximately 30%

Status of CR Chum Salmon

Spatial Structure and Diversity. This species includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, and progeny of three artificial propagation programs. The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers *et al.* 2006) (Table 11). CR chum salmon spawning aggregations identified in the mainstem Columbia River were included in the population associated with the nearest river basin.

The very low persistence probabilities or possible extirpations of most chum salmon populations are due to low abundance, productivity, spatial structure, and diversity. Although, hatchery production of chum salmon has been limited and hatchery effects on diversity are thought to have been relatively small, diversity has been greatly reduced at the ESU level because of presumed extirpations and the low abundance in the remaining populations (fewer than 100 spawners per year for most populations)(Lower Columbia Fish Recovery Board 2010; NMFS 2012b). The Lower Gorge population meets abundance and productivity criteria for very high levels of viability, but the distribution of spawning habitat (i.e., spatial structure) for the population has been significantly reduced (Lower Columbia Fish Recovery Board 2010); spatial structure may need to be improved, at least in part, through better performance from the Oregon portion of the population (NMFS 2012b).

Table 11. CR chum salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2012b). Persistence probability ratings are very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

* No data are available to make a quantitative assessment.

<u>Abundance and Productivity</u>. Of the 17 populations that historically made up this ESU, 15 of them (six in Oregon and nine in Washington) are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010). All three strata in the ESU fall significantly short of the WLC-TRT criteria for viability. Currently almost all natural production occurs in just two populations: the Grays/Chinook and the Lower Gorge. The

Grays/Chinook population has a moderate persistence probability, and the Lower Gorge population has a high probability of persistence (Lower Columbia Fish Recovery Board 2010; NMFS 2012b).

Limiting Factors include (NMFS 2012b; NOAA Fisheries 2011):

- Degraded estuarine and nearshore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system
- Degraded freshwater habitat, in particular of floodplain connectivity and function, channel structure and complexity, stream substrate, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development
- Degraded stream flow as a result of hydropower and water supply operations
- Loss of access and loss of some habitat types as a result of passage barriers such as roads and railroads
- Reduced water quality
- Current or potential predation from hatchery-origin salmonids, including coho salmon
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- 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 strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

Status of LCR Coho Salmon

Spatial Structure and Diversity. This species includes all naturally-spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 25 artificial propagation programs.[12] Spatial diversity is rated “moderate” to “very high” for all the populations, except the North Fork Lewis River, which has a “low” rating for spatial structure.

Three status evaluations of LCR coho salmon status, all based on WLC-TRT criteria, have been conducted since the last NMFS status review in 2005 (McElhany *et al.* 2007; NMFS 2012b). Out of the 24 populations that make up this ESU (Table 12), 21 are considered to have a very low probability of persisting for the next 100 years, and none is considered viable (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010).

[12] The Elochoman Hatchery Type-S and Type-N coho salmon programs were eliminated in 2008. The last adults from these two programs returned to the Elochoman in 2010. NMFS has recommended that these two programs be removed from the ESU (NMFS 2011b).

Table 12. LCR coho salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2012b). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

Abundance and Productivity. In Oregon, the Clatskanie Creek and Clackamas River populations have "low" and "moderate" persistence probability ratings for A&P, while the rest are rated "very low." All of the Washington populations have "very low" A&P ratings. The persistence probability for diversity is "high" in the Clackamas population, "moderate" in the Clatskanie, Scappoose, Lower Cowlitz, South Fork Toutle, Coweeman, East Fork Lewis, and Sandy populations, and "low" to "very low" in the rest (NMFS 2012b). Uncertainty is high because of a lack of adult spawner surveys. Smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011; NMFS 2011b; NMFS 2012b).

Limiting Factors include (NMFS 2012b; NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system

- Fish passage barriers that limit access to spawning and rearing habitats
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Hatchery-related effects
- Harvest-related effects
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- 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 strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

Status of LCR Steelhead

Spatial Structure and Diversity. Four strata and 23 historical populations of LCR steelhead occur within the DPS: 17 winter-run populations and six summer-run populations, within the Cascade and Gorge ecological subregions (Table 13).[13] The DPS also includes the progeny of ten artificial propagation programs.[14] 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.

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

[14] In 2007, the release of Cowlitz Hatchery winter steelhead into the Tilton River was discontinued; in 2009, the Hood River winter steelhead program was discontinued; and in 2010, the release of hatchery winter steelhead into the Upper Cowlitz and Cispus rivers was discontinued. In 2011, NMFS recommended removing these programs from the DPS. A Lewis River winter steelhead program was initiated in 2009, and in 2011, NMFS proposed that it be included in the DPS (NMFS 2011b).

Table 13. LCR steelhead strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2012b). Persistence probability ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

It is likely that genetic and life history diversity has been reduced as a result of pervasive hatchery effects and population bottlenecks. Spatial structure remains relatively high for most populations Out of the 23 populations, 16 are considered to have a "low" or "very low" probability of persisting over the next 100 years, and six populations have a "moderate" probability of persistence (Ford 2011; Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010). All four strata in the DPS fall short of the WLC-TRT criteria for viability (NMFS 2012b).

Baseline persistence probabilities were estimated to be "low" or "very low" for three out of the six summer steelhead populations that are part of the LCR DPS, moderate for two, and high for one—the Wind, which is considered viable (Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010). Thirteen of the 17 LCR winter steelhead populations have "low" or "very low" baseline probabilities of persistence, and the remaining four are at "moderate" probability of persistence (Table 9) (Lower Columbia Fish Recovery Board 2010; NMFS 2012b; ODFW 2010).

Abundance and Productivity. The “low” to “very low” baseline persistence probabilities of most Lower Columbia River steelhead populations reflects low abundance and productivity (NMFS 2012b). All of the populations increased in abundance during the early 2000s, generally peaking in 2004. Most populations have since declined back to levels within one standard deviation of the long term mean. Exceptions are the Washougal summer-run and North Fork Toutle winter-run, which are still higher than the long term average, and the Sandy, which is lower. In general, the populations do not show any sustained dramatic changes in abundance or fraction of hatchery origin spawners since the 2005 status review (Ford 2011). Although current LCR steelhead populations are depressed compared to historical levels and long-term trends show declines, many populations are substantially healthier than their salmon counterparts, typically because of better habitat conditions in core steelhead production areas (Lower Columbia Fish Recovery Board 2010; NMFS 2012b).

Limiting Factors include (NMFS 2012b; NOAA Fisheries 2011):

- Degraded estuarine and nearshore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and recruitment of large wood, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects and lowland development
- Avian and marine mammal predation in the lower mainstem Columbia River and estuary.
- Hatchery-related effects
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- 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 strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

Status of UWR Steelhead

Spatial Structure and Diversity. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River. One stratum and four extant populations of UWR steelhead occur within the DPS (Table 14). 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, not part of the DPS. Additionally, stocked summer steelhead that have become established in the McKenzie River were not considered in the identification of historical populations (ODFW and NMFS 2011).

Table 14. 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 range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

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

Limiting Factors include (NOAA Fisheries 2011; ODFW and NMFS 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, and stream flow have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Degraded water quality and altered temperature as a result of both tributary dams and the cumulative impacts of agriculture, forestry, and urban development
- Reduced access to spawning and rearing habitats mainly as a result of artificial barriers in spawning tributaries
- Hatchery-related effects: impacts from the non-native summer steelhead hatchery program
- Anthropogenic introductions of non-native species and out-of-ESU races of salmon or steelhead have increased predation and competition on native UWR steelhead.

Status of Southern DPS Green Sturgeon

Spatial Structure and Diversity. Two DPSs have been defined for green sturgeon (*Acipenser medirostris*), a northern DPS (spawning populations in the Klamath and Rogue rivers) and a southern DPS (spawners in the Sacramento River). Southern green sturgeon 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.

Southern green sturgeon occur in the Willamette and Lower Columbia (WLC), Oregon Coast (OC), and Southern Oregon/Northern California Coasts (SONCC) recovery domains.

Limiting factors. The principal factor for the decline of southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. It is currently at risk of extinction primarily because of human-induced ‘‘takes’’ involving elimination of freshwater spawning habitat, degradation of freshwater and estuarine habitat quality, water diversions, fishing, and other causes (USDC 2009). Adequate water flow and temperature are issues of concern. Water diversions pose an unknown but potentially serious threat within the Sacramento and Feather Rivers and the Sacramento River Delta. Poaching also poses an unknown but potentially serious threat because of high demand for sturgeon caviar. The effects of contaminants and nonnative species are also unknown but potentially serious threats. As mentioned above, retention of green sturgeon in both recreational and commercial fisheries is now prohibited within the western states, but the effect of capture/release in these fisheries is unknown. There is evidence of fish being retained illegally, although the magnitude of this activity likely is small (NOAA Fisheries 2011).

Status of Southern DPS Eulachon

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

Abundance and Productivity. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River 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 2001–2003, 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), and since 2005, the fishery has operated at the most conservative level allowed in the management plan (Joint Columbia River Management Staff 2009). Large commercial and recreational fisheries have occurred in the Sandy River in the past. The most recent commercial harvest in the Sandy River was in 2003. No commercial harvest has been recorded for the Grays River from 1990 to the present, but larval sampling has confirmed successful spawning in recent years (USDC 2011).

Limiting Factors include (Gustafson *et al.* 2011; Gustafson *et al.* 2010; NOAA Fisheries 2011):

- Changes in ocean conditions due to climate change, particularly in the southern portion of its range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success.
- Climate-induced change to freshwater habitats, dams and water diversions (particularly in the Columbia and Klamath Rivers where hydropower generation and flood control are major activities)
- Bycatch of eulachon in commercial fisheries
- Adverse effects related to dams and water diversions
- Artificial fish passage barriers
- Increased water temperatures, insufficient streamflow
- Altered sediment balances
- Water pollution
- Over-harvest
- Predation

Interior Columbia Recovery Domain. Species in the Interior Columbia (IC) recovery domain include UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, MCR steelhead, and SRB steelhead. The IC-TRT identified 82 populations of those species based on genetic, geographic (hydrographic), and habitat characteristics (Table 15). In some cases, the IC-TRT further aggregated populations into "major groupings" based on dispersal distance and rate, and drainage structure, primarily the location and distribution of large tributaries (IC-TRT 2003). All 82 populations identified use the lower mainstem of the Snake River, the mainstem of the Columbia River, and the Columbia River estuary, or part thereof, for migration, rearing, and smoltification.

Table 15. Populations of ESA-listed salmon and steelhead in the IC recovery domain.

Species	Populations
UCR spring-run Chinook salmon	3
SR spring/summer-run Chinook salmon	31
SR fall-run Chinook salmon	1
SR sockeye salmon	1
MCR steelhead	17
UCR steelhead	4
SRB steelhead	24

The IC-TRT also recommended viability criteria that follow the VSP framework (McElhany *et al.* 2006) and described biological or physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period (IC-TRT 2007; NRC 1995).

Status of UCR Spring-run Chinook Salmon

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 IC-TRT identified four independent populations of UCR spring-run Chinook salmon in the upriver tributaries of Wenatchee, Entiat, Methow, and Okanogan (extirpated), but no major groups due to the relatively small geographic area affected (Ford 2011; IC-TRT 2003) (Table 16).

Table 16. Scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for spring-run UCR Chinook salmon (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) and extirpated (E).

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

The composite SS/D risks for all three of the extant populations in this MPG are at "high" risk. The spatial processes component of the SS/D risk is "low" for the Wenatchee River and Methow River populations and "moderate" for the Entiat River (loss of production in lower section increases effective distance to other populations). All three of the extant populations in this MPG are at "high" risk for diversity, driven primarily by chronically high proportions of hatchery-origin spawners in natural spawning areas and lack of genetic diversity among the natural-origin spawners (Ford 2011).

Increases in natural origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging; however, average productivity levels remain extremely low. Overall, the viability of Upper Columbia Spring Chinook salmon ESU has likely improved somewhat since the last status review, but the ESU is still clearly at "moderate-to-high" risk of extinction (Ford 2011).

Abundance and Productivity. UCR spring-run Chinook salmon is not currently meeting the viability criteria (adapted from the IC-TRT) in the Upper Columbia Recovery Plan. A&P remains at "high" risk for each of the three extant populations in this MPG/ESU (Table 12). The 10-year geometric mean abundance of adult natural origin spawners has increased for each population relative to the levels for the 1981-2003 series, but the estimates remain below the corresponding IC-TRT thresholds. Estimated productivity (spawner to spawner return rate at low to moderate escapements) was on average lower over the years 1987-2009 than for the previous period. The combinations of current abundance and productivity for each population result in a "high" risk rating.

Limiting Factors include (NOAA Fisheries 2011; Upper Columbia Salmon Recovery Board 2007):

- Mainstem Columbia River hydropower–related adverse effects: upstream and downstream fish passage, ecosystem structure and function, flows, and water quality
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Degraded estuarine and nearshore marine habitat
- Hatchery related effects: including past introductions and persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species
- Harvest in Columbia River fisheries

Status of SR Spring/summer-run Chinook Salmon

Spatial Structure and Diversity**.** This species includes all naturally-spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins; and progeny of fifteen artificial propagation programs. The IC-TRT identified 28 extant and 4 extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into major population groups (Ford 2011; IC-TRT 2003). Each of these populations faces a “high” risk of extinction (Ford 2011) (Table 17).

Table 17. SR spring/summer-run Chinook salmon ecological subregions, 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 (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH), and extirpated (E).

Ecological Subregions	Spawning Populations (Watershed)	A&P	Diversity	Integrated SS/D	Overall Viability Risk
Lower Snake River	Tucannon River	H	M	M	H
	Asotin River				E
Grande Ronde and Imnaha rivers	Wenaha River	H	M	M	H
	Lostine/Wallowa River	H	M	M	H
	Minam River	H	M	M	H
	Catherine Creek	H	M	M	H
	Upper Grande Ronde R.	H	M	H	H
	Imnaha River	H	M	M	H
	Big Sheep Creek				E
	Lookingglass Creek				E
South Fork Salmon River	Little Salmon River	*	*	*	H
	South Fork mainstem	H	M	M	H
	Secesh River	H	L	L	H
	EF/Johnson Creek	H	L	L	H
Middle Fork Salmon River	Chamberlin Creek	H	L	L	H
	Big Creek	H	M	M	H
	Lower MF Salmon	H	M	M	H
	Camas Creek	H	M	M	H
	Loon Creek	H	M	M	H
	Upper MF Salmon	H	M	M	H
	Pistol Creek				E
	Sulphur Creek	H	M	M	H
	Bear Valley Creek	H	L	L	H
	Marsh Creek	H	L	L	H
Upper Mainstem Salmon	N. Fork Salmon River	H	L	L	H
	Lemhi River	H	H	H	H
	Pahsimeroi River	H	H	H	H
	Upper Salmon-lower mainstem	H	L	L	H
	East Fork Salmon River	H	H	H	H
	Yankee Fork	H	H	H	H
	Valley Creek	H	M	M	H
	Upper Salmon main	H	M	M	H
	Panther Creek				E

* Insufficient data.

Abundance and Productivity. Population level status ratings remain at "high" risk across all MPGs within the ESU, although recent natural spawning abundance estimates have increased, all populations remain below minimum natural origin abundance thresholds (Table 13). Spawning escapements in the most recent years in each series are generally well below the peak returns but above the extreme low levels in the mid-1990s. Relatively low natural production rates and spawning levels below minimum abundance thresholds remain a major concern across the ESU.

The ability of SR spring/summer-run Chinook salmon populations to be self-sustaining through normal periods of relatively low ocean survival remains uncertain. Factors cited by Good (2005) remain as concerns or key uncertainties for several populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting Factors include (NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, elevated water temperature, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Mainstem Columbia River and Snake River hydropower impacts
- Harvest-related effects
- Predation

Status of SR Fall-run Chinook Salmon

Spatial Structure and Diversity**.** This species includes all naturally-spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, and progeny of four artificial propagation programs. The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon rivers. The extant population of Snake River fall-run Chinook salmon is the only remaining population from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (Ford 2011; IC-TRT 2003). The population is at moderate risk for diversity and spatial structure. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Abundance and Productivity. The recent increases in natural origin abundance are encouraging. However, hatchery origin spawner proportions have increased dramatically in recent years – on average, 78% of the estimated adult spawners have been hatchery origin over the most recent brood cycle. The apparent leveling off of natural returns in spite of the increases in total brood year spawners may indicate that density dependent habitat effects are influencing production or that high hatchery proportions may be influencing natural production rates. The A&P risk rating for the population is "moderate." Given the combination of current A&P and SS/D ratings summarized above, the overall viability rating for Lower SR fall Chinook salmon would be rated as "maintained."[15]

[15] "Maintained" population status is for populations that do not meet the criteria for a viable population but do support ecological functions and preserve options for ESU/DPS recovery.

Limiting Factors include (NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, and channel structure and complexity have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Harvest-related effects
- Loss of access to historic habitat above Hells Canyon and other Snake River dams
- Mainstem Columbia River and Snake River hydropower impacts
- Hatchery-related effects
- Degraded estuarine and nearshore habitat

Status of SR Sockeye Salmon

Spatial Structure and Diversity**.** This species includes all anadromous and residual sockeye salmon from the Snake River basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake captive propagation program. The IC-TRT identified historical sockeye salmon production in at least five Stanley Basin and Sawtooth Valley lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (*e.g.,* Wallowa and Payette Lakes), although current returns of SR sockeye salmon are extremely low and limited to Redfish Lake (IC-TRT 2007).

Abundance and Productivity. This species is still at extremely high risk across all four basic risk measures (abundance, productivity, spatial structure and diversity. Although the captive brood program has been successful in providing substantial numbers of hatchery produced *O. nerka* for use in supplementation efforts, substantial increases in survival rates across life history stages must occur to re-establish sustainable natural production (Hebdon *et al.* 2004; Keefer *et al.* 2008). Overall, although the risk status of the Snake River sockeye salmon ESU appears to be on an improving trend, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting Factors. The key factor limiting recovery of SR sockeye salmon ESU is survival outside of the Stanley Basin. Portions of the migration corridor in the Salmon River are impeded by water quality and temperature (Idaho Department of Environmental Quality 2011). Increased temperatures likely reduce the survival of adult sockeye returning to the Stanley Basin. The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals. In most years, sockeye adult returns to Lower Granite suffer catastrophic losses (Reed *et al.* 2003) (*e.g.*, > 50% mortality in one year) before reaching the Stanley Basin, although the factors causing these losses have not been identified. In the Columbia and lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown, but terns and cormorants consume 12% of all salmon smolts reaching the estuary, and piscivorous fish consume an estimated 8% of migrating juvenile salmon (NOAA Fisheries 2011).

Status of MCR Steelhead

Spatial Structure and Diversity**.** This species includes all naturally-spawned steelhead populations below natural and artificial impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the

Yakima River, Washington, excluding steelhead from the Snake River basin; and progeny of seven artificial propagation programs. The IC-TRT identified 17 extant populations in this DPS (IC-TRT 2003). The populations fall into four major population groups: the Yakima River Basin (four extant populations), the Umatilla/Walla-Walla drainages (three extant and one extirpated populations); the John Day River drainage (five extant populations) and the Eastern Cascades group (five extant and two extirpated populations) (Table 18) (Ford 2011; NMFS 2009).

Table 18. Ecological subregions, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for MCR steelhead (Ford 2011; NMFS 2009). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to 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.

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

* Re-introduction efforts underway (NMFS 2009).

Straying frequencies into at least the Lower John Day River population are high. Out-of-basin hatchery stray proportions, although reduced, remain very high in the Deschutes River basin.

Abundance and Productivity. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. 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 (adopted from the IC-TRT) in the MCR steelhead recovery plan (NMFS 2009). In addition, several of the factors cited by Good (2005) remain as concerns or key uncertainties. Natural origin spawning estimates of populations have been highly variable with respect to meeting minimum abundance thresholds. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting Factors include (NMFS 2009; NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas, fish passage, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, tributary hydro system activities, and development
- 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 UCR Steelhead

Spatial Structure and Diversity**.** This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, and progeny of six artificial propagation programs. Four independent populations of UCR steelhead were identified by the IC-TRT in the same upriver tributaries as for UC spring-run Chinook salmon (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan; Table 19) and, similarly, no major population groupings were identified due to the relatively small geographic area involved (Ford 2011; IC-TRT 2003). All extant populations are considered to be at high risk of extinction (Table 15)(Ford 2011). With the exception of the Okanogan population, the Upper Columbia populations rated as "low" risk for spatial structure. The "high" risk ratings for SS/D are largely driven by chronic high levels of hatchery spawners within natural spawning areas and lack of genetic diversity among the populations. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Table 19. Summary of the key elements (A&P, diversity, and SS/D) and scores used to determine current overall viability risk for UCR steelhead populations (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

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

Abundance and Productivity. Upper Columbia steelhead populations have increased in natural origin abundance in recent years, but productivity levels remain low. The modest improvements in natural returns in recent years are probably primarily the result of several years of relatively good natural survival in the ocean and tributary habitats.

Limiting Factors include (NOAA Fisheries 2011; Upper Columbia Salmon Recovery Board 2007):

- Mainstem Columbia River hydropower–related adverse effects
- Impaired tributary fish passage
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Effects of predation, competition, and disease mortality: Fish management, including past introductions and persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species.
- Hatchery-related effects
- Harvest-related effects

Status of SRB Steelhead

Spatial Structure and Diversity**.** This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, and progeny of six artificial propagation programs. The IC-TRT identified 24 historical populations in five major groups (Table 20) (Ford 2011; IC-TRT 2011). The IC-TRT has not assessed the viability of this species. The relative proportion of hatchery fish in natural spawning areas near major hatchery release sites is highly uncertain. There is little evidence for substantial change in ESU viability relative to the previous BRT and IC-TRT reviews. Overall, therefore, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Table 20. Ecological subregions, populations, and scores for the key elements (A&P, diversity, and SS/D) used to determine current overall viability risk for SRB steelhead (Ford 2011; NMFS 2011c). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to 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.

Ecological subregions	Spawning Populations (Watershed)	A&P	Diversity	Integrated SS/D	Overall Viability Risk*
Lower Snake River	Tucannon River	**	M	M	H
	Asotin Creek	**	M	M	MT
Grande Ronde River	Lower Grande Ronde	**	M	M	Not rated
	Joseph Creek	VL	L	L	Highly viable
	Upper Grande Ronde	M	M	M	MT
	Wallowa River	**	L	L	H
Clearwater River	Lower Clearwater	M	L	L	MT
	South Fork Clearwater	H	M	M	H
	Lolo Creek	H	M	M	H
	Selway River	H	L	L	H
	Lochsa River	H	L	L	H
Salmon River	Little Salmon River	**	M	M	MT
	South Fork Salmon	**	L	L	H
	Secesh River	**	L	L	H
	Chamberlain Creek	**	L	L	H
	Lower MF Salmon	**	L	L	H
	Upper MF Salmon	**	L	L	H
	Panther Creek	**	M	H	H
	North Fork Salmon	**	M	M	MT
	Lemhi River	**	M	M	MT
	Pahsimeroi River	**	M	M	MT
	East Fork Salmon	**	M	M	MT
	Upper Main Salmon	**	M	M	MT
Imnaha	Imnaha River	M		M	MT

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

Abundance and Productivity. The level of natural production in the two populations with full data series and the Asotin Creek index reaches is encouraging, but the status of most populations in this DPS remains highly uncertain. Population-level natural origin abundance and productivity inferred from aggregate data and juvenile indices indicate that many populations are likely below the minimum combinations defined by the IC-TRT viability criteria.

Limiting Factors include (IC-TRT 2011; NMFS 2011c):

- Mainstem Columbia River hydropower–related adverse effects
- Impaired tributary fish passage

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Impaired water quality and increased water temperature
- Related harvest effects, particularly for B-run steelhead
- Predation
- Genetic diversity effects from out-of-population hatchery releases

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

Status of OC Coho Salmon

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 stock (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; 21 independent and 35 dependent. The dependent populations were dependent on strays from other populations to maintain them over long time periods. The TRT also identified 5 biogeographic strata (Table 21) (Lawson *et al.* 2007).

Table 21. OC coho salmon populations. 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. 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 (FI) and potentially independent (PI) (Lawson *et al.* 2007; McElhany *et al.* 2000).

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		Sutton Creek	D
Mid-Coast	Salmon River	PI	Lakes	Siuslaw River	FI
	Devils Lake	D		Siltcoos Lake	PI
	Siletz River	FI		Tahkenitch Lake	PI
	Schoolhouse Creek	D		Tenmile Lakes	PI
	Fogarty Creek	D	Umpqua	Lower Umpqua River	FI
	Depoe Bay	D		Middle Umpqua River	FI
	Rocky Creek	D		North Umpqua River	FI
	Spencer Creek	D		South Umpqua River	FI
	Wade Creek	D	Mid-South Coast	Threemile Creek	D
	Coal Creek	D		Coos River	FI
	Moolack Creek	D		Coquille River	FI
	Big Creek (Yaquina)	D		Johnson Creek	D
	Yaquina River	FI		Twomile Creek	D
	Theil Creek	D		Floras Creek	PI
	Beaver Creek	PI		Sixes River	PI

A 2010 BRT noted significant improvements in hatchery and harvest practices have been made (Stout *et al.* 2011). However, harvest and hatchery reductions have changed the population dynamics of the ESU. Current concerns for spatial structure focus on the Umpqua River. Of the four populations in the Umpqua stratum, the North Umpqua and South Umpqua were of particular concern. The North Umpqua is controlled by Winchester Dam and has historically been dominated by hatchery fish. Hatchery influence has recently been reduced, but the natural productivity of this population remains to be demonstrated. The South Umpqua is a large, warm system with degraded habitat. Spawner distribution appears to be seriously restricted in this population, and it is probably the most vulnerable of any population in this ESU to increased temperatures.

Current status of diversity shows improvement through the waning effects of hatchery fish on populations of OC coho salmon. In addition, recent efforts in several coastal estuaries to restore lost wetlands should be beneficial. However, diversity is lower than it was historically because of the loss of both freshwater and tidal habitat loss coupled with the restriction of diversity from very low returns over the past 20 years.

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

Limiting Factors include (NOAA Fisheries 2011; Stout *et al.* 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, instream mining, dams, road crossings, dikes, levees, etc.
- Fish passage barriers that limit access to spawning and rearing habitats
- Adverse climate, altered past ocean/marine productivity, and current ocean ecosystem conditions have favored competitors and predators and reduced salmon survival rates in freshwater rivers and lakes, estuaries, and marine environments

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

Status of SONCC Coho Salmon

Spatial Structure and Diversity**.** This species includes all naturally-spawned populations of coho salmon in coastal streams from the Elk River near Cape Blanco, Oregon, through and including the Mattole River near Punta Gorda, California, and progeny of three artificial propagation programs (NMFS 2012c). Williams *et al.* (2006) designated 45 populations of coho salmon in the SONCC coho salmon ESU. 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 22).

Table 22. SONCC coho salmon populations in Oregon. Williams *et al.* (2006) classified populations as dependent or independent based on their historic 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 (FI) and potentially independent (PI). Core population types are independent populations judged most likely to become viable most quickly. Non-core 1 population types are independent populations judged to have lesser potential for rapid recovery than the core populations. 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. Two ephemeral populations (E) are defined as populations both small enough and isolated enough that they are only intermittently present (McElhany *et al.* 2000; NMFS 2012c; Williams *et al.* 2006).

Stratum	Population	Population Type
Northern Coastal	Elk River	FI Core
	Hubbard Creek	E
	Brush Creek	D
	Mussel Creek	D
	Euchre Creek	E
	Lower Rogue River	PI Non-Core 1
	Hunter Creek	D
	Pistol River	D
	Chetco River	FI Core
	Winchuck River*	PI Non-Core 1
Interior Rogue	Upper Rogue River	FI Core
	Middle Rogue/Applegate*	FI Non-Core 1
	Illinois River*	FI Core
Interior Klamath	Upper Klamath River*	FI Core
Central Coastal	Smith River*	FI core

* Populations that also occur partly in California.

NMFS considered the role each population is expected to play in a recovered ESU to determine population abundance and juvenile occupancy targets for all the populations in the SONCC coho salmon ESU. Independent populations are evaluated using a modified Bradbury *et al*. (1995) framework. This model uses three groupings of criteria for ranking watersheds for Pacific salmon restoration prioritization: 1) biological and ecological resources (Biological Importance); 2) watershed integrity and salmonid extinction risk (Integrity and Risk); and 3) potential for restoration (Optimism and Potential). Scores for Biological Importance are based on the concept of VSPs (McElhany *et al.* 2000), and are used to describe the current status of the population – population size, productivity, spatial structure, and diversity. "Core" populations were designated based on current condition, geographic location in the ESU, low risk threshold compared to the number of spawners needed for the entire stratum, and other factors. "Non-core 1" populations are in the moderate risk threshold, which is the depensation threshold[16] multiplied by four.

[16] Williams (2008) defines the depensation threshold as one spawner per km of stream with estimated rearing potential or Intrinsic Potential.

NMFS chooses this target if the population is likely to ultimately produce considerably more than the depensation threshold, but less than the low risk threshold (see Table 23).

Table 23. Draft SONCC coho salmon recovery objectives and criteria by population type (NMFS 2012c).

VSP Parameter	Population Type	Recovery Objective	Recovery Criteria
Abundance	Core	Low risk of extinction.	The geometric mean of wild spawners over 12 years at least meets the "low risk threshold" of spawners for each core population
	Non-Core 1	Moderate or low risk of extinction.	The annual number of wild spawners meets or exceeds the moderate risk threshold for each non-core population
Productivity	Core and Non-Core 1	Population growth rate is not negative.	Slope of regression of the geometric mean of wild spawners over the time series ≥ zero
Spatial Structure	Core and Non-Core 1	Ensure populations are widely distributed.	Annual within-population distribution ≥ 80% of habitat (outside of a temperature mask)
	Non-Core 2 and Dependent	Achieve inter- and intra-stratum connectivity.	20% of accessible habitat is occupied in years following spawning of cohorts that experienced good marine survival
Diversity	Core and Non-Core 1	Achieve low or moderate hatchery impacts on wild fish.	Proportion of hatchery-origin spawners (pHOS) ≤ 0.10
	Core and Non-Core 1	Achieve life history diversity.	Variation is present in migration timing, age structure, size and behavior. Variation in these parameters is retained.

Abundance and Productivity. Although long-term data on abundance of SONCC coho salmon are scarce, available evidence from shorter-term research and monitoring efforts indicate that conditions have worsened for populations since the last formal status review was published (Good *et al.* 2005; NMFS 2012c). Because the extinction risk of an ESU depends upon the extinction risk of its constituent independent populations and 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 (NMFS 2012c).

Limiting Factors. Threats from natural or man-made factors have worsened in the past 5 years, primarily due to four factors: small population dynamics, climate change, multi-year drought, and poor ocean survival conditions (NMFS 2012c; NOAA Fisheries 2011). Limiting factors 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

- Adverse fishery-related effects
- Adverse hatchery-related effects

2.2.2 Status of the Critical Habitats

We reviewed the status of designated critical habitat affected by the proposed program by examining the condition and trends of essential physical and biological features throughout the designated area. 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).

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.[17] The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, NMFS' critical habitat analytical review teams (CHARTs) evaluated the quantity and quality of habitat features (for example, spawning gravels, wood and water condition, side channels), the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area (NOAA Fisheries 2005). Thus, even a location that has poor quality of habitat could be ranked with a high conservation value if it were essential due to factors such as limited availability (*e.g.*, one of a very few spawning areas), a unique contribution of the population it served (*e.g.*, a population at the extreme end of geographic distribution), or the fact that it serves another important role (*e.g.*, obligate area for migration to upstream spawning areas).

This section examines critical habitat condition for LCR Chinook salmon, UWR spring-run Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR, steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, OC coho salmon, and SONCC coho salmon in the WLC, IC, OC and SONCC recovery domains, and for southern green sturgeon and eulachon.

The physical or biological features, or primary constituent elements (PCEs) 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 (Table 24-25). These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

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[17] 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 24. PCEs of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion (except SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and SONCC coho salmon), and corresponding species life history events.

Primary Constituent Elements		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
Offshore marine areas	Forage Water quality	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Table 25. PCEs of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONCC coho salmon, and corresponding species life history events.

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

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

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

Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality – current condition), which considers the existing condition of the quality of PCEs in the

HUC_5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC_5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.

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

For freshwater rivers north of and including the Eel River, the areas upstream of the head of the tide were not considered part of the geographical area occupied by the southern DPS. However, the critical habitat designation recognizes not only the importance of natal habitats, but of habitats throughout their range. Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) and freshwater (USDC 2009). Table 26 below delineates PCEs for Southern DPS green sturgeon.

Table 26. PCEs of critical habitat designated for southern green sturgeon and corresponding species life history events.

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

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

Southern DPS Eulachon. Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). All of these areas are designated as migration and spawning habitat for this species. In Oregon, 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. The mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles is also designated as critical habitat. Table 27 delineates the designated physical or biological features for eulachon.

Table 27. Physical or biological features of critical habitats designated for eulachon and corresponding species life history events.

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

The range of eulachon in the Pacific Northwest completely overlaps with the range of several ESA-listed stocks of salmon and steelhead as well as green sturgeon. Although the habitat requirements of these fishes differ somewhat from eulachon, efforts to protect habitat generally focus on the maintenance of watershed processes that would be expected to benefit eulachon. The BRT identified dams and water diversions as moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath systems, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods (Gustafson *et al.* 2010). Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown (Gustafson *et al.* 2010). The BRT identified dredging as a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental because eggs could be destroyed by mechanical disturbance or smothered by in-water disposal of dredged materials. The lower Columbia River mainstem provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Prior to the construction of Bonneville Dam, eulachon ascended the Columbia River as far as Hood River, Oregon. Major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis and Sandy rivers.

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

Willamette-Lower Columbia Recovery Domain. Critical habitat was designated in the WLC recovery domain for UWR spring-run Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, CR chum salmon, southern green sturgeon, and eulachon, and 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 associated subbasins. In the Willamette River mainstem and lower sub-basin mainstem reaches, high density urban development and widespread agricultural effects have reduced aquatic and riparian habitat quality and complexity, and altered sediment and water quality and quantity, and watershed processes. The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75%. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Logging in the Cascade and Coast Ranges, and agriculture, urbanization, and gravel mining on valley floors have contributed to increased erosion and sediment loads throughout the WLC domain.

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

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

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

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

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

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011d; NMFS 2012b). 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 2011d; NMFS 2012b). 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 ACOE. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the Lower Columbia River is now maintained at a depth of 43-feet and a width of 600-feet. The Lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons (PAHs), have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

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

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011d; NMFS 2012b). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates which feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary’s capacity to support juvenile salmon (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011d; NMFS 2012b). Diking and filling activities have reduced the tidal prism and eliminate emergent and forested wetlands and floodplain habitats. These changes have likely reduced the estuary’s salmon-rearing capacity. Moreover, water and sediment in the Lower Columbia River and its tributaries have toxic contaminants that are harmful to aquatic resources (Lower Columbia River Estuary Partnership 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT. Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns have likely begun to enhance the estuary’s productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats.

The WLC recovery domain CHART determined that most HUC_5 watersheds with PCEs for salmon or steelhead are in fair-to-poor or fair-to-good condition. 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 28).

Table 28. 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). Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

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

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Columbia Gorge #1707010xxx			
Wind River (511)	CK/ST	2/2	2/2
East Fork Hood (506), & Upper (404) & Lower Cispus (405) rivers	CK/ST	2/2	2/2
Plympton Creek (306)	CK	2	2
Little White Salmon River (510)	CK	2	0
Grays Creek (512) & Eagle Creek (513)	CK/CM/ST	2/1/2	1/1/2
White Salmon River (509)	CK/CM	2/1	1/2
West Fork Hood River (507)	CK/ST	1/2	2/2
Hood River (508)	CK/ST	1/1	2/2
Unoccupied habitat: Wind River (511)	Chum conservation value "Possibly High"		
Cascade and Coast Range #1708000xxx			
Lower Gorge Tributaries (107)	CK/CM/ST	2/2/2	2/3/2
Lower Lewis (206) & North Fork Toutle (504) rivers	CK/CM/ST	1/3/1	2/1/2
Salmon (101), Zigzag (102), & Upper Sandy (103) rivers	CK/ST	2/2	2/2
Big Creek (602)	CK/CM	2/2	2/2
Coweeman River (508)	CK/CM/ST	2/2/1	2/1/2
Kalama River (301)	CK/CM/ST	1/2/2	2/1/2
Cowlitz Headwaters (401)	CK/ST	2/2	1/1
Skamokawa/Elochoman (305)	CK/CM	2/1	2
Salmon Creek (109)	CK/CM/ST	1/2/1	2/3/2
Green (505) & South Fork Toutle (506) rivers	CK/CM/ST	1/1/2	2/1/2
Jackson Prairie (503) & East Willapa (507)	CK/CM/ST	1/2/1	1/1/2
Grays Bay (603)	CK/CM	1/2	2/3
Upper Middle Fork Willamette River (101)	CK	2	1
Germany/Abernathy creeks (304)	CK/CM	½	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

Current PCE Condition	Potential PCE 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
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	½	3/3
Upper Molalla River (905)	CK/ST	½	1/1
Abernethy Creek (704)	CK/ST	1/1	1/2
Luckiamute River (306) & Yamhill (807) Lower Molalla (906) rivers; Middle (504) & Lower (506) North Santiam rivers; Hamilton Creek/South Santiam River (601); Wiley Creek (608); Mill Creek/Willamette River (701); & Willamette River/Chehalem Creek (703); Lower South (804) & North (806) Yamhill rivers; & Salt Creek/South Yamhill River (805)	CK/ST	1	1
Hills (102) & Salmon (104) creeks; Salt Creek/Willamette River (103), Hills Creek Reservoir (105), Middle Fork Willamette/Lookout Point (107); Little Fall (108) & Fall (109) creeks; Lower Middle Fork of Willamette (110), Long Tom (301), Marys (305) & Mohawk (406) rivers	CK	1	1
Willamina Creek (802) & Mill Creek/South Yamhill River (803)	ST	1	1
Calapooia River (303); Oak (304) Crabtree (602), Thomas (603) & Rickreall (702) creeks; Abiqua (901), Butte (902) & Rock (903) creeks/Pudding River; & Senecal Creek/Mill Creek (904)	CK/ST	1/1	0/1
Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value "Possibly High"		
Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx			
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) 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 IC recovery domain, which includes the Snake River Basin, for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead. Major tributaries in the Oregon portion of the IC recovery domain include the Deschutes, John Day, Umatilla, Walla Walla, Grande Ronde, and Imnaha rivers.

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

Migratory habitat quality in this area has been severely affected by the development and operation of the FCRPS dams and reservoirs in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia river basins. For example, construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al.* 2005), and Grand Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River. 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 (IC-TRT 2003). Similarly, operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly reduced flows and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the IC recovery domain are over-allocated under state water law, with more allocated water rights than existing streamflow. Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this recovery domain except SR fall-run Chinook salmon and SR sockeye salmon (NMFS 2007; NOAA Fisheries 2011).

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 for agricultural or municipal use 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 IC recovery domain is a very large and diverse area. The CHART determined that few watersheds with PCEs for Chinook salmon or steelhead are in good to excellent condition with no potential for improvement. Overall, most IC recovery domain watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or high potential for improvement. In Washington, the Upper Methow, Lost, White, and Chiwawa watersheds are in good-to-excellent condition with no potential for improvement. In Oregon, only the Lower Deschutes, Minam, Wenaha, and Upper and Lower Imnaha Rivers HUC_5 watersheds are in good-to-excellent condition with no potential for improvement. In Idaho, a number of watersheds with PCEs 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 HUC5watersheds in the Hells Canyon area, straddling Oregon and Idaho, are in good-to-excellent condition with no potential for improvement (Table 29).

Table 29. **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 PCE Condition	Potential PCE 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),	ST	2	1

Current PCE Condition	Potential PCE 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
& Columbia River/Zintel Canyon (606)			
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 (409), Lookingglass (410) & Cabin (411) creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) creeks	ST	2	2
Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	ST	1	3
Five Points (404); Lower Joseph (606) & Deadman (703) creeks	ST	1	2
Tucannon/Alpowa Creek (701)	ST	1	1
Mill Creek (407)	ST	0	3
Pataha Creek (705)	ST	0	2
Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	ST	0	1
Flat Creek (704) & Lower Palouse River (808)	ST	0	0
Upper Salmon and Pahsimeroi #1706020xxx			
Germania (111) & Warm Springs (114) creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) creeks	ST	3	3
Basin Creek (124)	ST	3	2
Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	ST	2	3
Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi	ST	2	2

Current PCE Condition	Potential PCE 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
River/Falls Creek (202)			
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
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	ST	2	2

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Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
(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			
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 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	ST	3	3
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)	ST	1	2

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Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Sweetwater creeks			
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			
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

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Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Mill Creek (605) & Warm Springs River (606)	ST	2	1
Bakeoven (608) & Buck Hollow (611) creeks; Upper (701) & Lower (705) Trout Creek	ST	1	2
Beaver (605) & Antelope (702) creeks	ST	1	1
White River (610) & Mud Springs Creek (704)	ST	1	0
Unoccupied habitat in Deschutes River/McKenzie Canyon (107) & Haystack (311); Squaw Creek (108); Lower Metolius River (110), Headwaters Deschutes River (601)	ST Conservation Value "Possibly High"		

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

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

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

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

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

Southern Oregon/Northern California Coasts Recovery Domain. In this recovery domain, critical habitat has been designated for SONCC coho salmon, southern green sturgeon, and eulachon. 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 (or 58,678 acres) (Maguire 2001). Historical logging, mining, and road building have degraded stream and riparian habitats in the Elk River basin. Limiting factors identified for salmon and steelhead production in this basin include sparse riparian cover, especially in the lower reaches, excessive fine sediment, high water temperatures, and noxious weed invasions (Maguire 2001).

The Rogue River drains approximately 5,160 square miles within Curry, Jackson and Josephine counties in southwest Oregon. The mainstem is about 200 miles long and traverses the coastal mountain range into the Cascades. The Rogue River estuary has been modified from its historical condition. Jetties were built by the ACOE in 1960, which stabilized and deepened the mouth of the river. A dike that extends from the south shore near Highway 101 to the south jetty was completed in 1973. This dike created a backwater for the large shallow area that existed here, which has been developed into a boat basin and marina, eliminating most of the tidal marsh. The quantity of estuary habitat is naturally limited in the Rogue River. The Rogue River has a drainage area of 5,160 square miles, but the estuary at 1,880 acres is one of the smallest in Oregon. Between 1960 and 1972, approximately 13 acres of intertidal and 14 acres of subtidal land were filled in to build the boat basin dike, the marina, north shore riprap and the other north shore developments (Hicks 2005). Jetties constructed in 1960 to stabilize the mouth of the river and prevent shoaling have altered the Rogue River, which historically formed a sill during summer months (Hicks 2005).

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

The Chetco River estuary has been significantly modified from its historical condition. Jetties were erected by the ACOE 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).

2.3 Environmental Baseline

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

As described above in the Status of the Species and Critical Habitat sections, factors that limit the recovery of species considered in this opinion vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the program-level action area, many stream and riparian areas have been degraded by the effects of land and water use, including road construction, forest management, agriculture, mining, transportation, urbanization, and water development. Each of these economic activities has contributed to a myriad of interrelated factors for the decline of species considered in this opinion. Among the most important of these are changes in stream channel morphology, degradation of spawning substrates, reduced instream roughness and cover, loss and degradation of estuarine rearing habitats, loss of wetlands, loss and degradation of riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants) degradation, blocked fish passage, direct take, and loss of habitat refugia. Climate change is likely to play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest.

Anadromous salmonids have been affected by the development and operation of dams. Dams, without adequate fish passage systems, have extirpated anadromous fish from their pre-development spawning and rearing habitats. Dams and reservoirs, within the currently accessible migratory corridor, have greatly altered the river environment and have affected fish passage. The operation of water storage projects has altered the natural hydrograph of many rivers. Water impoundment and dam operations also affect downstream water quality characteristics, vital components to anadromous fish survival. In recent years, high quality fish passage is being restored where it did not previously exist, either through improvements to existing fish passage facilities or through dam removal (*e.g.*, Marmot Dam on the Sandy River and Powerdale Dam on the Hood River).

Within the habitat currently accessible by species considered in this opinion, dams have negatively affected spawning and rearing habitat. Floodplains have been reduced, off-channel habitat features have been eliminated or disconnected from the main channel, and the amount of large woody debris in the mainstem has been greatly reduced. Remaining habitats often are affected by flow fluctuations associated with reservoir water management for power peaking, flood control, and other operations.

The development of hydropower and water storage projects within the Columbia River basin have resulted in the inundation of many mainstem spawning and shallow-water rearing areas (loss of spawning gravels and access to spawning and rearing areas); altered water quality (reduced spring turbidity levels), water quantity (seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, or municipal purposes), water temperature (including generally warmer minimum winter temperatures and cooler maximum summer temperatures), water velocity (reduced spring flows and increased cross-sectional areas of the river channel), food (alteration of food webs, including the type and availability of prey species), and safe passage (increased mortality rates of migrating juveniles) (Ferguson *et al.* 2005; Williams *et al.* 2005).

Marine fish considered in this opinion are exposed to high rates of natural predation during all life stages. Fish, birds, and marine mammals, including harbor seals, sea lions, and killer whales all prey on juvenile and adult salmon. The Columbia River Basin has a diverse assemblage of native and introduced fish species, some of which prey on salmon, steelhead, green sturgeon, or eulachon. The primary resident fish predators of salmonids in many areas of the State of Oregon inhabited by anadromous salmon are northern pikeminnow (native), smallmouth bass (introduced), and walleye (introduced). Other predatory resident fish include channel catfish (introduced), Pacific lamprey (native), yellow perch (introduced), largemouth bass (introduced), and bull trout (native).

Avian predation is another factor limiting salmonid recovery in the Columbia River Basin. Throughout the basin, piscivorous birds congregate near hydroelectric dams and in the estuary near man-made islands and structures. Avian predation has been exacerbated by environmental changes associated with river developments. Water clarity caused by suspended sediments settling in impoundments increases the vulnerability of migrating smolts. Delay in project reservoirs, particularly immediately upstream from the dams increases smolt exposure to avian predators, and juvenile bypass systems concentrate smolts, creating potential feeding stations for birds. Dredge spoil islands, associated with maintaining the Columbia River navigation channel, provide habitat for nesting Caspian terns and other piscivorous birds. Caspian terns, double-crested cormorants, glaucous-winged/western gull hybrids, California gulls, and ring-billed gulls are the principal avian predators in the basin.

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

The environmental baseline includes the anticipated impacts of all Federal actions in the action area that have already undergone formal consultation. For example, from 2001 through 2011, the Corps authorized about 428 transportation projects and 132 restoration actions in Oregon under programmatic consultations (NMFS 2008b; NMFS 2008e). The Corps, Bonneville Power Administration (BPA), and Bureau of Reclamation have consulted on large water management actions, such as operation of the Federal Columbia River Power System, the Umatilla Basin Project, and the Deschutes Project. The U.S. Bureau of Indian Affairs (BIA), U.S. Bureau of Land Management (BLM), and the U.S. Forest Service (USFS) have consulted on Federal land management throughout Oregon, including restoration actions, forest management, livestock grazing, and special use permits. The BPA, NOAA Restoration Center, and USFWS have also consulted on large restoration programs that consist of actions designed to address species limiting factors or make contributions that would aid in species recovery.

The precise project-level action area for each transportation or restoration project 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, NMFS made the following assumptions regarding the environmental baseline in each area that will eventually be chosen to support an action: (1) The purpose of the proposed program is to fund transportation projects, or restoration and fish passage improvements for the benefit of populations of ESA-listed species; (2) each individual action area will be occupied by one or more populations of ESA-listed species; (3) transportation projects will occur as sites where the biological requirements of individual fish of ESA-listed species are not being fully met due, in part, to the presence of untreated highway runoff, impaired fish passage, floodplain fill, streambank hardening, or degraded riparian conditions; and (4) restoration projects will occur at sites where the biological requirements of individual fish of ESA-listed species are not being due to one or more impaired aquatic habitat functions related to any of the habitat factors limiting the recovery of the species in that area.

The action area for some of these previously consulted on actions is likely to overlap with the project-level action area for transportation and restoration projects that will be funded by the Oregon Division through the FAHP. Impacts to the environmental baseline from these previous actions include a wide range of short and long-term effects that maybe adverse or beneficial.

2.4 Effects of the Action on Species and Designated Critical Habitat

"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.

This analysis begins with an overview of the scope of the FAHP program, deconstructs the program and individual projects into four components – program administration, preconstruction, construction, restoration, and operations and maintenance – then examines the general environmental impacts of each of those elements in some detail before analyzing their combined impact on species and designated critical habitats.

The basic infrastructure of Oregon's highway transportation system is in place. With few exceptions, the Oregon Division uses the FAHP to maintain the integrity and safety of Oregon's existing roads and bridges. The scope of action and project elements proposed by the Oregon Division is consistent with actions that promote stewardship of existing infrastructure. The proposed program does not include any action that is intended to help carry out a long-term vision of modernization based on new general purpose highway lanes, new interchanges, new lanes to connect interchanges, or any other feature which result in or contribute to land use changes with effects that may affect ESA-listed species or their critical habitats that are not considered in this opinion. Each action of that type will be the topic of a separate, individual consultation. Thus, a central part of the proposed program includes processes for program administration to ensure that individual projects covered by this analysis remain within the scope of effects considered here, and to ensure that the aggregate or program-level effects of those individual projects are also accounted for.

The physical, chemical, and biotic effects of each individual project the Oregon Division will fund using the FAHP will vary according to the number and type of transportation elements present, although each element will share, in relevant part, a common set of effects related to pre-construction and construction (Darnell 1976; ODOT and FWHA 2011; Spence *et al.* 1996), site restoration (Cramer *et al.* 2003; Cramer 2012), and operation and maintenance (ODOT 2009). NMFS assumes that every individual project will share some the effects described here in proportion to the project's complexity and footprint proximity to species and critical habitat, but that no action will have effects that are greater than the full range of effects described here, because every action is based on the same set of underlying construction activities or elements, and each element is limited by the same design criteria. The duration of construction required to complete each project will normally be less than one year although significant bridge repair or replacement projects may require two or three years of in-water work, and three to four years of upland work to complete. Projects requiring more than three years of inwater work are likely to be quite rare and a project of that scale would typically require and EIS, making it ineligible for coverage under this consultation.

Program administration. The Oregon Division will provide an initial roll-out of the design criteria for ODOT and other likely users to ensure they are incorporated into all phases of design for each project to be funded under the FAHP, and that any unique project or site constraint related to site suitability, right-of-way, special maintenance needs, compensatory mitigation, or cost is resolved early on. Then, the Oregon Division will review each proposed project to ensure that the opinion is being used as intended. The Oregon Division will also obtain an additional approval from NMFS for any project that will have a substantial effect on fish passage or stream geometry, or has other characteristics that require NMFS' special expertise to determine whether the proposal is consistent with the incidental take statement for this opinion and therefore sufficient to fulfill the Oregon Division's ESA duties. The Oregon Division will also retain the right of reasonable access to each project site so that the use of effectiveness of these design criteria can be monitored if necessary. Further, the Oregon Division will notify NMFS before each project begins construction, and shortly after each project is completed to ensure that the projects as designed match the projects "as built."

As an additional program-level check on the continuing effects of the action, the Oregon Division, ODOT and NMFS will meet at least annually to review implementation of this opinion and opportunities to improve conservation, or make the program overall more effective or efficient. Application of consistent design criteria and engineering improvements to the maximum extent feasible in each recovery domain is likely to gradually reduce the total adverse impact of the transportation system, improve ecosystem resilience, and contribute to management actions necessary for the recovery of ESA-listed species and critical habitats in Oregon.

Preconstruction. Some transportation projects have little or even no construction footprint in the riparian zone, riparian area, or in the active channel. For example, upland projects whose only impact to aquatic environments is post-construction stormwater runoff. Other project footprints extend far into the active channel and require activities like work area isolation, fish capture and removal, pile driving, use of barges, or installation of rock or other hard structures.

Each construction footprint that extends into a riparian or instream area is likely to have short-term adverse effects due to the physical and chemical consequences of altering those environments, and to have long-term adverse effects due to the impact of maintaining the built environment's encroachment on aquatic habitats. Conversely, under the action as proposed, each project is also likely to have long-term positive effects through application of design criteria that reduce pre-existing impacts by, for example, improving floodplain connectivity, streambank function, water quality, or fish passage that were impaired by original construction of the transportation system.

Preconstruction activities for transportation projects that are not limited to the existing pavement footprint typically include surveying, mapping, placement of stakes and flagging guides, exploratory drilling, minor vegetation clearing, opening access roads, establishing vehicle and material staging areas, and exploratory drilling.

Surveying, mapping, and the placement of stakes and flagging entail minor movements of machines and personnel over the action area with minimal direct effects but important indirect effects by establishing geographic boundaries that will limit the environmental impact of subsequent activities. The Oregon Division will ensure that work area limits are marked to preserve vegetation and reduce soil disturbance as a fundamental and effective management practice that will to avoid and reduce the impact of all subsequent construction actions.

Excavating test pits removes vegetation in the excavated area and may cause soil compaction along wheel tracks and in excavated spoils placement areas. Typically, spoils do not erode into streams or wetlands since this material is placed back into the test pit once the investigation or sampling has been completed, usually within a 2-hour time period, and the disturbed area is stabilized by seeding and mulching to prevent rainfall from washing sediment from the spoils piles into nearby streams or wetlands (ODOT 2002).

Exploratory drilling with an auger typically produces 2 to 10 cubic yards of spoil that must be stabilized or removed from the site (ODOT 2002). Erosion control berms and ditching that are sometimes used to manage runoff from an active drill site may themselves cause erosion, sedimentation from drilling mud, or other temporary site disturbances. Similarly, untreated drilling fluids sometimes travel along a subsurface soil layer and exit in a stream or wetland and degrade water quality.

Effects from soils testing are similar to those described above for drilling operations. Air rotary drilling produces dust, flying sand-sized rock particles, foaming additives, and fine water spray that must be collected to prevent deposition in a stream or wetland. The distances that cuttings and liquids (*e.g.*, water, foaming additives) are ejected out of the boring depend on the size of the drilling equipment. Unrestrained, larger equipment will disperse particles up to 20-feet, while smaller equipment will typically expel particles up to 10-feet. As with any heavy equipment, drilling rigs are subject to accidental spills of fuel, lubricants, hydraulic fluid and other contaminants that, if unconfined, may harm the riparian zone or aquatic habitats.

When borings are abandoned near streams or wetlands, excess grout must be contained to prevent pollution, especially during rainy periods. In some cases, boring abandonment may not occur for months or even years after the drilling has been completed. Then, soils and vegetation are subjected to additional disturbance when workers re-enter the site. Sometimes, instruments must be drilled out. When this occurs, effects are similar to those described above for drilling.

The Oregon Division will ensure that a suite of erosion and pollution control measures will be applied to any project that involves test pits, exploratory drilling, soil testing, other soil disturbance, or use of hazardous or toxic substances, like drilling fluids or bonding agents, will not result in unnecessary environmental disturbance. Those measures will constrain the use and disposal of all hazardous products, the disposal of construction debris, secure the site against erosion and inundation during high flow events, and ensure that no drilling or other earthwork will occur at an EPA-designated Superfund Site, a state-designated clean-up area, or in the likely impact zone of a significant contaminant source, as identified by historical information or the Oregon Division's best professional judgment.

Establishing access roads and staging areas requires disturbance of vegetation and soils that support floodplain and riparian function, such as delivery of large wood and particulate organic matter, shade, development of root strength for slope and bank stability, and sediment filtering and nutrient absorption from runoff (Darnell 1976; Spence *et al.* 1996). Denuded areas will lose organic matter and dissolved minerals, such as nitrates and phosphates. The microclimate at each action site where vegetation is removed is likely to become drier and warmer, with a corresponding increase in wind speed, and soil and water temperature. Water tables and spring flow in the immediate area may be temporarily reduced. Loose soil will temporarily accumulate in the construction area. In dry weather, part of this soil is dispersed as dust and in wet weather loose soil; part is transported to streams by erosion and runoff, particularly in steep areas. Erosion and runoff increase the supply of sediment to lowland drainage areas and eventually to aquatic habitats, where they increase total suspended solids and sedimentation.

Whenever possible, the Oregon Division will avoid or minimize those adverse effects by requiring the use of existing routes to minimize soil disturbance and compaction within 150-feet of any waterbody, avoidance of slopes where excessive erosion or failure may occur, prompt obliteration and stabilization of all temporary access routes and, whenever possible, even eliminating the need for an access road for operations that can be completed by walking a tracked drill or spider into a site, or by lower into a site using a crane. Any temporary access roads will be obliterated when the action is completed, soil will be stabilized, and vegetation restored. Temporary routes in wet or flooded areas will be restored before the end of the applicable in-water work period.

During and after wet weather, increased runoff resulting from soil and vegetation disturbance at a a construction site both during preconstruction and construction phases is likely to suspend and transport more sediment to receiving waters as long as construction continues so that multiyear projects are likely to cause more sedimentation. This increases total suspended solids and, in some cases, stream fertility. Increased runoff also increases the frequency and duration of high stream flows and wetland inundation in construction areas. Higher stream flow increases stream energy that scours stream bottoms and transports greater sediment loads farther downstream that would otherwise occur. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. Redeposited sediments partly or completely fill pools, reduce the width to depth ration of streams, and change the distribution of pools, riffles, and glides. Increased fine sediments in substrate also reduce survival of eggs and fry, reducing spawning success of salmon and steelhead. Spawning areas for southern green sturgeon will not be affected by the proposed program.

During dry weather, the physical effects of increased runoff appear as reduced ground water storage, lowered stream flows, and lowered wetland water levels. The combination of erosion and mineral loss reduce soil quality and site fertility in upland and riparian areas. Concurrent in-water work compacts or dislodges channel sediments, thus increasing total suspended solids and allowing currents to transport sediment downstream where it is eventually re-deposited. Continued operations when the construction site is inundated significantly increase the likelihood of severe erosion and contamination. However, the Oregon Division proposes to cease work when high flows may inundate the project area, except for efforts to avoid or minimize resource damage, so significant erosion and contamination are unlikely.

Construction. Use of heavy equipment for vegetation removal and earthwork compact the soil, thus reducing permeability and infiltration. Use of heavy equipment, including stationary equipment like generators and cranes, also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain PAHs, which are acutely toxic to salmon, steelhead, and other fish and aquatic organisms at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz *et al.* 2000; Heintz *et al.* 1999; Incardona *et al.* 2005; Incardona *et al.* 2004; Incardona *et al.* 2006). It is likely that petroleum-based contaminants have similar effects on southern green sturgeon and eulachon.

The Oregon Division will require that heavy-duty equipment and vehicles for each project be selected with care and attention to features that minimize adverse environmental effects (e.g., minimal size, temporary mats or plates within wet areas or sensitive soils), use of staging areas at least 150-feet from surface waters, and regular inspection and cleaning before operation to ensure that vehicles remain free of external oil, grease, mud, and other visible contaminants. Also, as noted above, to reduce the likelihood that sediment or pollutants will be carried away from project construction sites, the Oregon Division will ensure that clearing areas are limited and that a suite of erosion and pollution control measures will be applied to any project that involves the likelihood of soil and vegetation disturbance that can increase runoff and erosion, including securing the site against erosion, inundation, or contamination by hazardous or toxic materials..

Work involving the presence of equipment or vehicles in the active channel when ESA-listed fish is likely to result in injury or death of some individuals. The Oregon Division avoid or reduce that risk by limiting the timing of that work to avoid vulnerable life stages of ESA-listed fish, including migration, spawning and rearing. Further, when work in the active channel involves substantial excavation, backfilling, embankment construction, or similar work below OHW where adult or juvenile fish are reasonably certain to be present, or 300-feet or less upstream from spawning habitats, the Oregon Division will require that the work area be effectively isolated from the active channel to reduce the likelihood of direct, mechanical interactions with fish, or indirect interactions through environmental effects. Regardless of whether a work area is isolated or not, and with few exceptions, the Oregon Division will require that passage for adult and juvenile fish that meets NMFS' (2011e) criteria, or most recent version, will be provided around the project area during and after construction.

If any juvenile fish are likely to be present in the work isolation area, the Oregon Division will require that they be captured and released. However, it is unlikely that any adult fish, including salmon or steelhead, southern green sturgeon, or eulachon will be affected by this procedure because it will occur when adults are unlikely to be present and, if any are present, their size allows them to easily escape from the containment area. Capturing and handling fish causes them stress though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived (NMFS 2002).

The primary contributing factors to stress and death from handling are differences in water temperature between the river where the fish are captured and wherever the fish are held, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on fish increases rapidly from handling if the water temperature exceeds 64°F or dissolved oxygen is below saturation. The Oregon Division's conservation measures regarding fish capture and release, use of pump screens during the de-watering phase, and fish passage around the isolation area are based on standard NMFS guidance to reduce the adverse effects of these activities (NMFS 2011e). Moreover, the Oregon Division will notify each project manager that injured, sick, or dead ESA-listed fish must be delivered to NMFS so that the cause of death for any dead specimen can be analyzed. If it is determined that carrying out the project had any unanticipated role in the death of an ESA-listed fish, that information will be reviewed by the Oregon Division and NMFS to decide whether it is necessary to modify the project or the program to further reduce impacts.

Many actions that the Oregon Division will fund under this opinion will seek to install rock or other hard structures above the streambank toe and within a functional floodplain to stabilize a streambank or channel and reduce erosion of the approach to, or foundation of, a road, culvert, or bridge. In addition to the construction impacts described above, the adverse impacts of hardening the functional floodplain include direct habitat loss, reduced water quality, upstream and downstream channel impacts, reduced ecological connectivity, and the risk of structural failure (Bates *et al.* 2003; Cramer 2012; Fischenich 2003; NMFS 2008e; Schmetterling *et al.* 2001).

Direct habitat loss refers to displacement of native streambed material and diversity by the installation of rock or other hard structures within the functional floodplain. The habitat features of concern include water velocity, depth, substrate size, gradient, accessibility and space that are suitable for salmon and steelhead rearing. In spawning areas, rock and other hard structures are often used to replace spawning gravels, realign channels to eliminate natural meanders, bends, spawning riffles and other habitat elements. Riffles and gravel bars downstream are scoured when flow velocity is increased. For sturgeon, the habitat features of concern include bays, estuaries, and sometimes the deep riverine mainstem in lower elevations where sturgeon congregate. For eulachon, the important habitat features are flow, water quality and substrate conditions, primarily in the lower Columbia River.

Rock and other hard structures within the functional floodplain reduce water quality by reducing or eliminating riparian vegetation that regulates the quantity and quality of runoff and, together with channel complexity, help to maintain and reduce stream temperatures. Conversely, where anthropogenic sources of bank or channel erosion are already present, installation of rock or other hard structures can reduce that erosion and subsequent sedimentation, sometimes allowing riparian vegetation to become reestablished and thus contributing to beneficial water quality effect (Fischenich 2003; Schmetterling *et al.* 2001). However, the benefits of using rock or other hard structures for this purpose are often speculative or minimal, at best, particularly in contrast to the multiple habitat benefits provided by other erosion control methods that do not require hardening of the stream bank or bed (Cramer *et al.* 2003; Cramer 2012).

Upstream and downstream channel effects occur when bank and channel hardening and channel narrowing alter stream velocity. Downstream, loss of stream roughness and channel narrowing causes water velocity and erosion to increase. Upstream, channel narrowing reduces water velocity and leads to backwater effects during high flows that typically result in upstream deposition. Then, when flows recede, erosion occurs around or through the new deposition. Thus, a hardened bank or channel creates chronically unstable conditions that increase bed and bank erosion upstream and downstream, and often affect either the subject structure or an unrelated structure in a way that applicants prefer to address by further hardening. This sets in motion another round of upstream and downstream channel effects that perpetuates and extends the extent of aquatic habitat damage.

Similarly, ecological connectivity is adversely affected by rock or other hard structures in the functional floodplain when bed material and aggrading channel processes cannot cycle throughout the reach, and when the upstream or downstream movements of organisms are restricted. Ecological connectivity refers to the capacity of the landscape to support the movement of energy, water, sediment, organisms, and other material. The conservation of salmon, steelhead, and sturgeon is intimately linked to the health of their underlying ecosystems. This, in turn, depends on more than just the ability of these fish to move upstream and downstream during different life history stages and under a wide variety of different stream conditions. Ecological health also requires ecological connectivity for a wide range of physical and biotic processes that are more difficult to quantify than fish passage, such as seasonally shifting channel patterns, the upstream flight and downstream drift of insects, and delivery of large wood from terrestrial sources to the stream, estuary and coastal ocean (Maser *et al.* 1988). Installation of rock or structures that require channel maintenance, capture large wood, accelerate or delay fish movements, or otherwise inhibit the movement of energy and material also reduce ecological connectivity material.

The Oregon Division will avoid or minimize the adverse impacts of installing rock or other hard structures by requiring (1) use of biotechnical streambank stabilization methods wherever possible, such as use of vegetation, planting terraces, use of large wood, irregular faces, or addition of toe roughness; (2) reduction in the on-going adverse effects by removing vacant structures and structural fill out of the functional floodplain whenever possible; (3) reshaping of exposed floodplains and streambanks to match upstream and downstream conditions; and (4) use of compensatory mitigation when project-level impacts cannot be minimized to meet program standards. Compensatory mitigation may take place elsewhere in the watershed and may include, but is not limited to, removal or retrofitting of existing riprap to include biotechnical elements and removal of vacant structures or other fill elsewhere in the watershed. The Oregon Division will also ensure that fish passage and floodplain connectivity are maintained or improved at all culvert and bridge stream crossings by requiring them to maintain a clear unobstructed opening above the general scour prism.

Rarely, transportation projects will require use of pesticide-treated wood as a construction material, e.g., for wooden bridges and historic covered bridges. Pesticide-based preservatives continue to be in common use. Common water-based wood preservatives include chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), alkaline copper quat (ACQ-B and ACQ-D), ammoniacal copper citrate (CC), copper azole (CBA-A), copper dimethyldithiocarbamate (CDDC), borate preservatives. Oil-type wood preservatives include creosote, pentachlorophenol, and copper naphthenate (FPL 2005). Acid copper chromate (ACC) and copper HDO (CX-A) are more recent compounds not yet in wide use (Lebow 2004). Withdrawal of CCA from most residential applications has increased interest in arsenic-free preservative systems that all rely on copper as their primary active ingredient (FPL 2004; Lebow 2004) with the proportion of preservative component ranging from 17% copper oxide in some CDDC formulations, to 96% copper oxide in CA-B (Lebow 2004).

A pesticide-treated wood structure placed in or over flowing water will leach copper and a variety of other toxic compounds directly into the stream (Hingston *et al.* 2001; Kelly and Bliven 2003; Poston 2001; Weis and Weis 1996). Although the likelihood of leaching pesticides, including copper, from wood used above or over the water is different than splash zone or in-water applications (Western Wood Preservers Institute *et al.* 2011), these accumulated materials add to the background loads of receiving streams. Movement of leached preservative components is generally limited in soil but is greater in soils with high permeability and low organic content. Mass flow with a water front is probably most responsible for moving metals appreciable distances in soil, especially in permeable, porous soils. Preservatives leached into water are more likely to migrate downstream compared with preservative leached into soil, with much or the mobility occurring in the form of suspended sediment. If shavings, sawdust, or smaller particles of pesticide-treated wood generated during construction, use, maintenance of a structure are allowed to enter soil or water below, they make a disproportionately large contribution to environmental contamination because the rate of leaching from smaller particles is 30 to 100 times greater than from solid wood (FPL 2001; Lebow 2004; Lebow and Tippie 2001).

Copper and other toxic chemicals, such as zinc, arsenic, chromium, and PAHs, that leach from pesticide-treated wood used to construct a road, culvert or bridge are likely to adversely affect salmon, steelhead, and sturgeon that spawn, rear, or migrate by those structures, and when they ingest contaminated prey (Poston 2001). Heavy metal contamination is identified as a threat to southern green sturgeon and copper has been shown to impair the olfactory nervous system and olfactory-mediated behaviors in salmon and steelhead (Baldwin *et al.* 2003; Baldwin and Scholz 2005; Hecht *et al.* 2007; Linbo *et al.* 2006; McIntyre *et al.* 2008). Similarly, PAHs, which leach from wood treated with creosote, may cause cancer, reproductive anomalies, immune dysfunction, growth and development impairment, and other impairments to exposed fish (Carls *et al.* 2008; Collier *et al.* 2002; Incardona *et al.* 2005; Incardona *et al.* 2004; Incardona *et al.* 2006; Johnson 2000; Johnson *et al.* 2002; Johnson *et al.* 1999; Stehr *et al.* 2009).

The Oregon Division proposed conservation measures to minimize exposure of fish to the adverse effects of pesticide-treated wood. It will require avoidance of treated wood whenever reasonable alternatives are available, such as silica-based wood preservation, improved recycled plastic technology, and environmentally safe wood sealer and stains.[18] Further, the Oregon Division will prohibit the use of lumber, pilings, or other wood products treated or preserved with pesticidal compounds below ordinary high water, or as part of an in-water or overwater structure, except under strict limits. Every surface of any bridge, overwater structure, or in-water structure built out of pesticide-treated wood that will be exposed to leaching by precipitation, overtopping waves, or submersion must be coated with paint, opaque stain, or barrier that will be maintained for the life of the project. Moreover, any project that requires removal of pesticide-treated wood must ensure that, to the extent possible, no wood debris falls into the water. If wood debris does fall into the water, it must be removed immediately. After treated wood is removed, in must be placed in an appropriate dry storage site until it can be removed from the project area.

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[18] See, *e.g.*, American Plastic Lumber (Shingle Springs, California) and Resco Plastics (Coos Bay, Oregon) for structural lumber from recycled plastic; Plastic Pilings, Inc. (Rialto, California) for structurally reinforced plastic marine products; Timbersil (Springfield, Virginia) for structural lumber from wood treated with a silica-based fusion technology; and Timber Pro Coatings (Portland, Oregon) for non-petroleum based wood sealer and stains. The use of trade, firm, or corporation names in this Opinion is for the information and convenience of the action agency and applicants and does not constitute an official endorsement or approval by the U.S. Department of Commerce or NMFS of any product or service to the exclusion of others that may be suitable.

When all the conservation measures for treated wood are considered collectively, the potential effects on fish and the aquatic environment are expected to be very small.

The installation and removal of piling with a vibratory or impact hammer is likely to result in adverse effects to salmon, steelhead, and sturgeon due to high levels of underwater sound that will be produced. Piles are typically limited to bridge construction or repair, when temporary support structures, such as work or detour bridges are necessary, to provide additional support to existing bridge foundations, or when a new bridge foundation is necessary. The number of piles needed will vary with the size and type of pile used, site conditions, substrate, load generated by the bridge and traffic, and other considerations. Small projects may require less than 10 piles, typical projects less than 100, and the largest projects may require several hundred. Pile installation proceeds intermittently at a rate of 5 to 10 pile per day spread across 1 to 40 days of a typical 60-day in-water work window, or for a shorter period split between two work seasons per project.

Although there is little information regarding the effects on fish from underwater sound pressure waves generated during the piling installation (Anderson and Reyff 2006; Laughlin 2006), laboratory research on the effects of sound on fish has used a variety of species and sounds (Hastings *et al.* 1996; Popper and Clarke 1976; Scholik and Yan. 2002). Because those data are not reported in a consistent manner and most studies did not examine the type of sound generated by pile driving, it is difficult to directly apply the results of those studies to pile driving effects on salmon, steelhead, and sturgeon. However, it is well established that elevated sound can cause injuries to fish swim bladders and internal organs and temporary and permanent hearing damage. These effects are presumed to extend across the stream channel regardless of width, and as far as the sound wave can travel within the line of site upstream and downstream for a total distance that varies with stream sinuosity and width, water depth, pile characteristics, pile driving technology, and sound attenuation methods used.

The degree to which normal behavior patterns are altered by pile driving is less known, although it is likely that salmon, steehead, and sturgeon that are resident within the action area are more likely to sustain an injury than fish that are migrating up or downstream. Removal of pilings within the wetted perimeter that are at the end of their service life will disturb sediments that become suspended in the water, often along with contaminants that may have been pulled up with, or attached to, the pile. A release of PAHs into the water is likely to occur if creosote-treated pilings unnecessarily damaged during removal, or if debris is allowed to re-enter or remain in the water.

The Oregon Division proposed conservation measures to minimize exposure of fish to high levels of underwater sound during pile driving and to increased suspended solids and contaminants during pile removal. Those include requirements that pilings must be 24 inches in diameter or smaller, steel H-pile must be designated as HP24 or smaller, a vibratory hammer must be used whenever possible for piling installation, and full or partial (bubble curtain) isolation of the pile while it is being driven. During pile extraction, care will be taken to ensure that sediment disturbance is minimized, including special measures for broken or intractable piles, all adhering sediment and floating debris are contained, and all residue is properly disposed. Nonetheless, it is still likely that sound energy will radiate directly or indirectly into the water as a result of pile driving vibrations, although widespread propagation of sounds injurious to fish is not expected to occur, and that a small contaminant release will occur when a creosote pile is removed, and total suspended sediment will increase with every pile removal.

Some transportation projects require the use of one or more barges as a temporary bridge, to carry cargo, or as a platform for workers or machinery, such as a drill, crane, dredge, hopper, or pile driver. The effects of a barge, separate from its role as a platform, include displacement of habitat area and shade under otherwise well-lighted conditions. When shade is in the path of downstream migrating juveniles or upstream migrating adults, those fish may avoid the shade or slow their migration, causing them more vulnerable to predation as well. Northern pike-minnow (*Ptychocheilus oregonensis*), smallmouth bass (*Micropterus dolomieu*), and largemouth bass (*Micropterus salmoides*) all consume juvenile salmon and have an affinity for in-water structure. Moreover, barges can be the source for discharges of hazardous materials, debris, or other pollutants, damage benthic habitats by grounding out, or sink and require salvage operations with attendant impacts. The Oregon Division will minimize these effects by ensuring that any barge used to support a specific project will be appropriately selected, large enough to remain stable under foreseeable loads and conditions, free of invasive species, and secured, stabilized and maintained as necessary to ensure that no release of a contaminant or construction debris occurs. Although certain effects from using a barge can be minimized, some effects such as creation of additional shade cannot be avoided. Even though the shade may temporarily increase predation on salmonids, barges are likely to be present at project sites for a year or less and will not create permanent sources of additional shade.

Some construction projects require temporary electrical service to power lights, signs, hand tools, and other machinery. The source for the electricity may be provided by hookup to a local utility or generators and extended to where it is needed with power cables and connectors. Similarly, some construction projects require water service or wastewater collection to support drilling, concrete production, dust abatement, vehicle washing, or other purposes. The water source may be provided by hookup to a local utility or from tanks, and the water may be conveyed to its use point in pipes These utilities may be strung across streams as aerial lines hung from an existing bridge, with no additional environmental effects, as drilled lines, with a smaller subset of drilling effects as discussed above, or as trenched utility lines with additional adverse effects related to erosion.

Although the trench necessary to install a utility line that will support construction or operation of a transportation feature is relatively very small, excavation and subsequent filling of a trench in a streambank or dry channel or is likely to make the area of the trench more or less resistant to erosion, depending on the substrate composition, the type of excavation, and the type of fill. If the trench area is less resistant to erosion, due to loosening of the substrate or through the use of fill with smaller substrate particles than were originally present, then high stream flows are likely to erode the disturbed substrate, thus mobilizing sediment or abruptly altering the bottom contours or bank stability of the stream. If the trench area is more resistant to erosion, through compaction of the substrate or through the use of fill with larger substrate particles than were originally present, then high stream flows may be less likely to erode the disturbed substrate than the remainder of the streambed or bank, possibly creating hydraulic control points and altering fluvial processes. Pipelines, cables, and materials used to armor them may also create hydraulic control points ("jumps") that degrade channel conditions and impede fish passage, if they remain at the same elevation after being exposed by streambed or bank erosion.

The Oregon Division will avoid or minimize these hazards by preferring aerial lines whenever feasible, then directional drilling below the scour prism, then trenching, and when trenching is necessary, each crossing will be aligned as perpendicular to the watercourse as possible and any large wood displaced by trenching or plowing must be returned as nearly as possible to its original position, or otherwise arranged to restore habitat functions. Any temporary water withdrawal will have a fish screen installed, operated, and maintained as described in NMFS (2011e). Conversely, the Oregon Division will require that all discharge water created by concrete washout, pumping for work area isolation, vehicle wash water, drilling fluids, or other construction work must be treated using the BMPs applicable to site conditions for removal of debris, heat, nutrients, sediment, petroleum products, metals 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) to ensure that no pollutants are discharged from the construction site.

Some of these adverse effects will abate almost immediately, such as vibration caused by pile driving a pile. Others will be long-term conditions that may decline quickly but persist at some level for weeks, months, or years, until riparian and floodplain vegetation are fully re-established. Failure to complete site restoration, or to prevent disturbance of newly restored areas by livestock or unauthorized persons will delay or prevent recovery of processes that form and maintain productive fish habitats.

The direct physical and chemical effects of site restoration to be included as parts of actions that will be completed under the proposed program are essentially the reverse of the construction activities that go before it. Bare earth will be protected by various methods, including seeding, planting woody shrubs and trees, and mulching. This will immediately dissipate erosive energy associated with precipitation and increase soil infiltration. It also will accelerate vegetative succession necessary to restore the delivery of large wood to the riparian area and aquatic system, root strength necessary for slope and bank stability, leaf and other particulate organic matter input, sediment filtering and nutrient absorption from runoff, and shade. Microclimate will become cooler and moister, and wind speed will decrease. Whether recovery occurs over weeks or years, the disturbance frequency, considered as the number of actions funded per year within a given recovery domain is likely to be extremely low, as is the intensity of the disturbance, considered as a function of the total number of miles of critical habitat present within each watershed (see Table 19).

Stormwater runoff from the highway system, including roads, culverts, and bridges, delivers a wide variety of pollutants to aquatic ecosystems, such as nutrients, metals, petroleum-related compounds, sediment washed off the road surface, and agricultural chemicals used in highway maintenance (Buckler and Granato 1999; Colman *et al.* 2001; Driscoll *et al.* 1990; Kayhanian *et al.* 2003). These ubiquitous pollutants are a source of potent adverse effects to salmon and steelhead, even at ambient levels (Hecht *et al.* 2007; Johnson *et al.* 2007; Loge *et al.* 2006; Sandahl *et al.* 2007; Spromberg and Meador 2006), and are among the identified threats to sturgeon. Aquatic contaminants often travel long distances in solution or attached to suspended sediments, or gather in sediments until they are mobilized and transported by next high flow

(Alpers *et al.* 2000b; Alpers *et al.* 2000a; Anderson *et al.* 1996). These contaminants also accumulate in the prey and tissues of juvenile salmon where, depending on the level of exposure, they cause a variety of lethal and sublethal effects on salmon and steelhead, including disrupted behavior, reduced olfactory function, immune suppression, reduced growth, disrupted smoltification, hormone disruption, disrupted reproduction, cellular damage, and physical and developmental abnormalities (Fresh *et al.* 2005; Hecht *et al.* 2007; Lower Columbia River Estuary Partnership 2007). Projects included in the proposed action will likely add a small amount of impervious surface to the existing infrastructure, thereby increasing the potential for stormwater runoff.

Pollutants included in stormwater travel long distances in rivers either in solution, adsorbed to suspended particles, or retained in sediments until mobilized and transported by future sediment moving flows (Alpers *et al.* 2000b; Alpers *et al.* 2000a; Anderson *et al.* 1996). The toxicity of these pollutants varies in other water quality speciation and concentration. Regarding dissolved heavy metals, Santore *et al.* (2001) indicates that the presence of natural organic matter and changes in pH and hardness affect the potential for toxicity (increase and decrease). Additionally, organics (living and dead) can adsorb and absorb other pollutants such as PAHs. The variables of organic decay further complicate the path and cycle of pollutants. The persistence and speciation of these pollutants also cause effects and, consequently, the action area, to extend from the point where highway runoff discharges into eventually discharged into a river mouth, bay, or estuaries, and then into coastal waters where they impact aquatic habitat, fish populations, and other coastal resources. Once in coastal waters, these pollutants have been linked to a wide variety of ecological stressors affecting the water column, sediments, and the diversity and abundance of aquatic life (EPA 2008; Hayslip *et al.* 2006; U.S. Commission on Ocean Policy 2004).

Stormwater treatment proposed by the Oregon Division is based on a design storm (50% of the 2-year, 24 hour storm) that will generally result in more than 95% of the runoff from all impervious surfaces within the action area being infiltrated at or near the point at which rainfall occurs (Igloira 2007; Igloira 2008; Igloria 2008). The treatment will consist primarily of infiltration practices such as bioretention, bioslopes, infiltration ponds, and porous pavement, supplemented with appropriate soil amendments as needed. The highway runoff literature identifies these practices as excellent treatments to reduce or eliminate contaminants from highway runoff (Barrett *et al.* 1995; Center for Watershed Protection and Maryland Department of the Environment 2000; GeoSyntec Consultants *et al.* 2006; Herrera Environmental Consultants 2006; Hirschman *et al.* 2008; National Cooperative Highway Research Program 2006; The Low Impact Development Center *et al.* 2006).

Although the Oregon Division proposes to capture, manage, and treat highway runoff up to the design storm level from most of the contributing impervious area for the proposed FAHP projects, including some areas that are not treated now or are treated to a lower level, the proposed treatment will not eliminate all pollutants in the highway runoff produced at those sites. Thus, some adverse effects of highway runoff will persist for the design life of the proposed project.

Operations and maintenance. Transportation features require routine maintenance to remain serviceable with a minimum of adverse effects to species and designated critical habitats. Most of these actions will be completed in accordance with BMPs in ODOT (2009), or the most recent version approved by NMFS. The effects of those BMPs were evaluated by NMFS in 2000 when it provided an exception from the prohibition against take of threatened salmon and steelhead for routine road maintenance actions completed as specified in the ODOT Maintenance Management System Water Quality and Habitat Guide, first published in 1999 (65 FR 42422, July 10, 2000). This exception has been affirmed for each subsequent listing of salmon and steelhead in Oregon. Operations and maintenance actions that are beyond the scope of ODOT (2009) will be completed using all relevant conservation measures described above.

Cleaning, painting and coating are common and important maintenance activities for bridges that are not covered by BMPs in ODOT (2009). These actions entail removing old or deteriorated paint, coating, or markings, and replacing them with newer materials. All existing coating and corrosion is removed down to clean, bare steel, typically by sand blasting or high pressure water jetting. The actual painting or coating activities may occur off-site, in staging areas, or in-place. Powder coating involves preparing and powder coating new and existing metal structures and features, including steel, galvanized, aluminum, and other specified surfaces. To ensure that old waste, including lead, re-coating materials, and other debris do not enter the water during this process, the Oregon Division requires prefabrication offsite or within a designated staging area whenever feasible, and work area isolation and containment that varies depending on whether work debris will be generated by dry blasts, water jets, or tool cleaning, and the type of emissions the new coatings will create. New coating materials may not contain lead and disposal of all debris must follow pollution control measures described above.

Site restoration. After each project is complete, the Oregon Division will require any significant disturbance of riparian vegetation, soils, streambanks, or stream channel that was caused by the construction to be cleaned up and restored to reestablish those features within reasonable limits of natural and management variation. Restoration projects may also consist of work necessary to complete compensatory mitigation for an action that is unable to meet on-site performance criteria (most often related to stormwater management, use of vegetated riprap, or protection of the functional floodplain), as a step toward future development of a conservation bank or, in some cases, solely for the benefit of ESA-listed species. Thus each restoration project will typically include replacement of natural materials or other geomorphic characteristics that were previously altered or degraded there in some way, so that ecosystem processes that form and maintain productive fish habitats are replaced and can function at those sites. The project footprint of any restoration project more complicated than simple site stabilization and revegetation will almost always occur in the riparian area or zone, or inside the active channel.

The direct physical and chemical effects of restoration on the environment are essentially the reverse of the construction activities that go before it. Bare earth will be protected by various methods, including seeding, planting woody shrubs and trees, and mulching. This will dissipate erosive energy associated with precipitation and increase soil infiltration. It also will accelerate vegetative succession necessary to restore the delivery of large wood to riparian areas and streams, root strength necessary for slope and bank stability, leaf and other particulate organic matter input, sediment filtering and nutrient absorption from runoff, and shade. Microclimate will become cooler and moister, and wind speed will decrease. Whether recovery occurs over weeks, months or years, the disturbance frequency (*i.e.*, the number of restoration actions per unit of time, at any given site) is likely to be extremely low, as is the intensity of the disturbance as a function of the quantity and quality of overall habitat conditions present within an action area.

In addition to construction effects discussed above, the effects of fish passage restoration as proposed by the Oregon Division by constructing step weirs are likely to include development of a backwater upstream of the weir, with reduced velocities and greater depths at a variety of flows, accelerated flow through the weir, and deposition of sediment immediately downstream of the weir ("tailouts") (Cramer *et al.* 2003). Adding a fish ladder to an existing facility, or improving a culvert for fish passage, is likely to decrease stream gradient in at least a portion of the reach, which will reduce stream energy and may cause aggradation due to sedimentation and provide access to previously blocked habitat (Cramer *et al.* 2003).

The Oregon Division proposes to use invasive and non-native plant control actions as a common site restoration and site maintenance technique, including manual, mechanical, and herbicidal treatment. Manual and mechanical treatments are likely to affect a definite, broad area, and to produce at least minor damage to riparian soil and vegetation. In some cases, this will decrease stream shade, increase suspended sediment and temperature in the water column, reduce organic inputs (*e.g.*, insects, leaves, woody material), and alter streambanks and the composition of stream substrates. However, these circumstances are likely to occur only in rare circumstances, such as treatment of an invasive plant monoculture that encompasses a small stream channel. This effect would vary depending on site aspect, elevation, and amount of topographic shading, but is likely to decrease over time at all sites as shade from native vegetation is reestablished.

Although the Oregon Division will limit the use of herbicides to specific formulas chosen for having ingredients that pose low direct risks to fish, those substances are still likely to have at least short term sublethal effects when they enter aquatic habitats where they can alter fish behavior in ways that are likely to impact survival, and through adverse impacts on aquatic habitats, such as reduction in cover and the abundance of food organisms (NMFS 2005). Herbicides can also pose risks when they combine with other pesticides and contaminants already in the water in ways that make them more toxic to fish.

Surface water contamination with herbicides occurs when herbicides are applied intentionally or accidentally into ditches, irrigation channels or other bodies of water, or when soil-applied herbicides are carried away in runoff to surface waters. Direct application into water sources is generally used for control of aquatic species. Accidental contamination of surface waters can occur when irrigation ditches are sprayed with herbicides or when buffer zones around water sources are not wide enough. In these situations, use of hand application methods will greatly reduce the risk of surface water contamination.

Spray and vapor drift are additional, important pathways for herbicide entry into aquatic habitats. Many factors influence herbicide drift, including spray droplet size, wind and air stability, humidity and temperature, physical properties of herbicides and their formulations, and method of application. For example, the amount of herbicide lost from the target area and the distance the herbicide moves both increase as wind velocity increases. Under inversion conditions, when cool air is near the surface under a layer of warm air, little vertical mixing of air occurs. Spray drift is most severe under these conditions, since small spray droplets will fall slowly and move to adjoining areas even with very little wind. Low relative humidity and high temperature cause more rapid evaporation of spray droplets between sprayer and target. This reduces droplet size, resulting in increased potential for spray drift. Vapor drift can occur when a herbicide volatilizes. The formulation and volatility of the compound will determine its vapor drift potential. The potential for vapor drift is greatest under high air temperatures and with ester formulations. For example, ester formulations such as triclopyr are very susceptible to vapor drift, particularly at temperatures above 80°F.

When herbicides are applied with a sprayer, nozzle height controls the distance a droplet must fall before reaching the weeds or soil. Less distance means less travel time and less drift. Wind velocity is often greater as height above ground increases, so droplets from nozzles close to the ground would be exposed to lower wind speed. The higher that an application is made above the ground, the more likely it is to be above an inversion layer that will not allow herbicides to mix with lower air layers and will increase long distance drift. The Oregon Division will avoid or minimize drift impacts by ensuring that herbicide treatments will be made using ground equipment or by hand, under calm conditions, preferably when humidity is high and temperatures are relatively low. Ground equipment reduces the risk of drift, and hand equipment nearly eliminates it.

The contribution from runoff will vary depending on site and application variables, although the highest pollutant concentrations generally occur early in the storm runoff period when the greatest amount of herbicide is available for dissolution. Lower exposures are likely when herbicide is applied to smaller areas, when intermittent stream channel or ditches are not completely treated, or when rainfall occurs more than 24 hours after application. Under the proposed program, some formulas of herbicide may be applied within the bankfull elevation of streams, in some cases up to the water's edge. Any juvenile fish in the margins of those streams are more likely to be exposed to herbicides as a result of overspray, inundation of treatment sites, percolation, surface runoff, or a combination of these factors.

Groundwater contamination is another important pathway. Most herbicide groundwater contamination is caused by "point sources," such as spills or leaks at storage and handling facilities, improperly discarded containers, and rinses of equipment in loading and handling areas, often into adjacent drainage ditches. Point sources are discrete, identifiable locations that discharge relatively high local concentrations. The Oregon Division will minimize these impacts by ensuing proper calibration, mixing, and cleaning of equipment. Non-point source groundwater contamination of herbicides is relatively uncommon but can occur when a mobile herbicide is applied in areas with a shallow water table. The Oregon Division will minimize these impacts by restricting the formulas used, and the time, place and manner of their application to minimize offsite movement.

In summary, the Oregon Division will limit the use of herbicide formulas, application methods, and the time and place of application to greatly reduce the likelihood that herbicide will be transported to aquatic habitats, although some herbicides are still likely to enter streams through aerial drift, in association with eroded sediment in runoff, and dissolved in runoff, including runoff from intermittent streams and ditches. The indirect effects or long-term consequences of invasive, non-native plant control will depend on the long-term progression of climatic factors and the success of follow-up management actions to exclude undesirable species from the action area, provide early detection and rapid response before such species establish a secure position in the plant community, eradicate incipient populations, and control existing populations.

Restoration of off and side-channel habitat as proposed by the Oregon Division includes removal of fill material to passively reconnect existing stream channels to historical off- and side-channels. This action does not include meander reconstruction or the creation of new off- and side-channel habitats. The effects on the environment of reconnecting stream channels with historical river floodplain swales, abandoned side channels, and floodplain channels are likely to include relatively intense construction effects, as discussed above. The indirect effects are likely to include equally intense beneficial effects to habitat diversity and complexity (Cramer 2012), including increased overbank flow and greater potential for groundwater recharge in the floodplain; attenuation of sediment transport downstream due to increased sediment storage; greater channel complexity and/or increased shoreline length; increased floodplain functionality reduction of chronic bank erosion and channel instability due to sediment deposition; and increased width of riparian corridors. Increased riparian functions are likely to include increased shade and hence moderated water temperatures and microclimate; increased abundance and retention of wood; increased organic material supply; water quality improvement; filtering of sediment and nutrient inputs; more efficient nutrient cycling; and restoration of flood-flow refuge for ESA-listed fish (Cramer 2012).

The effects of setting back existing berms, dikes, and levees are similar to off- and side-channel habitat restoration discussed above, although the effects of this type of action may also include short-term or chronic instability of affected streams and rivers as channels adjust to the new hydrologic conditions. Moreover, this type of action is likely to affect larger areas overall because the area isolated by a berm, dike or levee is likely to be larger than that included in an off- or side-channel feature.

The effects of stream bank restoration are likely to include construction effects discussed above, and reestablishment of native riparian forests or other appropriate native riparian plant communities, provide increased cover (large wood, boulders, vegetation, and bank protection structures) and a long-term source of all sizes of instream wood, reduce fine sediment supply, increase shade, moderate microclimate effects, and provide more normative channel migration over time.

Removal of water control structures, such as a small dam, earthen embankment, subsurface drainage features, tide gate, or gabion, as proposed by the Oregon Division is likely to have significant local and landscape-level effects to processes related to sediment transport, energy flow, stream flow, temperature, and biotic fragmentation (Poff and Hart 2002). The diversity of water control structures distributed on the landscape combined with the relative scarcity of knowledge about the environmental response to their removal makes it difficult to generalize about the ecological harm or benefits of their removal. However, many small water control structures are nearing the end of their useful life due to sediment accumulation and general deterioration, and are likely to be either intentionally removed by parties concerned about liability that may arise from failure, or fail due to lack of maintenance. Thus, it is likely that in some cases, the best outcome of a restoration action based on removal of a water control structure will be a minimization of adverse effects that may have followed an unplanned failure, such as reducing the size of a contaminated sediment release, or preventing an unplanned sediment pulse, controlling undesirable species, or ensuring fish passage around any remnant of the structure.

When a water control structure is specifically targeted for restoration, it may have less significant adverse effects and more beneficial effects than a structure that is removed primarily for safety or economic reasons, but neither action is likely to entirely restore pristine conditions. The legacy of flow control includes altered riparian soils and vegetation, channel morphology, and plant and animal species composition that frequently take many years or decades to fully respond to restoration of a more natural flow regime. The indirect effects or long-term consequences of water control structure removal will depend on the long-term progression of climatic factors and the success of follow-up management actions to manage sediments, exclude undesirable species, revegetate restored, and ensure that continuing water and land use impacts do not impair ecological recovery.

Removal of tide gates or tidal levees is likely to result in restoration of estuarine functions related to regulation of temperature, tidal currents, and salinity; increased habitat abundance from distributary channels, that increase in size after tidal flows are allowed to inundate and scour on a twice daily basis; reduction of fine sediment in-channel and downstream; reduced estuary filling due to increased availability of low-energy, overbank storage areas for fine sediment; restoration of fish access into tributaries, off- and side-channel pond and wetlands; restoration of saline-dependent plant species; increased primary productivity; increased estuarine food production; and restoration of an estuarine transition zone for fish and other species migrating through the tidal zone (Cramer 2012; Giannico and Souder 2004; Giannico and Souder 2005).

Wetland restoration projects as proposed by the Oregon Division are likely to have effects on the environment similar to those of construction; off-and side channel restoration; set-back of existing berms, dikes, and levees; and removal of water control structures, as described above.

Restoration of aquatic habitats is fundamentally about allowing stream systems to express their capacities, *i.e.*, the relief of human influences that have suppressed the development of desired habitat mosaics (Ebersole *et al.* 2001). Thus, the time necessary for recovery of functional habitat attributes sufficient to support species recovery following any disturbance, including construction necessary to complete a restoration action, will vary by the potential capacity of each habitat attribute. Recovery mechanisms such as soil stability, sediment filtering and nutrient absorption, and vegetation succession may recover quickly (*i.e.*, months to years) after completion of the project. Recovery of functions related to wood recruitment and microclimate may require decades or longer. Functions related to shading of the riparian area and stream, root strength for bank stabilization, and organic matter input may require intermediate lengths of time.

The rate and extent of functional recovery is also controlled in part by watershed context. Most transportation and restoration projects will occur in areas where productive habitat functions and recovery mechanisms were absent or degraded before construction took place. These sites are only likely to be functionally restored if the pre-construction environment retains the ecological potential to function properly, as evidenced by the residual productivity of riparian soils and channel conditions with balanced scour and fill processes. The prospect for ecological recovery might be further limited by ecological and social factors at the watershed and landscape scales. Thus, ecological recovery of an action area surrounded by intensive land use and severe upstream disturbance is likely to be less successful than the recovery of a site surrounded by wildlands where the headwaters are protected. To some extent, individual actions under the proposed program will help to compensate for low residual ecological potential and accelerate recovery. However, in and of themselves, these actions may not fully overcome severe site constraints imposed by low site capability.

The indirect effects, or effectiveness, of habitat restoration actions, in general, have not been well documented, in part because they often concentrate on instream habitat without addressing the processes that led to the loss of the habitat (Cederholm *et al.* 1997; Fox 1992; Simenstad and Thom 1996; Zedler 1996). Nonetheless, the careful, interagency process used by the Oregon Division to develop the proposed program ensures that it is reasonably certain to lead to some degree of ecological recovery within each action area, including the establishment or restoration of environmental conditions associated with functional habitat and high conservation value.

Operation and maintenance of new facilities. After construction, transportation facilities are operated and maintained to extend their usefulness, often on a programmed basis and for long periods of time until they become structurally or functionally obsolete. Most of maintenance actions for transportation projects completed under this opinion will be carried out in accordance with best management practices described in ODOT (2009), or the most recent version approved by NMFS, to ensure that they have a minimum of adverse effects to ESA-listed species and designated critical habitats. Operation and maintenance actions are generally distinguishable from more complicated actions because they do not require engineering to correct structural deficiencies, or add or restore function. Projects with those elements will are evaluated here the same as construction.

2.4.1 Effects of the Action on Species

As noted above, each individual project will be completed as proposed with full application of the design criteria for construction, installation of rock or other hard structures within the functional floodplain, stormwater management, and compensatory mitigation. Each action is likely to have the following effects on individual fish at the site and reach scale. The nature of these effects will be similar between projects because each project is based on a similar set of underlying construction activities that are limited by the same design criteria and the individual salmon and steelhead have relatively similar life history requirements and behaviors regardless of species. Although the life history and distribution of southern green sturgeon are less well known than salmon, steelhead, and eulachon, NMFS assumes that individual projects which include construction, rock installation, and stormwater management in areas adjacent to bays, estuaries, and deep riverine mainstem habitat will also affect the rearing and migration of southern green sturgeon. Southern green sturgeon only spawn in the Sacramento River system, well outside the area covered by this consultation. The proposed action will have no effect on green sturgeon spawning.

The intensity of the effects, in terms of changes in the condition of individual fish from baseline condition and the number of individuals affected, and severity of these effects, in terms of individual recovery time, will also vary somewhat between projects because of differences at each site in the scope of work area isolation and construction, the particular life history stages present, the baseline condition of each fish present, and factors responsible for those conditions. However, no project will have effects on fish that are more important that the full range of effects described here.

The proximity of spawning adults, eggs, and fry of most salmon and steelhead species to any construction-related effects of projects completed under the proposed program that could injure or kill them will be rigorously limited by the proposed design criteria that require work within the active channel to be isolated from that channel and completed in accordance with the Oregon guidelines for timing of in-water work to protect fish and wildlife resources. The Oregon guidelines for timing of in-water work are primarily based on the average run timing of salmon and steelhead populations, although the actual timing of each run varies from year to year according to environmental conditions. Moreover, because populations of salmon and steelhead have evolved different run timings, work timing becomes less effective as a measure to reduce adverse effects on species when two or more populations occur in a particular area. It is unlikely that spawning adults, eggs, or fry of endangered UCR spring-run Chinook salmon, SR sockeye salmon, and UCR steelhead will ever occur in proximity to construction-related effects of the projects completed under the proposed program because those species do not spawn in Oregon. Nonetheless, adult and juvenile individuals of these species pass through the Columbia River mainstem and estuary and so are likely to encounter effects of the action during those life history periods. It is unknown whether the Oregon guidelines for timing of in-water work are also protective of southern green sturgeon or eulachon because their migration and rearing times are less well known and were not considered when the guidelines were prepared.

In general, direct effects are ephemeral (instantaneous to hours) or short-term (days to months), and indirect effects are long-term (years to decades, or the life of the project). Effects are described by life history stage in outline form below as an increase or decrease relative to the environmental baseline. Projects with a more significant construction aspect are likely to adversely affect more fish, and to take a longer time to recover, than projects with less construction. However, larger projects are also likely to have correspondingly greater conservation benefits because they are more likely to include a significant design or engineering change that will correct an improper or inadequate engineering design. This will contribute to more normal freshwater habitat conditions that produce fry, parr, or smolts who are larger or healthier when they enter the estuary than they would otherwise be under baseline conditions, and therefore more likely to survive to adulthood, and to improve access and other spawning conditions for adults. Although no project will have solely detrimental effects, projects that have a larger restoration component, or are for restoration only, are likely to have the greatest benefits.

Except for fish that are captured during work area isolation, or injured or killed during pile driving, individual fish whose condition or behavior is impaired by the effects of a project authorized or completed under this opinion are likely to suffer primarily from ephemeral or short-term sublethal effects during construction, including diminished rearing and migration as described below. Projects that will require two or more years to complete are also likely to adversely affect more fish because their duration will be longer, but those effects are also likely to be less intense during each subsequent year as a result of work area isolation that will only be completed once per work area.

Any construction impacts to stream margins are likely to be most important to fish because those areas often provide shallow, low-flow conditions, may have a slow mixing rate with mainstem waters, and may also be the site at which subsurface runoff is introduced. Juvenile salmon and steelhead, particularly recently emerged fry, often use low-flow areas along stream margins. Wild Chinook salmon rear near stream margins until they reach about 60 mm in length (Bottom *et al.* 2005; Fresh *et al.* 2005). As juveniles grow, they migrate away from stream margins and occupy habitats with progressively higher flow velocities. Nonetheless, stream margins continue to be used by larger salmon and steelhead for a variety of reasons, including nocturnal resting, summer and winter thermal refuge, predator avoidance, and flow refuge.

Under certain weather conditions (*e.g.*, measurable precipitation after a long dry period) and streamflow levels (*e.g.*, higher than bankfull elevation), and after some maintenance actions (*e.g.*, herbicide applications) individual fish entering each project area after construction and site restoration have been completed will still encounter some adverse impacts as a result of a unavoidable stormwater runoff or floodplain development. However, any adverse environmental baseline conditions that had been caused by preexisting transportation infrastructure and its operation and maintenance (*e.g.*, obstructed fish passage, untreated stormwater runoff, disconnected floodplains, use of more toxic herbicides or application methods) are likely to be substantially improved or eliminated.

The Oregon Division expects that no more than 24 transportation projects and 5 restoration projects will be completed in a single recovery domain, in a single year, using this opinion and most domains will have many fewer (Table 1). This number of projects is already small compared to the total number of watersheds in each recovery domain, but appears vastly smaller when the average physical impact of these projects is combined measured as miles of streambank disturbance compared to the total number of miles of critical habitat available in each recovery domain (Table 29). Moreover, those numbers are likely to decrease as future transportation revenues and expenditures decline and, by 2015, are expected to be at half of current levels (ODOT 2011a). The likelihood of additive effects on species at the program level due to projects occurring in close proximity within the same watershed, or even within sequential watersheds, is very remote, whether those effects are adverse or beneficial.

Based on our previous experience with transportation projects, it is unlikely at the program level, although not impossible, that the action area for two or more projects will occur in proximity to each in the same 5th field watershed, during the same year (Table 30). Moreover, the total streamside footprint that will be physically disturbed by the full program each year, which corresponds to the area where almost all direct construction impacts will occur except for pile driving, is extremely small compared to the total number of watersheds or critical habitat miles in each recovery domain.

Table 30. Number of HUC5 watersheds, total critical habitat miles, maximum anticipated number of projects expected to be authorized or completed under this opinion per year, and maximum anticipated action area per year in miles, by recovery domain.

Recovery Domain	Total HUC5	Total Critical Habitat (miles)	Maximum Number of Projects (per year)		Streamside Footprint (miles per year)*
			Transportation	Restoration	
WLC	88	3240	24	5	1.1
IC	152	6108	10	3	0.5
OC	80	6652	13	3	0.6
SONC	42		6	3	0.3
Total	362		53	14	2.5

*The average anticipated streamside footprint in miles of disturbance per year, by recovery domain, is equal to the maximum number of projects that is likely to occur in that domain multiplied by the average anticipated length of the action area for each project (see Action Area, p.23) (*e.g*., for the WLC recovery domain, 29 projects multiplied by 200 linear feet per project and divided by 5280 feet per mile equals 1.1 miles).

Of the ESA-listed species considered in this opinion, only juvenile salmon and steelhead are likely to be captured during work area isolation. This is because timing and place restrictions make this process extremely unlikely to overlap with the juvenile life history stage of eulachon, and any adult salmon or steelhead, southern green sturgeon, or eulachon that may be present when the isolation area is being staged are likely to leave by their own volition, or can otherwise be easily excluded without capture or other direct contact before the isolation is complete.

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

A = number of adult equivalents "killed" each year
n = number of projects likely to occur in a recovery domain each year
p = 31, *i.e*., number of juveniles to be captured per project[19]
c = .05, *i.e*., rate of juvenile injury or death caused by electrofishing during capture and release, primarily steelhead and coho salmon. Consistent with observations by Cannon (2008) and data reported in McMichael *et al*. (1998).
t = .02, *i.e*., an estimated average smolt to adult survival ratio, see Smoker *et al*. (2004) and Scheuerell and Williams (2005). This is very conservative because many juveniles are likely to be captured as fry or parr, life history stages that have a survival rate to adulthood that is exponentially smaller than for smolts.

Thus, the effects of work area isolation on the abundance of juvenile or adult salmon or steelhead in any population is likely to be so small that it is almost negligible (Table 31).

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[19] In 2007, ODOT completed 36 work area isolation operations involving capture and release using nets and electrofishing; 12 of those operations resulted in capture of 0 Chinook salmon, 345 coho salmon, and 22 steelhead; with an average mortality of 5% Cannon (2008). No sturgeon or eulachon have been captures as a result of ODOT Salvage operations.

Table 31. Number of salmon and steelhead affected, per year, by recovery domain.

Recovery Domain	Estimated Number of Projects (per year)	Estimate of Juveniles Captured (per year)	Estimate of Juveniles Injured or Killed (per year)	Estimate of Adult Equivalents "Killed" (per year)
WLC	29	1742	87	1.7
IC	13	403	20	0.4
OC	16	496	25	0.5
SONC	9	279	14	0.3
Total	67	2920	146	2.9

Additional fish are likely to be indirectly injured or killed due to the habitat-related effects of this action, including pile driving, stormwater runoff, floodplain impacts, increased turbidity from erosion, and increased predation due to shade. The linear extent of pile driving impacts on the species will be limited primarily by the received level and duration of the sound exposure. Data are not available to estimate the frequency and full distribution of stormwater and floodplain effects but, under some weather and flow conditions, they are expected to extend from the project site to the nearshore marine environment where they are still capable of having adverse effects on the growth and behavior of fish under natural conditions, and additive adverse effects when they combine with other contaminants discharged into the aquatic environment from a wide variety of sources. Although it is not possible to estimate those effects as a number of fish because they will arise due to multiple stressors for which no data are available that are comparable to those obtained from past salvage operations, they are expected to be small, commensurate with the intensity and severity of environmental effects described above.

Given the small reduction in the growth and survival of fish that will be directly affected by individual projects, primarily at the fry, parr, and smolts life stages, the relatively low intensity and severity of the that reduction at the population level, and their low frequency in a given population, any adverse effects to fish growth and survival are likely to be inconsequential. Moreover, projects completed under the proposed program are also reasonably certain to lead to some degree of species recovery within each action area, including more normal growth and development, improved survival, and improved spawning success. Projects or compensatory mitigation actions that improve water quality with stormwater treatment, improve fish passage through culverts, or improve ecological connectivity between streams and floodplains or better longitudinal connectivity (up and downstream), in particular, may have long-term beneficial effects.

Summary of the effects of the action by fish life history stages:

1. <u>Freshwater spawning</u>.
    a. Salmon and steelhead.
        i. Adult. *Direct* – Chemical contaminants in construction and stormwater runoff impair reproductive behavior. Although no holding or spawning are

likely to occur in the immediate construction area due to in-water timing and work restrictions, more pre-spawning mortality and less spawning success will occur upstream and downstream of long-term construction areas due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. The occurrence of these effects is likely to be infrequent and spread over a very large area. No long term effects on population abundance or productivity are expected. *Indirect* – Better pre-spawning survival and spawning success after site restoration due to less disease induced morality, improved migration conditions, improved water quality, and fewer adult fish passage barriers.

ii. Egg. *Direct* – Chemical contaminants and sediment in stormwater runoff reduce egg survival. *Indirect* – No effect if spawning areas are upstream of construction and restoration areas. Survival of eggs may be reduced for some years in some limited areas that are downstream of construction areas if sufficient fine sediment is deposited to reduce the availability of interstitial space and impeding delivery of sufficient oxygen to incubating embryos until natural scouring effects restore the preferred sediment distribution size. Where fine sediments is not deposited, or after it is scoured, more normal egg development is likely to occur due to improved water quality.

iii. Alevin. *Direct* – Chemical contaminants and sediment in stormwater runoff reduce alevin survival. No direct effects due to in-water timing and work restrictions. *Indirect* – More normal growth and development after site restoration due to improved water quality and cover, and less disease and predator induced mortality, and improved conditions for local movements.

b. Southern green sturgeon. No effect because this species does not spawn in Oregon.

c. Eulachon. Assumed to be similar to salmon and steelhead, although impacts of contaminants on adult eulachon reproductive behavior are undocumented, and eulachon eggs and larvae are carried downstream and widely dispersed by estuarine and ocean currents.

2. <u>Freshwater rearing</u>.

a. Salmon and steelhead.

i. Fry. *Direct* – Chemical contaminants and sediment in stormwater runoff reduce forage and impair behavior. Capture, with some injury and death, during in-water work isolation and construction, reduced growth and development due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, an increased likelihood of competition, predation, and disease, and a degraded biological community. These effects may be stronger when projects take place beside or in small tributaries where aquatic habitat areas are correspondingly small and easily modified. Conversely, fewer individuals are likely to occur in those habitats. In larger tributaries and main stem rivers, aquatic habitat areas are larger and less likely to be modified by a construction disturbance, although more individual fish may be affected. Pile driving effects are most severe for fish this size. *Indirect* – More normal growth and development after site restoration due to better forage, less disease and predator induced mortality, more effective migration and distribution due to improved water quality and cover, better forage, more functional floodplain conditions, and fewer juvenile passage barriers.

ii. Parr. Same as for fry, although probably fewer individuals directly affected due to greater swimming ability.

b. Southern green sturgeon. Assumed to be similar to salmon and steelhead, although physical effects are limited to projects with a construction footprint occurring in deep mainstem habitats.

c. Eulachon. Assumed to be similar to salmon and steelhead, although freshwater rearing is largely absent in eulachon.

3. <u>Freshwater migration</u>.

a. Salmon and steelhead.

i. Adult. *Direct* – Chemical contaminants and sediment in stormwater runoff impair orientation and migratory behavior. Delayed upstream migration and increased pre-spawning mortality during construction due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. These effects are likely to occur very limited number of sites in any given year, Pile driving effects are slightly less severe than for juvenile fish, and adults are more protected than juveniles from those effects by in-water work timing restrictions. *Indirect* – More normal upstream migration and pre-spawning mortality after site restoration due to less disease induced morality, improved migration conditions, and fewer adult fish passage barriers.

ii. Kelt (steelhead). *Direct* – Same as for adults, plus delayed seaward migration and increased post-spawning mortality during construction due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. *Indirect* – More normal seaward migration and post-spawning mortality after site restoration due to less disease induced morality, improved migration conditions, and fewer adult fish passage barriers.

iii. Fry. *Direct* – Same as for freshwater rearing, plus capture (with some injury and death) during in-water work isolation, delayed seaward migration and reduced growth and development during construction due to higher bioenergetic cost, more sublethal effects of contaminants, less adaptive behavior and movement, and an increased likelihood of competition, predation, and disease. *Indirect* – More normal seaward migration, growth and development after site restoration due to improved water quality and cover, better forage, more functional floodplain conditions, and fewer juvenile passage barriers.

   iv. Parr. Same as for fry, although probably fewer individuals affected due to greater swimming ability.
  b. Southern green sturgeon. No effect because this species does not migrate, in the sense of changing locations to complete sequential life history stages, in freshwater in Oregon.
  c. Eulachon. Assumed to be similar to salmon and steelhead, although freshwater migration by juvenile eulachon is assumed to passive and accomplished largely by currents.

4. Estuary rearing and smoltification.
   a. Salmon and steelhead.
      i. Fry. *Direct* – Same as for freshwater rearing and migration.
      ii. Parr. Same as for fry.
      iii. Smolt. Same as for fry and parr, plus increased saltwater challenge due to physiological stress of stormwater runoff and other contaminants, although probably fewer individuals affected due to greater swimming ability.
   b. Southern green sturgeon. Assumed to be similar to salmon and steelhead, although physical effects are limited to projects with a construction footprint occurring in deep mainstem habitats.
   c. Eulachon. Assumed to be similar to salmon and steelhead, although estuary movement by juvenile eulachon is assumed to be passive and accomplished largely by currents.

5. Nearshore marine growth and migration.
   a. Salmon and steelhead.
      i. Kelt (steelhead). Chemical contaminants in stormwater runoff impair orientation and migratory behavior.
      ii. Adult. Same as for kelt.
      iii. Smolt. *Direct* – Delayed growth, transition to adulthood, and migration during in-water work area isolation and work due to smaller size at ocean entry. *Indirect* – More normal growth, transition to adulthood, and migration after site restoration due to to improved water quality and cover, better forage, more functional floodplain conditions, and fewer juvenile passage barriers.
   b. Southern green sturgeon. Assumed to be similar to salmon and steelhead, although impacts of contaminants on adult southern green sturgeon are undocumented.
   c. Eulachon. Assumed to be similar to salmon and steelhead, although impacts of contaminants on adult eulachon are undocumented.

6. Offshore marine growth and migration.
   a. Salmon and steelhead adult. No effect because marine growth and migration of adult salmon and steelhead are controlled by ocean conditions largely disconnected from terrestrial and nearshore conditions.
   b. Southern green sturgeon. Assumed to be similar to salmon and steelhead.

c. Eulachon. Assumed to be similar to salmon and steelhead.

2.4.2 Effects of the Action on Designated Critical Habitat

Each individual project, completed as proposed, including full application of the design criteria for construction and site restoration, is likely to have the following effects on critical habitat PCEs. The particular suite of effects caused by each project will vary, depending on the scope of the project and whether its construction footprint extends into aquatic areas. Similarly, the intensity of each effect, in terms of change in the PCE from baseline condition, and severity of each effect, measured as recovery time, will vary somewhat between projects because of differences in the scope of the work. However, no project is likely to have any effect on PCEs that is greater than the full range of effects summarized here.

It is likely that the function of most PCEs that are impaired at the site or reach level by the construction impact of a transportation or restoration project completed under this opinion will only be impaired for a period of hours to months and will affect an individual project action area that includes 200-feet or less of linear bank impact. However, some impacts related to modification of riparian vegetation, floodplain alteration, bank or channel hardening, and stormwater discharge may require longer recovery times, or persist for the life of the project. Those impacts will continue to affect the quality and function of PCEs under certain weather conditions (*e.g.*, measurable precipitation after a long dry period) and streamflow levels (*e.g.*, higher than bankfull elevation), and after some maintenance actions (*e.g.*, herbicide applications).

However, adverse environmental baseline conditions that had been caused by preexisting transportation infrastructure and its operation and maintenance (*e.g.*, obstructed fish passage, untreated stormwater runoff, disconnected floodplains, and use of more toxic herbicides or application methods) are likely to be substantially improved or eliminated. Overall, no more than 5,750 linear feet (1.1 miles) of streambank are likely to be affected, and often much less. For those few projects that require 2 or more years of work to complete, some adverse effects will last proportionally longer and effects related to runoff from the construction site may be exacerbated by winter precipitation.

As noted above, no more than 24 transportation projects and 5 restoration projects will be completed in a single recovery domain, in a single year, using this opinion and most domains will have many fewer (Table 1). This number of projects is already small compared to the total number of watersheds in each recovery domain, but the intensity of those project effects appears far smaller when considered as a function of their average streamside footprint. Based on that, these projects are likely to have a total, direct streambank disturbance of 2.5 linear miles per year, or less than 0.0002 of the total number of miles of critical habitat available in each recovery domain (Table 30). The streamside footprint that will be physically disturbed by the full program each year corresponds to the area where almost all direct construction impacts will occur except for pile driving. The linear extent of pile driving impacts on the quality and function of critical habitat will be limited primarily by the received level and duration of the sound exposure.

Stormwater runoff and floodplain fill will cause additional indirect effects to critical habitat. Data are not available to estimate the frequency and full distribution of those effects but under some weather and flow conditions, they are expected to extend from the project site to the nearshore environment, to have adverse effects on quality and function of critical habitat under natural conditions, and to have additive adverse effects when those impacts combine with other contaminants discharged into the aquatic environment from a wide variety of sources.

Because the action area for individual projects is small, the intensity and severity of the effects described is relatively low, and their frequency in a given watershed is very low, any adverse effects to PCE conditions and conservation value of critical habitat at the site level or reach level are likely to quickly return to, and improve beyond, critical habitat conditions that existed before the action. Moreover, projects completed under the proposed program are also reasonably certain to lead to some degree of ecological recovery within each action area, including the establishment or restoration of environmental conditions associated with functional aquatic habitat and high conservation value. This is because each action is likely to partially or fully correct improper or inadequate engineering designs in ways that will help to restore lost habitat, improve water quality, reduce upstream and downstream channel impacts, improve floodplain connectivity, and reduce the risk of structural failure. Improved fish passage through culverts and more functional floodplain connectivity, in particular, may have long-term beneficial effects.

Summary of the effects of the action by critical habitat PCE:

1. <u>Freshwater spawning sites</u>,
   a. Water quantity. *Direct* – Reduced base flow due to withdrawals for short-term construction needs and reduced hyporheic flow due to floodplain and riparian disturbance, including reduced permeability and increased runoff. *Indirect* – Beneficial effects from reduced peak flow and increased base flow due to improved stormwater management, riparian conditions, floodplain connectivity, and ecological connectivity.
   b. Water quality. *Direct* – Increased temperature, suspended sediment, and contaminants, decreased dissolved oxygen, and a degraded biological community structure, including the composition, distribution, and abundance of prey, competitors, and predators due to floodplain, riparian, and channel disturbance, and increased erosion, sedimentation, and contaminants. *Indirect* – More normal temperature and sediment load, reduced contaminants, and increased dissolved oxygen due to improved stormwater management, riparian, streambank, and channel conditions, floodplain connectivity, ecological connectivity, and more normative community structure.
   c. Substrate. *Direct* – Decreased space and gravel supply, increased compaction and embeddedness, and impoverished community structure due mechanical compression and floodplain, riparian, and channel disturbance, including loss of large wood. *Indirect* – More functional sediment balance, with increased gravel and large wood supply, due to improved riparian, streambank, and channel conditions, improved floodplain connectivity, ecological connectivity and more normative invertebrate community structure.

2. Freshwater rearing sites.
    a. Water quantity. Same as above.
    b. Floodplain connectivity. *Direct* – Short-term reduction of hyporheic flow due to temporary floodplain and riparian disturbance, including reduced permeability and increased runoff. *Indirect* – More functional floodplain area due to improvements in stormwater management, riparian, streambank and channel conditions, floodplain connectivity, and ecological connectivity.
    c. Water quality. Same as above, plus direct noise exposure due to pile driving.
    d. Forage. *Direct* – Temporary decrease in quantity and quality of forage due to increased suspended sediment and contaminants, decreased space, decreased dissolved oxygen, loss of habitat diversity and productivity, and impoverished community structure caused by floodplain, riparian, and channel disturbance. *Indirect* – Increased quantity and quality of forage due to increased habitat diversity and productivity caused by improved riparian, streambank, and channel conditions, improved floodplain connectivity, ecological connectivity and more normative community structure.
    e. Natural cover. *Direct* – Temporary decreased in natural cover quantity and quality for thermal, velocity, and predator refugia, due to increased temperature, riparian and channel disturbance, reduced space, and impoverished community structure. *Indirect* – Increased natural cover due to improved habitat diversity and productivity, including space, width-depth ratio, pool frequency, pool quality, and off-channel habitat caused by improved riparian, streambank, and channel conditions, improved floodplain connectivity, ecological connectivity and more normative community structure.

3. Freshwater migration corridors.
    a. Free passage. *Direct* – Decreased access due to decreased space, water quantity and quality, and floodplain connectivity, and in-water work area isolation. *Indirect* – Increased access due to improved water quantity and quality, greater habitat diversity, more natural cover, and more normative community structure caused by improved riparian conditions, streambank conditions, floodplain connectivity, and ecological connectivity.
    b. Water quantity. Same as above.
    c. Water quality. Same as above.
    d. Natural cover. Same as above.

4. Estuarine areas.
    a. Free passage. Same as above.
    b. Water quality. Same as above.
    c. Water quantity. Same as above.
    d. Salinity. No effect.
    e. Natural cover. Same as above.
    f. Forage. Same as above.

5. Nearshore marine areas.
    a. Free passage. No effect.

b. Water quality. *Direct* – Increased contaminants, degraded community structure. *Indirect* – Reduced contaminants, more normative community structure.
c. Water quantity. No effect.
d. Forage. *Direct* – Decreased quantity and quality of forage due to degraded community. *Indirect* – Increased quantity and quality of forage due to more normative community structure.
e. Natural cover. *Direct* – Decreased natural cover quantity and quality due to reduced large wood. *Indirect* – Increased natural cover due to increased large wood.

6. Offshore marine areas.
   a. Water quality. No effect because offshore marine habitat conditions are controlled by ocean conditions largely disconnected from terrestrial and nearshore conditions.
   b. Forage. No effect because offshore marine habitat conditions are controlled by ocean conditions largely disconnected from terrestrial and nearshore conditions.

2.5 Cumulative Effects

Cumulative effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within the program-level action area was described in the Status of the Species and Critical Habitats and Environmental Baseline sections, above. Among those activities were agriculture, forest management, mining, road construction, urbanization, water development, and river restoration. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

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

The economic and environmental significance of natural resource-based economy is currently declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology (Brown 2011). Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the program-action area for the indefinite future. However, over time those industries have adopted management practices that avoid or reduce many of their most harmful impacts, as is evidenced by the extensive conservation measures included with the proposed action, but which were unknown or in uncommon use until even a few years ago.

While natural resource extraction within 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 (Metro 2010; Metro 2011). 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. Between 2000 and 2010, the population of Oregon grew from approximately 3.4 to 3.8 million, primarily due to migration from other states (U.S. Census Bureau 2011). Most of that growth occurred before the economic slowdown that began in 2007. Half of the population increase occurred in Oregon's three most populated counties around the City of Portland area. Other large counties in the Willamette Valley also gained population although the largest increase statewide, 37%, was in Deschutes County in central Oregon. Only 12% of Oregon's population lives east of the Cascade Mountains, a primarily rural area with an economic base dominated by agriculture and Federal lands. Eight eastern counties lost population during the last decade. The State population is expected to continue to grow in the future, although the rate of growth has slowed and is unlikely to change soon.

The adverse effects of non-Federal actions stimulated by general resource demands are likely to continue in the future driven by changes in human population density and standards of living. These effects are likely to continue to a similar or reduced extent in the rural areas of the Willamette Valley, eastern Oregon, and along the Oregon Coast where counties are maintaining or losing population. Counties that are gaining population around the City of Portland, parts of the Willamette Valley, and part of central Oregon are likely to experience greater resource demands, and therefore more adverse environmental effects. Oregon's land use laws and progressive policies related to long-range planning will help to limit those impacts by ensuring that concern for a healthy economy that generates jobs and business opportunities is balanced by concern for protection of farms, forests, rivers, streams and natural areas (Metro 2000; Metro 2008; Metro 2011). In addition to careful land use planning to minimize adverse environmental impacts, larger population centers may also partly offset the adverse effects of their growing resource demands with more river restoration projects designed to provides ecosystem-based cultural amenities, although the geographic distribution of those actions, and therefore any benefits to ESA-listed species or critical habitats, may occur far from the centers of human populations.

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; NMFS 2011a; NWPCC 2012; OWEB 2011). 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 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 such as timber harvest, agriculture, mining, shipping, and energy development are likely to continue to exert an influence on the quality of freshwater and estuarine habitat in the action area. The intensity of this influence is difficult to predict and is dependent on many social and economic factors. 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 result in a gradual decrease in influence over time. In contrast, the population of Oregon is expected to increase in the next several decades with a corresponding increase in natural resource consumption. Additional residential and commercial development and a general increase in human activities are expected to cause localized degradation of freshwater and estuarine habitat. Interest in restoration activities is also increasing as is environmental awareness among the public. 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 flat or improve gradually over time. This will, at best, have positive influence on population abundance and productivity 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. Similarly, we expect the quality and function of critical habitat PCEs or physical and biological features to express a slightly positive to neutral trend over time as a result of the cumulative effects.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of implementing the proposed program. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency's opinion as to whether the proposed program is likely to: (1) Result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).

As described in Section 2.2, individuals of many ESA-listed salmon and steelhead species and eulachon use the program action area to fully complete the migration, spawning and rearing parts of their life cycle; some salmon and steelhead, southern green sturgeon, and eulachon migrate and rear in the program action area; and some species only migrate through, once as out-migrating juveniles and then again as adult fish on upstream spawning migration. The viability of the various populations that comprise the 15 salmon and steelhead species considered in this opinion ranges from extirpated or nearly so to populations that are a low risk for extinction. The southern eulachon population abundance has declined significantly since the early 1990s and there is no evidence to date of their returning to former population levels.

Adult upstream migrating ESA-listed salmonids are present primarily from early spring through autumn but upstream migrating fish may be found year-around. The adult fish are generally migrating in the upper 25-feet of the water column but may be found to depths of 50-feet. Shallow water habitats are an important rearing habitat for juvenile salmon and steelhead, especially for species that spend an extended amount of time in freshwater. The highest densities of juvenile salmon and steelhead occur in the spring when individuals of all the species may be present, with the lowest densities occurring in the summer and fall. The juvenile fish tend to inhabit shallow waters near the shoreline but have been observed at depths of 20-feet. Some individuals spend little time in shallow water or in the estuary during juvenile migration, although food produced in the shallow waters and estuaries may still be important to the migrating fish.

Southern eulachon typically enter the Columbia River, and probably the Umpqua River, from mid-December to May with peak entry and spawning during February and March. The eulachon spawn in the mainstem Columbia River, Cowlitz River, Grays River, Skamokawa Creek, Elochoman River, Kalama River Lewis River and Sandy River. Eulachon eggs are believed to hatch in 30-40 days. The young eulachon are feeble swimmers, usually near the bottom as they are transported downstream but may be found throughout the water column.

The action area is also designated as critical habitat for ESA-listed salmon, southern green sturgeon, and eulachon. The physical and biological features of salmon and steelhead critical habitat in the action area are freshwater spawning, freshwater rearing, adult and juvenile migration corridors, and estuarine habitat. The features of southern green sturgeon critical habitat that are likely to be affected by projects completed under the proposed program support freshwater rearing. The features of eulachon critical habitat that are likely to be affected by projects completed under the proposed program are freshwater spawning and incubation habitat, and freshwater migration. Climate change and human development have and continue to adversely impact critical habitat creating limiting factors and threats to the recovery of the ESA listed species.

Information in Section 2.3 described the environmental baseline in the action area as widely variable but NMFS assumes that transportation projects will occur as sites where the environmental baseline does not fully meet the biological requirements of individual fish due to the presence of untreated highway runoff, impaired fish passage, floodplain fill, streambank hardening, or degraded riparian conditions. Similarly, it is likely that the environmental baseline is also not meeting the biological requirements of individual fish of ESA-listed species at sites where restoration projects will occur due to one or more impaired aquatic habitat functions related to any of the habitat factors limiting the recovery of the species in that area, but the quality of critical habitat at those sites is likely to be raised due to completion of the restoration projects.

Habitat improvement projects are being actively implemented through salmon recovery efforts, the FCRPS, and a combination of Federal, tribal, state and local actions. At the same time population growth and development pressures on aquatic systems are increasing, particularly in the Willamette Valley. The extent to which these trends may further reduce populations, degrade the quality and function of critical habitat, or preclude some restoration actions, is unknown.

As described in Section 2.4, the most short-term t effects of transportation and restoration actions on ESA-listed fish and designated critical habitat include construction effects related to construction-site runoff, work area isolation, and the use of herbicides. Transportation projects have additional impacts related to pile driving, post-construction stormwater runoff., and stream bank hardening. The programmatic nature of the action prevents a precise analysis of each project that eventually will be funded under this opinion, but each one will be carefully designed and constrained by conservation measures such that construction impacts of transportation and restoration projects will cause only short term, localized, and minor exacerbation of factors limiting the viability of the listed species. The longer-term impacts of transportation projects are likely to include corrections of engineering flaws in existing transportation facilities that do not currently allow for adequate fish passage, functional riparian area or floodplains, or abatement of highway runoff, or by the addition of compensatory mitigation when those standards cannot be achieved onsite. Restoration projects are likely to have a similar, but less severe short term impacts due to construction, but a long-term effect that will contribute to a further lessening of many of the factors limiting the recovery of these species related to fish passage, degraded floodplain connectivity, reduced aquatic habitat complexity, and riparian conditions, and improve the currently-degraded environmental baseline, particularly at the site scale.

As noted in Sections 2.2 and 2.3, climate change is likely to affect all species considered in this opinion and their habitat in the program area. These effects are expected to be positive and negative, but are likely to result in a generally negative trend for stream flow and temperature.

As described in Section 2.5, the cumulative effects of state and private actions that are reasonably certain to occur within the action area are also variable across the program action area, but are likely to reflect continued population growth in urban areas, where redevelopment will begin to improve negative baseline conditions, continued use of agricultural and forestry practices in rural areas that are under less influence to become restorative in nature. Federal efforts to improve aquatic habitat conditions throughout the State of Oregon may moderate any adverse cumulative effects, and add to any beneficial ones, so that the action area may be guided toward improved habitat conditions overall.

In summary, projects completed under the proposed program will result in relatively intense but brief disturbances to a small number of areas distributed throughout each recovery domain, but these disturbances will not appreciably reduce or prevent the increase of abundance or productivity of the populations addressed by this consultation. This is because: (1) Effects from construction related activities are short-term and temporary, (2) a very small portion of the total number of fish in any one population will be exposed to the adverse effects of the proposed action, (3) the geographic extent of the adverse effects is small when compared to the size of any watershed where an action will occur or the total area occupied by any of the species affected. Similarly, projects completed under the proposed program will not affect the diversity of any populations or species because the effects of the action will not impact factors that influence population diversity such as management of hatchery fish or selective harvest practices. Projects that improve fish passage may improve population spatial structure. By contributing to improved habitat conditions that will, over the long term, support populations with higher abundance and productivity, projects completed under the proposed program are consistent with the recovery strategies of increasing productivity and spatial diversity, a critical step toward recovery of these species as whole.

The conservation value of critical habitat within the action area for salmon and steelhead varies by life history strategy, and is higher for species with stream-type histories than for the ocean-type. That is because the latter group is more reliant on shallow-water habitats that are easily affected by a wide range of natural and human disturbances. The conservation value of critical habitat for sturgeon is less evident, but appears most closely associated with deeper parts of mainstem channels that are likely to be little affected by projects completed under the proposed program. Similarly, the conservation value of critical habitat for eulachon is limited to the Lower Columbia River and the Umpqua River where the scale of the river helps to intercept and buffer the short-term impact of construction actions, and to attenuate the benefits of local restoration although it is likely that increasing the conservation function of estuaries will be a focus of future restoration projects.

For the most part, the conservation value of these critical habitats is high and the projects completed under the proposed program will have minor effects on the quality and function of critical habitat PCEs. The full set of management measures proposed by the Oregon Division will ensure that effects to PCEs remain minimal. As site restoration matures at transportation project site, and restoration projects accumulate over time, habitat conditions may improve and critical habitat will be able to better serve its intended conservation role, supporting viable populations of ESA-listed salmon, steelhead, southern green sturgeon, and eulachon.

Thus, the proposed program is not likely to result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or reduce the value of designated or proposed critical habitat for the conservation of the species.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed program, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' biological opinion that the proposed program is not likely to jeopardize the continued existence of LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, OC coho salmon, SONCC coho salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, southern green sturgeon, or eulachon, or result in the destruction or adverse modification of their designated critical habitats, except for LCR coho salmon, for which critical habitat has not been proposed.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.[20] Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

[20] NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as "an intentional or negligent act or omission which creates 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 (50 CFR 17.3). The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the Service's interpretation of the term.

2.8.1 Amount or Extent of Take

Work necessary to construct, operate, and maintain the transportation and restoration projects that will be funded each year under the FAHP will take place beside and within aquatic habitats that are reasonably certain to be occupied by individuals of the 17 ESA-listed species considered in this consultation. Part of that work will require in-water work area isolation that will capture juvenile fish, some of which will be injured or killed. Other elements of that work will alter floodplain, riparian, streambank or channel conditions, require installation of steel piles that are greater than or equal to 24 inches in diameter, or discharge construction or post-construction stormwater runoff. Those habitat alterations will harm or harass juvenile or adult fish by annoying them to the extent their normal behavior patterns for breeding, feeding, sheltering and migration are disrupted, resulting in reduced growth, increased disease, increased competition, increased predation, inhibited movements necessary for rearing and migration, and ultimately resulting in injury or death.

This take will typically occur within an area that includes the streamside and channel footprint of each project and, in the case of post-construction stormwater runoff, extends downstream to the nearshore marine environment, and upstream to the extent that the effects of the project impair or improve fish passage above the construction site. Projects that require two or more years of work to complete will cause adverse effects that last proportionally longer, and effects related to runoff from the construction site may be exacerbated by winter precipitation. These adverse effects may continue intermittently for weeks, months, or years until riparian vegetation and floodplain vegetation are restored and a new topographic equilibrium is reached. Incidental take within that area that meets the terms and conditions of this incidental take statement will be exempt from the taking prohibition.

NMFS does not anticipate that any southern green sturgeon or eulachon will be captured as a result of work necessary to isolate in-water construction areas, although up to 3,000 juvenile individuals, per year, of the salmon and steelhead species considered in the consultation will be captured (Table 31). Further, of those individual salmon and steelhead that are captured, NMFS anticipates that no more than 150 individuals, per year, will be killed. Because these fish are from different species that are similar to each other in appearance and life history, and to unlisted species that occupy the same area, it is not possible to assign this take to individual species. Capture and release of adult fish is not likely to occur as part of the proposed isolation of in-water work areas.

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 may operate across far broader temporal and spatial scales than are affected by projects that will be completed under the proposed program. Thus, the distribution and abundance of fish within the program action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by actions that will be completed under the proposed program. Additionally, there is no practical way to, without causing additional stress and injury, count the number of fish exposed to the adverse effects of 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.

Here, the best available indicators for the extent of take for the FAHP are the following combination of project features, by recovery domain, because these variables are proportional to the amount of harm and harassment that are attributable to the FAHP program (Table 32).

1. For floodplain, riparian, streambank and channel conditions within the project footprint:
    a. ESA-listed fish captured (number salvaged) during in-water work area isolation. No adult fish are likely to be included in this total as they can be effectively excluded from the work area before it is completely isolated from flowing water. Of the juvenile fish that will be collected, fewer than 2% are likely to be killed while the remaining fish are likely to be released and survive with no adverse effects. This number is far too small to result in even a single adult equivalent and therefore will not delay recovery of any species regardless of the recovery status of the population those juveniles are drawn from.
    b. Acres of upland vegetation disturbed
    c. Number of trees removed
    d. Linear feet of streambank hardened
    e. Acres of new impervious area created
    f. Number of steel pile driven, greater than or equal to 24-inches in diameter (20 bridge repair or replacement projects per year, approximately 100 pile each)
2. For stormwater discharge,
    a. Construction runoff turbidity may not exceed 10% increase in natural stream turbidity, as demonstrated by a turbidity monitoring protocol that is sufficient to meet Oregon Department of Water Quality Clean Water Act section 401 certification requirements, except for limited duration activities necessary to address an emergency or accommodate essential construction activities (e.g., channel reconstruction, removal of work area containment), provided that all practicable turbidity control techniques have been applied.
    b. Number and type of stormwater BMPs installed, inspected and maintained (Claytor and Brown 1996; Santa Clara Valley Urban Runoff Pollution Prevention Program 1999; Santa Clara Valley Urban Runoff Pollution Prevention Program 2001), to ensure that facilities proposed to treat highway runoff meet approved design specifications are installed and maintained in a fully operational condition, including a process to identify which facilities and areas require additional management attention to maintain service level over time. This indicator will be evaluated using the following information, as applicable to each project.
        i. For complex projects that are otherwise required to complete this step, "Preliminary Stormwater Recommendations" as developed by ODOT (2011b) in Chapter 4.6.2 Preliminary Stormwater Recommendations in the ODOT Hydraulics Manual, including specifically all LID practices and BMP mitigation alternatives considered and the proposed mitigation

alternatives. This report should be sealed by a registered professional engineer.

ii. "Stormwater Design Report" as developed by ODOT (2011b) in Chapter 4.6.4 Stormwater Design Report. This report should be sealed by a registered professional engineer and include, specifically:
   (1) Any references to published design material
   (2) Analysis methods used
   (3) Narrative and calculations used in the design
   (4) The number and type of stormwater LID practices that are applied and BMPs that are installed
   (5) Inspection and maintenance requirements

iii. "Stormwater Operation and Maintenance Manual" as developed by ODOT (2011b)in Chapter 4.6.6 Stormwater Operation and Maintenance Manual with site-specific information on facility operation and maintenance, including specifically:
   (1) Required and recommended maintenance actions
   (2) Inspection and maintenance schedule

iv. A photograph of the stormwater outfall and a map showing the exact location of the project, stormwater outfall, and receiving water.

v. For any project that will discharge highway runoff into a CSO or municipal or other non-highway wastewater facility, include:
   (1) A written statement from the facility administrator saying that the facility can effectively manage the volume of highway runoff the project will deliver, and agreeing to accept that volume.
   (2) A description of how the facility, or pre-treatment before highway runoff is discharged into the facility, will remove metals, PAHs, and other transportation-related pollutants from the highway runoff as efficiently as the six water quality BMPs listed above.

Table 32. Extent of take indicators based on average quantifiable impacts identified in previous ESA consultations for transportation and restoration projects funded by the Oregon Division using the FAHP, by NMFS recovery domain. "WLC" means Willamette/ Lower Columbia; "IC" means Interior Columbia; "OC" means Oregon Coast; "SONCC" means Southern Oregon California Coasts; "n" is the number of projects in a given recovery domain per year.

Extent of Take Indicator	Recovery Domains			
	WLC n=29	IC n=13	OC n=16	SONCC n=9
ESA-listed fish captured (number salvaged)	290	130	160	90
Upland habitat disturbed (acres)	66	29	36	20
Trees removed (number)	957	429	528	198
Streambank hardening (linear feet)	5493	2462	3030	1705
New impervious area (acres)	117	53	65	36
Steel pile ≥24-inches in diameter (number)	900	380	50	220
Construction runoff (turbidity)	≤10% increase in natural stream turbidity			
Post-construction runoff (management)	BMPs installed, inspected, and maintained			

2.8.2 Effect of the Take

In Section 2.7, NMFS determined that the level of anticipated take, coupled with other effects of the proposed program, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02).

The following measures are necessary and appropriate to minimize the impact of incidental take of listed species from the proposed program.

The Oregon Division shall:

1. Minimize incidental take due to funding of transportation and restoration projects through the FAHP by ensuring that all such projects use the conservation measures described in this opinion, as appropriate.

2. Ensure completion of a comprehensive monitoring and reporting program regarding all transportation and restoration projects funded through the FAHP.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Oregon Division of the FHWA, ODOT, or any other party affected by these terms and conditions must comply with them to implement the reasonable and prudent measures (50 CFR 402.14). The Oregon Division and ODOT have a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will likely lapse.

1. To implement reasonable and prudent measure #1 (conservation measures for transportation and restoration projects), the Oregon Division shall ensure that:
    a. Every action funded or carried out under this opinion will be administered by the Oregon Division consistent with conservation measures 1 through 6.
    b. For each action involving compensatory mitigation, erosion and pollution control, fish passage, or site restoration, conservation measures 9 through 24, as appropriate, will be added as conditions of funding.
    c. For each action involving construction, conservation measures 25 through 37, as appropriate, will be added as conditions of funding.

2. To implement reasonable and prudent measure #2 (monitoring and reporting), the Oregon Division shall ensure that it completes the notification, monitoring, reporting, and annual meeting requirements as described in conservation measures 7 and 8.

2.9 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. Aggregate used for construction of transportation projects comes from a variety of sources, including pits or quarries in upland sites, floodplains, or from instream sources. Aggregate operations in floodplains or from instream sources can have significant adverse effects of ESA-listed species and critical habitats. NMFS recommends that the Oregon Division should require ODOT or other agencies receiving FAHP funding to track and report whether the source for aggregate used in their projects was obtained an upland, floodplain, or in-stream mine, and whether those sources were authorized by Federal permit obtained in compliance with ESA section 7(a)(2). This information should be included as part of the annual program report.

2. Coal tar is often used an anti-corrosion coating to protect steel piles used in salt water environments. Coal tar is also a source of PAHs that cause significant adverse effects to ESA-listed species and designated critical habitats. NMFS recommends that the Oregon Division should require ODOT and other agencies using funds from FAHP to limit the use of coal tar pile coating to those projects that have already included such piles in the their project scope, schedule and budget, and to prohibit the use of such piles in any future project that is in the early planning phase, or that has not yet begun planning.

Please notify NMFS if the Oregon Division 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.

2.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 "Not Likely to Adversely Affect" Determination

For purposes of the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is NLAA listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial (USFWS and NMFS 1998). Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Steller Sea Lion Determination. The eastern Steller sea lion ranges from southeast Alaska to southern California. The best available information indicates the eastern DPS has increased from an estimated 18,040 animals in 1979 (90% CI: 14,076-24,761) to an estimated 63,488 animals in 2009 (90% CI: 53,082 - 80,497); thus an estimate of an overall rate of increase for the eastern DPS of 4.3% per year (90% confidence bounds of 1.99% – 7.33%) (NMFS 2012a). The greatest increases have occurred in southeast Alaska and British Columbia (together accounting for 82 percent of pup production), but performance has remained poor in California at the southern extent of their range. In Southeast Alaska, British Columbia and Oregon, the number of Steller sea lions has more than doubled since the 1970s. There are no substantial threats to the species, and the population continues to increase at approximately 3 percent per year. The final Steller sea lion recovery plan identifies the need to initiate a status review for the eastern DPS and consider removing it from the federal List of Endangered Wildlife and Plants (NMFS 2008c).

The eastern Steller sea lions breeds on rookeries located in southeast Alaska, British Columbia, Oregon, and California; there are no rookeries located in Washington. Haulouts are located throughout the eastern Steller sea lion range (NMFS 2008c).

Steller sea lions are generalist predators, able to respond to changes in prey abundance. Their primary prey includes a variety of fishes and cephalopods. Some prey species are eaten seasonally when locally available or abundant, and other species are available and eaten year-round (NMFS 2008c). Pacific hake appears to be the primary prey item across the eastern Steller sea lion range (NMFS 2008c). Other prey items include Pacific cod, walleye Pollock, salmon, and herring, among other species.

Steller sea lions occur in Oregon waters throughout the year, and use breeding rookeries at Rogue Reef and Orford Reef and haulout locations along the Oregon coast. Four haulout sites are used by Steller sea lions in the Columbia River, including the tip of the South Jetty, where greater than 500 Steller sea lions commonly occur, and three locations proximate to and at the Bonneville Dam tailrace area where Steller sea lions occasionally occur.

Over the last nine years, the number of Steller sea lions seasonally present at the Bonneville Dam has increased from zero individuals in 2002 to a minimum estimate of 53 subadult and adult male Steller sea lions in 2010, which although an increase is still a relatively small number of individuals (NMFS 2008c; Stansell and Gibbons 2010; Stansell *et al.* 2008; Stansell *et al.* 2009). The few Steller sea lions that travel up the Columbia River to the tailrace area of Bonneville Dam travel there to forage on anadromous fishes. Some individual Steller sea lions occur at the tailrace area as early as fall; their numbers peak in winter to early spring and they depart by late spring (Stansell and Gibbons 2010; Stansell *et al.* 2008; Stansell *et al.* 2009). Individuals are likely to transit through the river up to the tailrace area within 1-2 days based on the transit times of California sea lions. Median downriver and upriver speeds were 6.7 km/hr and 3.7 km/hr, respectively (Brown *et al.* 2011).

Steller sea lions may be present in the Lower Columbia River or near the mouths of other coastal rivers during the proposed in-water work window. As described above, the installation of piles will elevate underwater sound in the action area. Sound pressure generated by this activity could injure or disturb Steller sea lions. NOAA is currently developing comprehensive guidance on sound levels likely to cause injury and behavioral disruption for marine mammals in the context of the Marine Mammal Protection Act and Endangered Species Act, among other statutes. Until formal guidance is available, NMFS uses conservative thresholds of sound pressure levels from broadband sounds that cause behavioral disturbance (160 dB rms re: 1µPa for impulse sound and 120 dB rms re: 1µ Pa for continuous sound) and injury (190 dB rms re: 1µPa for pinnipeds) (70 FR 1871).

Based on these conservative thresholds, the Oregon Division anticipates that in the event that a transportation or restoration project involving pile driving is proposed by the Oregon Division within the area where Steller sea lions may occur, the pile driving would produce sound pressure levels that could disturb or injure Steller sea lions. To ensure injury does not occur, the Oregon Division will implement a safety zone during all impact pile driving and during vibratory installation of steel pile casings anytime those actions occur in the Columbia River below Bonneville Dam, or near the mouth of other coastal rivers where Steller sea lions may occur out to the 190 dB isopleths. Oregon Division established the initial size of safety zones based on worst-case underwater sound modeling.

Installation and vibratory installation of steel casings, and pile-driving operations will not initiate or will suspend if a Steller sea lion is detected approaching or entering the safety zone. The safety zone monitoring makes any potential injury of Steller sea lions extremely unlikely, and therefore discountable. Hydroacoustic monitoring of both impact and vibratory installation will confirm the anticipated sound levels. The Oregon Division will use the actual SPL measurements from this monitoring to enlarge or reduce the size of safety zones, based on the most conservative SPL measurements.

Although the safety zone monitoring and shutdown procedures will avoid injury of Steller sea lions, beyond this zone behavioral disruption may occur out to the 160 dB and 120dB isopleths for impact and vibratory driving, respectively. It is unlikely that Steller sea lions exposed to sound levels above the disturbance thresholds will temporarily avoid traveling through the affected area. For example, Steller sea lions en route to the Bonneville tailrace area are highly motivated to travel through the action area in pursuit of foraging opportunities upriver (NMFS 2008c). Steller sea lions have shown increasing habituation in recent years to various hazing techniques used to deter the animals from foraging on sturgeon and salmon in the Bonneville tailrace area, including acoustic deterrent devices, boat chasing, and above-water pyrotechnics (Stansell *et al.* 2009). Many of the individuals that travel to the tailrace area return in subsequent years (NMFS 2008c). Therefore, it is likely that Steller sea lions will continue to pass through an area where pile driving is occurring even when sound levels are above disturbance thresholds.

Although Steller sea lions are unlikely to be deterred from passing through the area, even temporarily, they may respond to the underwater noise by passing through the area more quickly, or they may experience stress as they pass through the area. Steller sea lions already move quickly through the lower Columbia River on their way to foraging grounds below Bonneville Dam. Any increase in transit speed is therefore likely to be slight. Another possible effect is that the underwater noise will evoke a stress response in the exposed individuals, regardless of transit speed. However, the period of time during which an individual would be exposed to sound levels that might cause stress is short given their likely speed of travel through the affected areas. In addition, there would be few repeat exposures for the individual animals' involved (estimated six exposures per animal). Thus it is unlikely that the potential increased stress will have an effect on individuals.

The amount of disturbance that may occur before a Steller sea lion is detected in the safety zone is unlikely to significantly change Steller sea lions' behavior, or the amount of time they would otherwise spend in the foraging areas. Even in the event that either change was significant and animals were displaced from foraging areas in the Columbia River, there are alternative foraging areas available to the affected individuals. NMFS does not anticipate any effects on haulout behavior because there are no proximate haulouts within the areas proposed for projects by the Oregon Division. All other effects of actions completed under the proposed program are at most expected to have a discountable or insignificant effect on Steller sea lions, including an insignificant reduction in the quantity and quality of prey otherwise available to Steller sea lions where they would intercept the affected species (*i.e.*, salmonids and green sturgeon as described in the respective sections above).

NMFS finds that any affect the proposed program is may have on Steller sea lions, including any direct effects as the result of safety zone monitoring and indirect effects on their prey, is likely to be discountable, insignificant or beneficial. Therefore, NMFS finds that the proposed program may affect, but is not likely to adversely affect Southern Resident killer whales.

Southern Resident Killer Whale Determination. Southern Resident killer whales spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and typically move south into Puget Sound in early autumn (NMFS 2008d). Pods make frequent trips to the outer coast during this season. In the winter and early spring, Southern Resident killer whales move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California, including coastal Oregon and off the Columbia River (NMFS 2008d).

No documented sightings exist of Southern Resident killer whales in Oregon coastal bays, and there is no documented pattern of predictable Southern Resident occurrence along the Oregon outer coast and any potential occurrence would be infrequent and transitory. Southern Residents primarily eat salmon and prefer Chinook salmon (Hanson *et al.* 2010; NMFS 2008d).

As stated above for Steller sea lions, the proposed program may affect the quantity of their preferred prey, Chinook salmon. Any salmonid take including Chinook salmon up to the aforementioned amount and extent of take would result in an insignificant reduction in adult equivalent prey resources for Southern Resident killer whales that may intercept these species within their range.

NMFS finds that any affect the proposed program is may have on Southern Resident killer whales, including indirect effects on their prey, is likely to be discountable, insignificant or beneficial. Therefore, NMFS finds that the proposed program may affect, but is not likely to adversely affect Southern Resident killer whales.

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

The consultation requirement of 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 effects occur when EFH quality or quantity is reduced by a direct or indirect physical, chemical, or biological alteration of the waters or substrate, or by the loss of (or injury to) benthic organisms, prey species and their habitat, or other ecosystem components. 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 Oregon Division and descriptions of EFH for Pacific coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific coast salmon(PFMC 1999) 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 Pacific Fishery Management Council (PFMC) described and identified EFH for groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of groundfish, coastal pelagic species, and Chinook and coho. Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for Pacific Coast salmon:

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided in the BA and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for those species, including estuarine areas designated at habitat areas of critical concern in the Lower Columbia River and at other river mouths, bays, estuaries, and coastal waters where transportation and restoration projects will occur:

1. Freshwater quantity will be reduced due to short-term construction needs, reduced riparian permeability, and increased riparian runoff, and a slight longer-term increase based on improved riparian function and floodplain connectivity.

2. Freshwater quality will be reduced due to a short-term increase in turbidity, dissolved oxygen demand, and temperature due to riparian and channel disturbance, long-term discharges of post-construction runoff, and longer-term improvement due to improved riparian function and floodplain connectivity.

3. Tributary substrate will have a short-term reduction in quality due to increased compaction and sedimentation, and a long-term increase due to increased sediment storage from boulders and large wood.

4. Floodplain connectivity will have a short-term decrease due to increased compaction and riparian disturbance during construction, long-term decrease due to any additional rock or other fill placed in floodplains, and a long-term improvement due to floodplain fill removal, off- and side channel habitat restoration, set-back of berms, dikes, and levees, and removal of water control structures.

5. Forage will have a short-term decrease due to riparian and channel disturbance, a long-term decrease due to the continuing effects of post-construction runoff, and a long-term improvement due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, and litter retention.

6. Natural cover will have short-term decrease due to riparian and channel disturbance, and a long-term increase due to improved habitat diversity and complexity, improved riparian function and floodplain connectivity, off- and side channel habitat restoration.

7. Fish passage will have a short-term decrease due to decreased water quality and in-water work isolation, and a long-term increase due to improved water quantity and quality, habitat diversity and complexity, forage, and natural cover.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS expects that fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2 above, approximately 420,000 acres of designated EFH for Pacific coast salmon, Pacific coast groundfish, and coastal pelagic species:

1. The Oregon Division should follow proposed design criteria from 1 to 8 (except for 5, related to fish salvage) as guidance for administration of the FAHP program.

2. The Oregon Division should ensure that proposed design criteria from 9 to 37 (except 12, for fish capture and removal from in-water work area isolation sites) are included, as applicable, as enforceable conditions to be applied to any ODOT, or their designees, as they carry out any project funded by the Oregon Division through the FAHP.

3. The Oregon Division should carry out the conservation recommendations in Section 2.9, in the ESA portion of this document, as they relate to the tracking and reporting the source for aggregate used in FAHP projects, and limiting the use of coal tar as an anti-corrosion coating to protect steel piles used in salt water environments.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, Oregon Division must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The Oregon Division 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 FHWA. Other interested users could include ODOT, local transportation agencies, Metropolitan Planning Organizations, universities, or other organizations throughout the state that are engaged in highway and bridge survey, design and construction, planning, research, transit capital projects, and various other studies. Individual copies of this opinion were provided to the FHWA and ODOT. This opinion will be posted on the NMFS Northwest Region web site (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References Section. The analyses in this opinion and EFH response 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 Northwest Region ESA quality control and assurance processes.

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