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

Refer to NMFS No:
WCR-2016-4853

July 25, 2016

Margaret Solle Salazar
U.S. Department of Housing and Urban Development
Oregon State Office
1200 SW 3rd Avenue, Suite 400
Portland, Oregon 97204

Re: Endangered Species Act Section 7 Formal Programmatic Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the U.S. Department of Housing and Urban Development Housing Programs in Oregon.

Dear Ms. Salazar:

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 or "the Act") on the effects of U.S. Department of Housing and Urban Development (HUD) programs that authorize or fund the development and/or redevelopment of housing and community buildings in Oregon described in 24 CFR Part 50 and actions under 24 CFR Part 58, where Responsible Entities assume responsibility for environmental review, including ESA compliance.

During this consultation, NMFS concluded that the proposed programs are 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.

1. Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*)
2. Upper Willamette River (UWR) Chinook salmon
3. Upper Columbia River (UCR) 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. Middle Columbia River (MCR) steelhead
14. UCR steelhead

15. Snake River Basin (SRB) steelhead
16. Southern distinct population segment (DPS) green sturgeon (*Acipenser medirostris*)
17. Southern DPS 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, except eulachon because NMFS has not yet promulgated an ESA section 4(d) rule prohibiting take of threatened eulachon. However, anticipating that such a rule may be issued in the future, we have included terms and conditions to minimize take of eulachon. These terms and conditions are identical to the terms and conditions required to minimize take of listed salmon and steelhead. Therefore, we expect HUD would follow these terms and conditions regardless of whether take of eulachon is prohibited. The take exemption for eulachon will take effect on the effective date of any future 4(d) rule prohibiting take of eulachon.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. 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, HUD must explain why it will not follow the recommendations, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations NMFS provide 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.

If you have questions regarding this consultation, please contact Marc Liverman of my staff at 503-231-2336, in the Washington/Oregon Coast Office.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

cc: Deborah Peavler-Stewart, HUD
Sara Jensen, HUD

Endangered Species Act – Section 7 Programmatic Biological Opinion
and
Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation
for

U.S. Department of Housing and Urban Development Housing Programs in Oregon

NMFS Consultation Number: WCR-2016-4853

Federal Action Agency: U.S. Department of Housing and Urban Development

Affected Species and Determinations:

ESA-Listed Species	ESA Status	Is the action likely to adversely affect (LAA) 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 (LCR) Chinook salmon	T	Yes	No	No
Upper Willamette River (UWR) Chinook salmon	T	Yes	No	No
Upper Columbia River (UCR) Chinook salmon	E	Yes	No	No
Snake River (SR) spring/summer-run Chinook salmon	T	Yes	No	No
Snake River (SR) fall-run Chinook salmon	T	Yes	No	No
Columbia River (CR) chum salmon	T	Yes	No	No
Lower Columbia River (LCR) coho salmon	T	Yes	No	No
Oregon Coast (OC) coho salmon	T	Yes	No	No
Southern Oregon/Northern California coast (SONCC) coho salmon	T	Yes	No	No
Snake River (SR) sockeye salmon	E	Yes	No	No
Lower Columbia River (LCR) steelhead	T	Yes	No	No
Upper Willamette River (UWR) steelhead	T	Yes	No	No
Middle Columbia River (MCR) steelhead	T	Yes	No	No
Upper Columbia River (UCR) steelhead	T	Yes	No	No
Snake River Basin (SRB) steelhead	T	Yes	No	No
Southern DPS green sturgeon	T	Yes	No	No
Southern DPS eulachon	T	Yes	No	No

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

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

Issued By:

William W. Stelle, Jr.
Regional Administrator

Date: July 25, 2016

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LIST OF ACRONYMS

BMP	Best Management Practice
BRT	Biological review team
CFR	Code of Federal Regulations
CHART	Critical Habitat Analytical Review Team
CHRT	Critical Habitat Review Team
CK	Chinook salmon
CM	Chum salmon
CR	Columbia River
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloro-ethylene
DDT	Dichlorodiphenyltrichloro-ethane
DDx	Collective reference to DDT and its metabolites DDE and DDD
DPS	Distinct population segment
EFH	Essential fish habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Hydropower System
FHA	Federal Housing Authority
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
HAPC	Habitat Area of Particular Concern
HUC	Hydraulic Unit Code
HUD	U.S. Department of Housing and Urban Development
IC	Interior Columbia
ITS	Incidental take statement
LAA	Likely to Adversely Affect
LCR	Lower Columbia River
LID	Low impact development
MCR	Middle Columbia River
MS4	Municipal Separate Storm Sewer System
MSA	Magnuson Stevens Act
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint source
OC	Oregon Coast
ODEQ	Oregon Department of Environmental Quality
Opinion	Biological Opinion
OWCO	Oregon Washington Coastal Office
PAHs	Polycyclic aromatic hydrocarbons
PBDE	polybrominated diphenyl ethers
PBF	physical or biological features
PCB	Polychlorinated biphenyls
PCE	Primary constituent elements
PCSMP	Post-construction stormwater management plan
PFMC	Pacific Fisheries Management Council
RE	Responsible entity
RM	River Mile
SONCC	Southern Oregon Northern California Coasts
SR	Snake River
SRB	Snake River Basin
ST	Steelhead
SWMP	Stormwater management plans
The Act	The Endangered Species Act of 1973, as amended
TRT	Technical Review Team
U.S.C.	United States Code
UCR	Upper Columbia River
USACE	U.S. Army Corps of Engineers
U.S. EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UWR	Upper Willamette River
WCR	(NOAA) West Coast Region
WLC	Willamette-Lower Columbia

GLOSSARY

For purposes of this consultation:

Biofiltration. 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. Bioretention is the process in which contaminants and sedimentation are removed from stormwater runoff. Stormwater is collected into the treatment area, which consists of a grass buffer strip, sand bed, ponding area, organic or mulch layer, planting soil, and plants. Runoff passes first over or through a sand bed, which slows the runoff's velocity, distributes it evenly along the length of the ponding area, which consists of a surface organic layer or groundcover and the underlying planting soil. The ponding area is graded, its center depressed. Water is ponded to a depth of approximately 15cm (5.9 inches) and gradually infiltrates the bioretention area or is evapotranspired. The bioretention area is graded to divert excess runoff away from itself. Stored water in the bioretention area planting soil exfiltrates over a period of days into the underlying soils.

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

Bioswales. Landscape elements designed to remove silt and pollution from surface runoff water consisting of a swaled drainage course with gently sloped sides (less than 6%) and filled with vegetation, compost or riprap.

Catchment. The area that drains an individual development site to its first intersection with a stream, ranging from a few acres up to several hundred acres in size. Best management practices (BMP) and site design are the management focus at this scale.

Constructed wetland. Natural-looking lined marsh systems that pretreats wastewater by filtration, settling, and bacterial decomposition.

Contributing impervious area. All impervious surfaces associated with roads, streets, building roofs, 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.

Federal Action Agency. HUD or the Responsible Entity, id funded under 24 CFR Part 58.

Filter strip. A filter strip is an area of vegetation, generally narrow and long, that slows the rate of runoff, allowing sediments, organic matter, and other pollutants that are being conveyed by the water to be removed by settling out. Filter strips reduce erosion and the accompanying stream pollution.

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

Infiltration ponds or basins (*i.e.*, recharge basins, sumps). Shallow artificial ponds that are designed to infiltrate stormwater though permeable soils into the groundwater aquifer. Infiltration basins do not discharge to a surface water body under most storm conditions, but are designed with overflow structures (pipes, weirs, *etc.*) that operate during flood conditions.

Low impact development (LID). Site designs 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. Performance of work on a planned, routine basis, or the response to specific conditions and events, as necessary to maintain and preserve the condition of a project feature at an adequate level of service.

Media filters. Media filters are usually two-chambered, including a pretreatment settling basin and a filter bed filled with sand or other absorptive filtering media, used to reduce pollutant loading in runoff.

Municipal separate storm sewer system (MS4). A conveyance or system of conveyances (*e.g.,* roads with drainage systems, municipal streets, catch basins, curbs, gutters, manmade channels or storm drains) owned or operated by a governmental entity that discharge to waters of the State.

Porous pavement. Permeable pavement surface with a stone reservoir underneath. The reservoir temporarily stores surface runoff before infiltrating it into the subsoil. Runoff is thereby infiltrated directly into the soil and receives some water quality treatment. Porous pavement often appears the same as traditional asphalt or concrete but is manufactured without "fine" materials, and instead incorporates void spaces that allow for infiltration.

Responsible Entity (RE). The city, county, state or Tribe that assumes the responsibility for environmental review decision-making and action that would otherwise apply to HUD, including the responsibility to comply with ESA

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

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

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

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 Marines Fisheries Service (NMFS) prepared the biological opinion and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA or "the Act") of 1973, as amended (16 United States Code (U.S.C.) 1531, et seq.), and implementing regulations at 50 Code of Federal Regulation (CFR) 402.

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

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

1.2 Consultation History

In December 2011, the U.S. Department of Housing and Urban Development (HUD) initiated informal consultation with NMFS on the effects of its proposal to fund a loan guarantee for a 48-unit apartment project known as the Lone Pine Village Apartments in City of The Dalles, Wasco County, Oregon. HUD proposed to fund the loan guarantee pursuant to its authority under section 311 of the Housing and Community Development Act of 1974. NMFS concluded that consultation with a biological opinion (opinion) issued on July 30, 2013 (see NWR-2012-9493).

Based on information in the Lone Pine opinion about the effects of stormwater runoff from impervious surfaces associated with new or redeveloped housing projects, HUD requested informal programmatic consultation on the effects of all of its programs to fund, or carry out, construction or redevelopment of housing in Oregon. During informal consultation, we learned that HUD regulations at 24 CFR Part 58 allow, and sometimes require, states, tribes or other units of local government with jurisdiction over a project site to assume environmental compliance duties that would otherwise be the responsibility of HUD.

HUD regulations refer to a governmental unit that assumes these duties as a "responsible entity" (RE). The RE is directly responsible for assuring that HUD funding actions comply with Federal environmental laws, including section 7 of the ESA. This differs from the usual role of an applicant in the ESA consultation process in that the RE's role is not voluntary and includes compliance with all requirements of section 7, although HUD may reject the RE if they are unable to fully perform as required. Thus for purposes of this opinion, HUD and REs both have specific duties to ensure that requirements of the attached incidental take statement are completed for all types of HUD programs considered in this opinion. HUD programs that can delegate an RE are detailed in 24 CFR Part 58. A partial list of these programs are presented in Table 1.

Table 1. Partial list of HUD programs subject to the "responsible entity" provisions of 24 CFR 58.

Law	HUD Programs
Section 104(g) of the Housing and Community Development Act of 1974 (42 U.S.C. 5304(g))	• Community Development Block Grants (Entitlement) • Community Development Block Grants (for States and Small Cities Section 108 Loan Guarantees) • Community Development Block Grants for Indian Tribes and Alaska Native Villages • Economic Development Initiative Grants • Brownfields Economic Development Initiative Grants
Section 443 of the McKinney-Vento Homeless Assistance Act (42 U.S.C. 11402)	• Emergency Shelter Grants • Shelter Plus Care Grants • Supportive Housing Grants • Section 8 Moderate Rehabilitation Single Room • Occupancy for Homeless Individuals
Section 288 of the Cranston-Gonzales National Affordable Housing Act (42 U.S.C. 12838)	• HOME Investment Partnerships Grants
Section 1011(o) of the Housing and Community Development Act of 1992 (42 U.S.C. 4852(o))	• Grants to State and local governments for lead-based paint hazard control
Section 26 of the United States Housing Act of 1937 (42 U.S.C. 1437x)	• Public Housing Assistance (Capital Improvements) • HOPE VI Revitalization Grants • HOPE VI Demolition Grants • Capital Fund Grants • Mixed Finance Assistance • Section 202 Conversions • Section 8 (except the Section 8 special allocation program) • Section 8 Program for Disposition of HUD-owned projects
Section 305 of the Multifamily Housing Property Disposition Reform Act of 1994 (42 U.S.C. 3547)	• Special Project Grants
Section 542(c) (9) of the Housing and Community Development Act of 1992 (12 U.S.C. 1707 note)	• Federal Housing Authority (FHA) Multifamily Housing Finance Agency Pilot Program

Law	HUD Programs
Section 11(m) of the Housing Opportunity Program Extension Act of 1996 (42 U.S.C. 12805 note)	• Self-Help Homeownership Opportunity Program
Section 105 of the Native American Housing Assistance and Self-Determination Act of 1996 (25 U.S.C. 4115)	• Native American Housing Block Grants
Section 184(k) of the Housing and Community Development Act of 1992 (12 U.S.C. 1715z-13a(k))	• Native American Housing Loan Guarantees
Section 806 of the Native American Housing Assistance and Self-Determination Act of 1996 (25 U.S.C. 4226)	1. Native Hawaiian Housing Block Grants
Section 207(c) of the FY 1999 Department of Veterans Affairs and Housing and Urban Development and Independent Agencies Appropriations Act (Pub. L. 108-276)	• Grants for Housing Opportunities for Persons with AIDS

On May 31, 2016, NMFS received a letter from HUD requesting formal programmatic consultation on effects of the full range of housing construction or redevelopment projects that it funds or carries out in Oregon. NMFS initiated formal consultation with HUD on that date, and this opinion is based on information developed through the preceding informal consultation and HUD's letter.

Based on guidance from NMFS, HUD has determined that the proposed action is likely to adversely affect (LAA) 17 ESA-listed species and their designated critical habitats (Table 2). HUD also determined that the proposed action would adversely affect areas designated by the Pacific Fisheries Management Council (PFMC) as essential fish habitat for Pacific salmon (PFMC 2014), groundfish (PFMC 2005), and coastal pelagic species (PFMC 1998), including estuarine areas designated as Habitat Areas of Particular Concern (HAPCs).

A complete record of this consultation is on file in Portland, Oregon.

Table 2. 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.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon *(Oncorhynchus tshawytscha)*			
Lower Columbia River (LCR)	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River (UWR)	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River (UCR) spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River (SR) spring/summer-run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River (SR) 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 (CR)	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 (LCR)	T 6/28/05; 70 FR 37160	2/24/16; 81 FR 9251	6/28/05; 70 FR 37160
Oregon Coast (OC)	T 6/20/11; 76 FR 35755	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Southern Oregon/Northern California Coasts (SONCC)	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 (SR)	E 8/15/11; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River (LCR)	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River (UWR)	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River (MCR)	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River (UCR)	T 1/5/06; 71 FR 834	9/02/05; 70 FR 52630	2/1/06; 71 FR 5178
Snake River Basin (SRB)	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

Listing status: 'T' means listed as threatened; 'E' means listed as endangered; 'P' means proposed for listing or designation.
DPS = Distinct Population Segment

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). "Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). We have not identified any interrelated or interdependent effects for this consultation.

HUD proposes to fund, or carry out, actions to construct or redevelop housing and public facilities in Oregon, including single and multifamily housing units, healthcare facilities (e.g., hospitals, senior centers, nursing homes), associated minor infrastructure (e.g., sidewalks, streets, utility lines), and similar activities. This opinion will not cover development of complex infrastructure such as a new road system or wastewater treatment facilities. Moreover, all proposed construction activity will occur at upland sites outside of riparian or aquatic habitats and will not require entry into, or any disturbance of, those habitats. As noted above, this includes projects that REs will complete as authorized under 24 CFR Part 58.

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 action area consists of all the areas where listed species covered by this opinion that may be affected by post-construction stormwater runoff from the construction or redevelopment projects that HUD funded projects in Oregon, except for projects in river basins that are inaccessible to species considered in this opinion. River basins in Oregon that are not included in the action area include Goose and Summer Lake, Owyhee River, Malheur River, Powder River, and the Oregon portion of the Klamath Basin.

The overall action area is also designated by the PFMC as EFH for Pacific Coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific Coast salmon (PFMC 2014), or is in an area where environmental effects of the proposed action is likely to adversely affect designated EFH for those species.

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a) (2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b) (3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat.

Section 9 of the ESA defines those acts that are prohibited under the ESA. Section 9(a) (1) (b) of the Act prohibits the "take"[1] of any fish or wildlife species listed under the ESA as endangered. Section 4(d) of the Act extends the take prohibition to fish or wildlife species listed as threatened, unless otherwise specifically authorized by regulation. Section 10 of the ESA includes exceptions to the Act, including exception to the section 9 take prohibition. Under section 10(a) (1) (B), authorized projects allow for the "incidental take" of endangered and threatened species of wildlife. Incidental take is defined by the ESA as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity." If incidental take is expected, section 7(b) (4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

[1] Take, as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct," a species listed as endangered under the Act.

2.1 Approach to the Analysis

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

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

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

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

2.2 Rangewide Status of the Species

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. This 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 the ESA-listed species considered in this opinion and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance 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 (Zabel et al. 2006; USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel et al. 2006). Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Marine fish species have exhibited negative responses to ocean acidification conditions that include changes in growth, survivorship, and behavior. Marine phytoplankton, which are the base of the food web for many marine species, have shown varied responses to ocean acidification that include changes in growth rate and calcification (Feely et al. 2012).

Table 3, below, provides a summary of listing and recovery plan information, status summaries and limiting factors, for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available at the NMFS West Coast Region (WCR) website.

Table 3. Listing classifications, recovery plan information, status summaries and limiting factors for the species addressed in this opinion

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	Ford 2011	This Evolutionarily Significant Unit[2] (ESU) comprises 32 independent populations. Twenty-six populations have a very low probability of persistence. One population has a moderate, and three have a low probability of persistence. Two populations have a high probability of persistence. Significant improvements in viability are required for this ESU to meet recovery goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminants
Upper Columbia River Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	Ford 2011	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Overall, the viability of this ESU has likely improved somewhat since the last status review, but it is still clearly at moderate to high risk of extinction. The viability ratings for all the remaining population must improve for this ESU to meet recovery goals.	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries

[2] For the purposes of the ESA a "species" is defined to include "any distinct population segment (DPS) of any species of vertebrate fish or wildlife which interbreeds when mature." An ESU is generally considered to be synonymous with a DPS, but is exclusive to marine species regulated by NMFS. Both ESUs and DPS represent the smallest population management unit that can be regulated under the ESA. To be considered, a population must be substantially reproductively isolated from other conspecific populations, and represent an important component in the evolutionary legacy of the biological species (Waples 1991).

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2014	Ford 2011	This ESU comprises 27 extant and four extirpated populations. All extant populations are at high risk. Although recent natural spawning abundance estimates have increased, all populations remain below minimum natural origin abundance thresholds. Relatively low natural production rates and spawning levels below minimum abundance thresholds remain a major concern across the ESU.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	Ford 2011	This ESU comprises seven populations. Five population are at very high risk, one population is at moderate risk and one population is at low risk. 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). 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.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus • Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2014	Ford 2011	This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is 'maintained.'	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	Ford 2011	Of the 17 populations that historically made up this ESU, 15 of them are so depleted that either their baseline probability of persistence is very low or they are extirpated (or nearly so). All three strata in the ESU fall significantly short of 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.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations 1. Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants •
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	Ford 2011	Of the 24 populations that make up this ESU, 21 have a very low probability of persisting for the next 100 years, and none of them are viable. Significant improvements in population viability are required for this ESU to meet recovery goals.	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Oregon Coast coho salmon	Threatened 6/20/11	In development	Stout et al 2012	This ESU comprises 56 populations including 21 independent and 35 dependent populations. The last status review indicated a moderate risk of extinction. Significant improvements in hatchery and harvest practices have been made for this ESU. However, harvest and hatchery reductions have changed the population dynamics of the ESU. 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 ESU to survive another prolonged period of poor marine survival remains in question.	• Degraded stream complexity • Reduced recruitment of wood to streams • Loss of beaver dams • Increased water temperature • Reduced stream flow • Loss of wetlands and estuaries • Fish passage barriers • Effects of climate change • Periodic reduction in marine productivity • Hatchery effects • Effects from exotic species
Southern Oregon/ Northern California Coasts coho salmon	Threatened 6/28/05	NMFS 2014	Williams et al 2011	This ESU comprises 45 independent and dependent populations. Although long-term data on abundance of this ESU are scarce, available evidence from shorter-term research and monitoring efforts indicate that conditions have worsened for populations since the last formal status review. 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, this ESU is at high risk of extinction and is not viable.	• Lack of floodplain and channel structure • Impaired water quality • Altered hydrologic function • Impaired estuary/mainstem function • Degraded riparian forest conditions • Altered sediment supply • Increased disease/predation/competition • Barriers to migration • Fishery-related effects • Hatchery-related effects
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	Ford 2011	This single population ESU is at very high risk dues to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re-establish sustainable natural production	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	Ford 2011	This DPS comprises four independent populations. All extant populations are at high risk of extinction. Population abundance has increased in natural origin 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. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	Ford 2011	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Population persistence probability varies considerably from high to very low. Of the 23 populations, 16 have a low or very low probability of persisting over the next 100 years, and six populations have a moderate probability of persistence. 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.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	Ford 2011	This DPS has four extant populations. Three populations are at low risk and one population is at moderate risk. Since the last status review in 2005, this DPS initially increased in abundance but subsequently declined and current abundance is at the levels observed in the mid-1990s when the DPS was first listed. The DPS appears to be at lower risk than UWR Chinook	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				salmon, 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.	• Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	Ford 2011	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. 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 DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease.
Snake River Basin steelhead	Threatened 1/5/06	In development	Ford 2011	This DPS comprises 24 populations. Twelve populations are at high risk, 10 populations are rated as maintained, one population is not rated, and population rating is variable. 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 below minimum viability criteria.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of green sturgeon	Threatened 4/7/06	In development	Biological Review Team (BRT) 2005	The Sacramento River contains the only known green sturgeon spawning population in this DPS. 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.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching
Southern DPS of eulachon	Threatened 3/18/10	In development	Gustafson et al. 2010	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Core populations for this species include the Fraser River, Columbia River and (historically) the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Starting in 2011, returns in the Columbia River have rebounded by up to two orders of magnitude.	• Changes in ocean conditions due to climate change • Climate-induced change to freshwater habitats • 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

2.3 Status of the Critical Habitats

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7214) replace this term with physical or biological features (PBF). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified primary constituent elements, physical or biological features, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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.[3] The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, NMFS's critical habitat analytical review teams (CHART) 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 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).

Freshwater habitat areas are those that will predominantly be indirectly affected by the proposed action. The PBFs of freshwater spawning and incubation sites include: water flow, quality and temperature conditions, suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles (Tables 4 and 5). 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.

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

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

Table 5 Physical and biological features of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, SONCC coho salmon, and corresponding species life history events

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

2.3.1 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 PBFs essential for the conservation of those species and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that are also essential for conservation. The CHARTs assigned a 0 to 3 point score for the PBFs in each HUC_5 watershed for:

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

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

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

2.3.2 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 2009b). The CHRT did not identify those particular areas using HUC nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For freshwater rivers north of and including the Eel River, the areas upstream of the head of the tide were not considered part of the geographical area occupied by the southern DPS. However, the critical habitat designation recognizes not only the importance of natal habitats, but of habitats throughout their range. Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms (360 feet) 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 6 below delineates physical and biological features for Southern DPS green sturgeon.

Table 6. Physical or biological features of critical habitat designated for southern DPS green sturgeon and corresponding species life history events

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

The CHRT identified several activities that threaten physical or biological features 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 nonpoint source (NPS) 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).

2.3.3 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 7 delineates the designated PBFs for eulachon.

Table 7. 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. Although the habitat requirements of these fishes differ somewhat from eulachon, efforts to protect salmonid habitat generally focuses on the maintenance of watershed processes that would also be expected to benefit eulachon. The BRT identified dams and water diversions as moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath systems, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods (Gustafson *et al.* 2010). Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown (Gustafson *et al.* 2010). The BRT identified dredging as a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

The lower Columbia River mainstem provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Prior to the construction of Bonneville Dam at river mile (RM) 146.1, eulachon ascended the Columbia River as far as Hood River, Oregon. Major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis and Sandy rivers.

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

2.3.4 Willamette-Lower Columbia Recovery Domain

Critical habitat was designated in the Willamette-Lower Columbia (WLC) recovery domain for UWR Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, and CR chum 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 practices have reduced aquatic and riparian habitat quality and complexity, altered sediment and water quality and quantity, and disrupted 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. Agriculture, urbanization, and gravel mining on the valley floor logging in the Cascade and Coast Ranges contribute to increased erosion and sediment loads throughout the basin.

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 1120 to 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 of which were constructed by the U.S. Army Corps of Engineers (USACE). Generally, the revetments were placed in the vicinity of roads or on the outside bank of river bends, so that while only 26% of the total length is revetted, 65% of the meander bends are revetted (Gregory *et al.* 2002b). The majority of dynamic sections have been armored, reducing adjustments in channel bed and sediment storage by the river, and thereby diminishing both the complexity and productivity of aquatic habitats (Gregory *et al.* 2002b).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al.* 2002c). Sedell and Froggatt (1984) noted that agriculture and cutting of streamside trees were major agents of change for riparian vegetation, along with snagging of large wood in the channel. The reduced shoreline, fewer and smaller snags, and reduced riparian forest comprise large functional losses to the river, reducing structural features, 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 2011c; NMFS 2013). 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 2011c; NMFS 2013). Since 1878, 100 miles of river channel within the mainstem Columbia River, its estuary, and Oregon’s Willamette River have been dredged as a navigation channel by the USACE. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania

County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons, have been identified in lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

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

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005; Fresh *et al.* 2005; NMFS 2011c; NMFS 2013). 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 (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 2011c; NMFS 2013). 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 (dichlorodiphenyltrichloroethane). 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 PBFs 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 8).

Table 8. Willamette-Lower Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST) (NOAA Fisheries 2005).[4]

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

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

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

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

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

Watershed Name(s) and HUC5 Code(s)	Listed Species	Current quality	Restoration Potential
Washougal (106) & East Fork Lewis (205) rivers	CK/CM/ST	1/1/1	2/1/2
Upper Cowlitz (402) & Tilton rivers (501) & Cowlitz Valley Frontal (403)	CK/ST	1/1	2/1
Clatskanie (303) & Young rivers (601)	CK	1	2
Rifle Reservoir (502)	CK/ST	1	1
Beaver Creek (302)	CK	0	1
Unoccupied Habitat: Upper Lewis (201) & Muddy (202) rivers; Swift (203) & Yale (204) reservoirs	CK & ST Conservation Value "Possibly High"		
Willamette River #1709000xxx			
Upper (401) & South Fork (403) McKenzie rivers; Horse Creek (402); & McKenzie River/Quartz Creek (405)	CK	3	3
Lower McKenzie River (407)	CK	2	3
South Santiam River (606)	CK/ST	2/2	1/3
South Santiam River/Foster Reservoir (607)	CK/ST	2/2	1/2
North Fork of Middle Fork Willamette (106) & Blue (404) rivers	CK	2	1
Upper South Yamhill River (801)	ST	2	1
Little North Santiam River (505)	CK/ST	1/2	3/3
Upper Molalla River (905)	CK/ST	1/2	1/1
Abernethy Creek (704)	CK/ST	1/1	1/2
Luckiamute River (306) & Yamhill (807) Lower Molalla (906) rivers; Middle (504) & Lower (506) North Santiam rivers; Hamilton Creek/South Santiam River (601); Wiley Creek (608); Mill Creek/Willamette River (701); & Willamette River/Chehalem Creek (703); Lower South (804) & North (806) Yamhill rivers; & Salt Creek/South Yamhill River (805)	CK/ST	1	1
Hills (102) & Salmon (104) creeks; Salt Creek/Willamette River (103), Hills Creek Reservoir (105), Middle Fork Willamette/Lookout Point (107); Little Fall (108) & Fall (109) creeks; Lower Middle Fork of Willamette (110), Long Tom (301), Marys (305) & Mohawk (406) rivers	CK	1	1
Willamina Creek (802) & Mill Creek/South Yamhill River (803)	ST	1	1
Calapooia River (303); Oak (304) Crabtree (602), Thomas (603) & Rickreall (702) creeks; Abiqua (901), Butte (902) & Rock (903) creeks/Pudding River; & Senecal Creek/Mill Creek (904)	CK/ST	1/1	0/1
Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value "Possibly High"		
Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx			
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) 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

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

Watershed Name(s) and HUC5 Code(s)	Listed Species	Current quality	Restoration Potential
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

2.3.5 Interior Columbia Recovery Domain

Critical habitat has been designated in the Interior Columbia (IC) recovery domain, which includes the Snake River Basin, for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR 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 out-migrating juveniles.

Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have altered hydrological cycles. The Technical Review Team (TRT) found that 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 instream flows, degraded water quality, and impaired physical habitat in this domain.

Water withdrawal from 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 section 303(d) list for water temperature pursuant to the Clean Water Act (33 U.S.C. §1251 *et seq.*). 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 PBFs for Chinook salmon or steelhead are in good to excellent condition with no potential for improvement. Overall, most IC recovery domain watersheds are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some or high potential for improvement. In Washington, the upper Methow, Lost, White, and Chiwawa watersheds are in good-to-excellent condition with no potential for improvement. In Oregon, only the lower Deschutes, Minam, Wenaha, and upper and lower Imnaha rivers' HUC_5 watersheds are in good-to-excellent condition with no potential for improvement. In Idaho, a number of watersheds with PBFs for steelhead (upper Middle Salmon, upper Salmon/Pahsimeroi, Middle Fork Salmon, Little Salmon, Selway, and Lochsa rivers) are in good-to-excellent condition with no potential for improvement. Additionally, several lower Snake River HUC_5watersheds in the Hells Canyon area, straddling Oregon and Idaho, are in good-to-excellent condition with no potential for improvement (Table 9).

Table 9. Interior Columbia Recovery Domain: Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK) and steelhead (ST) (NOAA Fisheries 2005).

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

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

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

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

Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Indian (409), Lookingglass (410) & Cabin (411) creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) creeks			
Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	ST	1	3
Five Points (404); Lower Joseph (606) & Deadman (703) creeks	ST	1	2
Tucannon/Alpowa Creek (701)	ST	1	1
Mill Creek (407)	ST	0	3
Pataha Creek (705)	ST	0	2
Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	ST	0	1
Flat Creek (704) & Lower Palouse River (808)	ST	0	0

Upper Salmon and Pahsimeroi #1706020xxx			
Germania (111) & Warm Springs (114) creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) creeks	ST	3	3
Basin Creek (124)	ST	3	2
Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	ST	2	3
Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi River/Falls Creek (202)	ST	2	2
Yankee Fork/Jordan Creek (125)	ST	1	3
Salmon River/Kinnikinnick Creek (112); Garden Creek (129); Challis Creek/Mill Creek (130); & Patterson Creek (203)	ST	1	2
Road Creek (107)	ST	1	1
Unoccupied habitat in Hawley (410), Eighteenmile (411) & Big Timber (413) creeks	Conservation Value for ST "Possibly High"		
Middle Salmon, Panther and Lemhi #1706020xxx			
Salmon River/Colson (301), Pine (303) & Moose (305) creeks; Indian (304) & Carmen (308) creeks, North Fork Salmon River (306); & Texas Creek (412)	ST	3	3
Deep Creek (318)	ST	3	2
Salmon River/Cow Creek (312) & Hat (313), Iron (314), Upper Panther (315), Moyer (316) & Woodtick (317) creeks; Lemhi River/Whimpey Creek (402); Hayden (414), Big Eight Mile (408), & Canyon (408) creeks	ST	2	3
Salmon River/Tower (307) & Twelvemile (311) creeks; Lemhi River/Kenney Creek (403); Lemhi River/McDevitt (405), Lemhi River/Yearian Creek (406); & Peterson Creek (407)	ST	2	2
Owl (302) & Napias (319) creeks	ST	2	1
Salmon River/Jesse Creek (309); Panther Creek/Trail Creek (322); & Lemhi River/Bohannon Creek (401)	ST	1	3

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

Watershed Name and HUC5 Code(s)	Listed Species	Current Quality	Restoration Potential
Salmon River/Williams Creek (310)	ST	1	2
Agency Creek (404)	ST	1	1
Panther Creek/Spring Creek (320) & Clear Creek (323)	ST	0	3
Big Deer Creek (321)	ST	0	1
Mid-Salmon-Chamberlain, South Fork, Lower, and Middle Fork Salmon #1706020xxx			
Lower (501), Upper (503) & Little (504) Loon creeks; Warm Springs (502); Rapid River (505); Middle Fork Salmon River/Soldier (507) & Lower Marble Creek (513); & Sulphur (509), Pistol (510), Indian (511) & Upper Marble (512) creeks; Lower Middle Fork Salmon River (601); Wilson (602), Upper Camas (604), Rush (610), Monumental (611), Beaver (614), Big Ramey (615) & Lower Big (617) creeks; Middle Fork Salmon River/Brush (603) & Sheep (609) creeks; Big Creek/Little Marble (612); Crooked (616), Sheep (704), Bargamin (709), Sabe (711), Horse (714), Cottonwood (716) & Upper Chamberlain Creek (718); Salmon River/Hot Springs (712); Salmon River/Kitchen Creek (715); Lower Chamberlain/McCalla Creek (717); & Slate Creek (911)	ST	3	3
Marsh (506); Bear Valley (508) Yellow Jacket (604); West Fork Camas (607) & Lower Camas (608) creeks; & Salmon River/Disappointment Creek (713) & White Bird Creek (908)	ST	2	3
Upper Big Creek (613); Salmon River/Fall (701), California (703), Trout (708), Crooked (705) & Warren (719) creeks; Lower South Fork Salmon River (801); South Fork Salmon River/Cabin (809), Blackmare (810) & Fitsum (812) creeks; Lower Johnson Creek (805); & Lower (813), Middle (814) & Upper Secesh (815) rivers; Salmon River/China (901), Cottonwood (904), McKenzie (909), John Day (912) & Lake (913) creeks; Eagle (902), Deer (903), Skookumchuck (910), French (915) & Partridge (916) creeks	ST	2	2
Wind River (702), Salmon River/Rabbit (706) & Rattlesnake (710) creeks; & Big Mallard Creek (707); Burnt Log (806), Upper Johnson (807) & Buckhorn (811) creeks; Salmon River/Deep (905), Hammer (907) & Van (914) creeks	ST	2	1
Silver Creek (605)	ST	1	3
Lower (803) & Upper (804) East Fork South Fork Salmon River; Rock (906) & Rice (917) creeks	ST	1	2
Little Salmon #176021xxx			
Rapid River (005)	ST	3	3
Hazard Creek (003	ST	3	2
Boulder Creek (004)	ST	2	3
Lower Little Salmon River (001) & Little Salmon River/Hard Creek (002)	ST	2	2
Selway, Lochsa and Clearwater #1706030xxx			
Selway River/Pettibone (101) & Gardner (103) creeks; Bear (102), White Cap (104), Indian (105), Burnt Knob (107), Running (108) & Goat (109) creeks; & Upper Selway River (106); Gedney (202), Upper Three Links (204), Rhoda (205), North Fork Moose (207), Upper East Fork Moose (209) & Martin (210) creeks; Upper (211),	ST	3	3

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

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Middle (212) & Lower Meadow (213) creeks; Selway River/Three Links Creek (203); & East Fork Moose Creek/Trout Creek (208); Fish (302), Storm (309), Warm Springs (311), Fish Lake (312), Boulder (313) & Old Man (314) creeks; Lochsa River/Stanley (303) & Squaw (304) creeks; Lower Crooked (305), Upper Crooked (306) & Brushy (307) forks; Lower (308), Upper (310) White Sands, Ten Mile (509) & John's (510) creeks			
Selway River/Goddard Creek (201); O'Hara Creek (214) Newsome (505) creeks; American (506), Red (507) & Crooked (508) rivers	ST	2	3
Lower Lochsa River (301); Middle Fork Clearwater River/Maggie Creek (401); South Fork Clearwater River/Meadow (502) & Leggett creeks; Mill (511), Big Bear (604), Upper Big Bear (605), Musselshell (617), Eldorado (619) & Mission (629) creeks, Potlatch River/Pine Creek (606); & Upper Potlatch River (607); Lower (615), Middle (616) & Upper (618) Lolo creeks	ST	2	2
South Fork Clearwater River/Peasley Creek (502)	ST	2	1
Upper Orofino Creek (613)	ST	2	0
Clear Creek (402)	ST	1	3
Three Mile (512), Cottonwood (513), Big Canyon (610), Little Canyon (611) & Jim Ford (614) creeks; Potlatch River/Middle Potlatch Creek (603); Clearwater River/Bedrock (608), Jack's (609) Lower Lawyer (623), Middle Lawyer (624), Cottonwood (627) & Upper Lapwai (628) creeks; & Upper (630) & Lower (631) Sweetwater creeks	ST	1	2
Lower Clearwater River (601) & Clearwater River/Lower Potlatch River (602), Fivemile Creek (620), Sixmile Creek (621) and Tom Taha (622) creeks	ST	1	1
Mid-Columbia #1707010xxx			
Wood Gulch (112); Rock Creek (113); Upper Walla Walla (201), Upper Touchet (203), & Upper Umatilla (301) rivers; Meacham (302) & Birch (306) creeks; Upper (601) & Middle (602) Klickitat River	ST	2	2
Glade (105) & Mill (202) creeks; Lower Klickitat River (604); Mosier Creek (505); White Salmon River (509); Middle Columbia/Grays Creek (512)	ST	2	1
Little White Salmon River (510)	ST	2	0
Middle Touchet River (204); McKay Creek (305); Little Klickitat River (603);Fifteenmile (502) & Fivemile (503) creeks	ST	1	2
Alder (110) & Pine (111) creeks; Lower Touchet River (207), Cottonwood (208), Pine (209) & Dry (210) creeks; Lower Walla Walla River (211); Umatilla River/Mission Creek (303) Wildhorse Creek (304); Umatilla River/Alkali Canyon (307); Lower Butter Creek (310); Upper Middle Columbia/Hood (501); Middle Columbia/Mill Creek (504)	ST	1	1
Stage Gulch (308) & Lower Umatilla River (313)	ST	0	1

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

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

2.3.6 Oregon Coast Recovery Domain

In this recovery domain, critical habitat has been designated for Oregon Coast (OC) coho salmon. 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 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 (ODEQ) analyzed the status and trends of water quality in the range of OC coho salmon using the Oregon water quality index, which is based on a combination of temperature, dissolved oxygen, biological oxygen demand, pH, total solids, nitrogen, total phosphates, and bacteria. Using the index at the species scale, 42% of monitored sites had excellent to good water quality, and 29% show poor to very poor water quality (ODEQ 2005). Within the four monitoring areas, the North Coast had the best overall conditions (6 sites in excellent or good condition out of 9 sites), and the Mid-South coast had the poorest conditions (no excellent condition sites, and only 2 out of 8 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 (6 out of 9) had a significant improvement in index scores. The Umpqua River basin, with one out of 9 sites (11%) showing an improving trend, had the lowest number of improving sites.

2.3.7 Southern Oregon/Northern California Coasts Recovery Domain

In this recovery domain critical habitat has been designated for Southern Oregon/Northern California Coasts (SONCC) coho salmon. 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). Historic 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 historic condition. Jetties were built by the USACE in 1960, which stabilized and deepened the mouth of the river. A dike that extends from the south shore near Highway 101 to the south jetty was completed in 1973. This dike created a backwater for the large shallow area that existed here, which has been developed into a boat basin and marina, eliminating most of the tidal marsh. The quantity of estuary habitat is naturally limited in the Rogue River. The Rogue River has a 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 the lower Rogue River watershed. The list includes water temperatures, low stream flows, riparian forest conditions, fish passage and over-wintering habitat. Limiting factors identified for the upper Rogue River basin include fish passage barriers, high water temperatures, insufficient water quantity, lack of large wood, low habitat complexity, and excessive fine sediment (Rogue Basin Coordinating Council 2006).

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

2.4 Environmental Baseline

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

NMFS describes the environmental baseline in terms of the biological requirements for habitat features and processes necessary to support all life stages of each listed species within the program action area, resulting in recovery of the species. Each listed species considered in this document resides in or migrates through the program action area. Thus, for this program action area, the biological requirements for salmon and steelhead are the habitat characteristics that support successful completion of rearing and freshwater migration. Limiting factors described above in the Status of the Species table, and habitat conditions described in the critical habitats sections, are also among the baseline conditions throughout the action area, and are influenced activities occurring 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, 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.

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 mainstem rivers 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. In the Columbia River Basin, the environmental baseline is controlled primarily by management of streamflow on the mainstem and its tributaries through a series of 60 major dams and reservoirs throughout the basin, including 31 Federally-owned projects that comprise the FCRPS, which is further moderated by variability in ocean and climate conditions (NRC 1995; NWPCC 2012). Dramatic reductions in flow compared to the historic spring freshet pose particularly high risks for juvenile Pacific salmon by increasing the travel time of juvenile out-migrants and thus their potential exposure to elevated temperatures, disease, and other environmental stressors.

Availability of aquatic habitat for native fish, particularly those that rely heavily on low-velocity side channel habitat for holding, feeding, and rearing, has declined because of these changes to habitat-forming processes. Active navigation channel management by the USACE through dredging has resulted in the filling of shallow, off-channel habitats and expanded/created main-stem islands. The development of hydropower and water storage projects has also altered water quality (reduced spring turbidity levels), water temperature (including generally warmer minimum winter temperatures and cooler maximum summer temperatures), 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).

Johnson *et al.* (2013) found PCBs and DDT in juvenile salmon and salmon diet samples from the lower Columbia River and estuary at concentrations above estimated thresholds for effects on growth and survival. The Columbia River between Portland, Oregon, and Longview, Washington (approximate RM 68 to 102), appears to be an important source of contaminants for juvenile salmon and a region in which salmon were exposed to toxicants associated with urban development and industrial activity. Highest concentrations of PCBs were found in fall Chinook salmon stocks with subyearling life histories, including populations from the upper Columbia and Snake rivers, which feed and rear in the tidal freshwater and estuarine portions of the river for extended periods. Spring Chinook salmon stocks with yearling life histories that migrate more rapidly through the estuary generally had low PCB concentrations, but high concentrations of DDTs. Pesticides can be toxic to primary producers and macroinvertebrates, thereby limiting salmon population recovery through adverse, bottom-up impacts on aquatic food webs (Macneale *et al.* 2010).

Water quality throughout most of the action area is degraded to various degrees because of contaminants that are harmful to species considered in this consultation. Aerial deposition, discharges of treated effluents, and stormwater runoff from residential, commercial, industrial, agricultural, recreational, and transportation land uses are all source of these contaminants. For example, the U.S Environmental Protection Agency (EPA) found that 4.7 million pounds of toxic chemicals were discharged into surface waters of the Columbia River Basin (a 39% decrease from 2003) and another 91.7 million pounds were discharged in the air and on land in 2011 (U.S. EPA 2011). This reduction can be attributed, in part, to significant state, local and private efforts to modernize and strengthen tools available to treat and manage stormwater runoff (U.S. EPA 2009; U.S. EPA 2011). Additionally:

- The City of Portland adopted regulations to control the quantity and quality of stormwater produced by all new development and redevelopment to ensure that they comply with water quality standards and protect beneficial uses (City of Portland 2004; City of Portland 2008; City of Portland 2014).
- In December 2011, Portland successfully completed a 20-year effort to control combined sewer overflows.
- The State of Washington adopted statewide regulations in Washington to control the quantity and quality of stormwater produced by all new development and redevelopment to ensure that they comply with water quality standards and protect beneficial uses (Washington State Department of Ecology 2004; Washington State Department of Ecology 2012).
- Both Oregon and Washington have approved, or are developing, total maximum daily load allocations and discharge permits for the Columbia River and 17 major tributaries for arsenic, chlorinated pesticides (*e.g.*, DDT, dieldrin), dioxins, dissolved gas, lead, mercury, polycyclic aromatic hydrocarbons (PAHs), PCBs, and other metals (U.S. EPA 2009). Through August 2013, U.S. EPA has approved total maximum daily load allocations on 1,279 stream segments in Oregon. Within 28 watersheds, 1,207 stream segments coincide with habitat for listed species in this opinion (ODEQ 2013b).
- ODEQ has approved mMS4 permits for all Oregon cities that were required under Phase I and 2. Phase I was for populations greater than 100,000 and Phase II was for regulated (or "small") MS4s with populations less than 100,000, but located within Census Bureau-defined Urbanized Areas (ODEQ 2013a).
- “Early action” clean-up areas in the Portland Harbor Superfund site, including: Arkema, a former pesticide manufacturing facility contaminated with high levels of DDT and other

chemicals; Gasco-Siltronic, a former manufactured gas plant contaminated with tar deposits from past manufacturing; River Mile 11E, an area located between the Fremont and Broadway Bridges on the east side of the Willamette River; Terminal 4, a former industrial site contaminated with pesticides, PCBs, metals, and PAHs; Triangle Park, a 35-acre former industrial site with soil and groundwater contamination; and U.S. Moorings Early Action Area, a former industrial site contaminated with metals, solvents, and petroleum by-products from historic boat maintenance activities (U.S. EPA 2013).

Stormwater runoff has been degrading water quality throughout the action area for years but reducing that role has been notoriously difficult. That is because the runoff is produced everywhere in the developed landscape, the production and delivery of runoff are episodic and difficult to attenuate, and runoff accumulates and transports much of the collective waste of the developed environment (NRC 2009). In most rivers in Oregon, the full spatial distribution and load of contaminants is not well known. In the Columbia River, arsenic, chromium, copper, lead, zinc, PAHs, 173 pesticides and degradation products, wastewater compounds, such as the endocrine disrupter bisphenol A and other phthalates and nonylphenols, PCB congeners, pharmaceuticals, radionuclides, and many others have all been detected (Fuhrer *et al.* 1996; Morace 2006; Morace 2012; ODEQ 2012). Some contaminants, like metals, also have natural sources, and most were not found at levels of concern with regards to aquatic-life toxicity (Johnson *et al.* 2013; ODEQ 2012). But hydrologically low-energy areas, where fine-grained sediment and associated contaminants settle, are also more likely to have high water temperatures, concentrations of nitrogen and phosphorus that may promote algal blooms, and concentrations of aluminum, iron, copper, and lead that exceed ambient water quality criteria for chronic toxicity to aquatic life (Fuhrer *et al.* 1996).

Even at extremely low levels, many of these contaminants still make their way into salmon tissues at levels that are likely to have sublethal and synergistic effects on individual Pacific salmon, such as immune toxicity, reproductive toxicity, and growth inhibition (Baldwin *et al.* 2011; Carls and Meador 2009; Hicken *et al.* 2011; Johnson *et al.* 2013), that may be sufficient to reduce their survival and therefore the abundance and productivity of some populations (Baldwin *et al.* 2009; Spromberg and Meador 2006). The adverse effect of contaminants on aquatic life often increases with temperature because elevated temperatures accelerate metabolic processes and thus the penetration and harmful action of toxicants. The full presence of these contaminants throughout the program action area is poorly understood, but the concentration of many increase in downstream reaches (Fuhrer *et al.* 1996; Johnson *et al.* 2013; Johnson *et al.* 2005; Morace 2012).

The fate and transport of contaminants varies by type, but are all determined by similar biogeochemical processes (Alpers *et al.* 2000a; Alpers *et al.* 2000b; Bricker 1999; Chadwick *et al.* 2004; Johnson *et al.* 2005). After deposition, each contaminant typically processes between aqueous and solid phases, sorption and deposition into active or deep sediments, diffusion through interstitial pore space, and re-suspension into the water column. Uptake by benthic organisms, plankton, fish, or other species may occur at any stage except deep sediment, although contaminants in deep sediments become available for biotic uptake when re-suspended by dredging or other disturbances.

Whenever a contaminant is in an aqueous phase or associated with suspended sediments, it is subject to the processes of advection and dispersion toward the Pacific Ocean. For example, low suspended loads and the moderately high average velocity (30 cm s^{-1}) of water in the lower Columbia River can move copper that stays in solution from RM 190 to the Pacific Ocean in less than 12 days, with a half-life measured in months compared to the 20 year half-life for copper that is adsorbed onto active sediments (Johnson *et al.*2005). Adsorbed contaminants are highest in clay and silt, which can only be deposited in areas of reduced water velocity, such as behind dams and the backwater or off-channel areas preferred as rearing habitat by juveniles of some Pacific salmon (Johnson *et al.* 2005; ODEQ 2012). Similar estimates for the residence time of contaminants in the freshwater plume are unavailable, although the plume itself has been tracked as a distinct coastal water mass that may extend up to 50 miles beyond the mouth of the Columbia River, where the dynamic interaction of tides, river discharge, and winds can cause significant variability in the plume's location at the interannual, seasonal scale, and even at the event scale of hours (Burla *et al.* 2010; Kilcher *et al.* 2012).

The action area is also influenced by recovery plans adopted for the listed species. The Oregon action area for Pacific salmon recovery planning purposes includes the Interior Columbia, Oregon Coast, Southern Oregon/Northern California Coast (NMFS 2012a), and the Willamette-Lower Columbia. The Interior Columbia and the Willamette-Lower Columbia are further divided into five sub-basin planning units, the LCR, UWR, UCR, SR and MCR, each with its own recovery plan.

The LCR plan (NMFS 2013) identifies increased surface runoff from urban and rural development as a factor that has diminished overall tributary habitat productivity, and calls for recovery actions based on better stormwater management to reduce contaminants in streams. Reducing exposure to contaminants commonly found in stormwater is also cited as an important part of the recovery strategy for estuarine habitats, where exposure to toxic contaminants is cited as a secondary limiting factor for juveniles in all populations. While exposure of those life stages to contaminants in the water column of the lower Columbia River and estuary is important, contaminants in the sediment and in the food web are likely to be even more significant as diet is probably a more important route for exposure to contaminants than the water column (Fresh *et al.* 2005; NMFS 2011c).

Each recovery plan for an upper sub-basin acknowledges that its success depends partly on the completion of actions to improve survival for life-cycle events that take place outside their respective areas and incorporate those actions by reference, including specifically actions to improve survival during migration and rearing in the lower Columbia River and estuary. For example, the UCR plan notes that action to reduce toxics in the estuary may provide a large survival benefit for UCR populations and that, in any event, it is highly probable that combined actions in all sectors will move UCR populations to a more viable state (Upper Columbia Salmon Recovery Board 2007). The draft or final recovery plan for these sub-basins each identify water quality impairment due to stormwater runoff as a baseline limiting factor and threat to the recovery of Pacific salmon, and specify better stormwater management as an essential recovery action.

A draft or final recovery plan for Southern DPS green sturgeon is not available yet, but the final rulemaking to establish take prohibitions identifies exposure to contaminants as an important limiting factor (USDC 2010). Contaminant loads in the Sacramento River, the sturgeon's primary reproductive area, increased significantly since the mid-70s. That may place green sturgeon at risk by decreasing their prey or contaminating the prey such that the total body burden of contaminants in sturgeon is increasing through bioaccumulation. Southern DPS green sturgeon occur in coastal, estuarine and freshwater areas from Monterey, California to Graves Harbor, Alaska, although the Columbia River is one of only 18 bays and estuaries where its presence has been confirmed (Adams *et al.* 2002). Large aggregations of green sturgeon from all known spawning populations, including the Southern DPS, gather in the Columbia River estuary during summer, where they are likely feeding to optimize growth.

Similarly, a recovery plan for eulachon is not available, although their status review ranked water quality as an intermediate threat to CR eulachon, below climate change, by-catch, dams, and water diversions, but ahead of dredging, predation and nine other types of threat (Gustafson *et al.* 2010). That review also suggested the high lipid content of eulachon makes them vulnerable to chemical contaminants that bioaccumulate, and that they may be affected by point and nonpoint source discharges of persistent contaminants and contaminated waste disposal. Eulachon spawn in the lower part of certain rivers from northern California to Bristol Bay, Alaska, including the lower Columbia River and several of its tributaries (the Grays, Elochoman, Kalama, Lewis, and Sandy Rivers) where most of the U.S. production occurs. Aside from schooling, little is known of eulachon behavior. Their annual run timing is highly variable and sporadic from year to year. Adults can appear from early to late winter to begin spawning in the Columbia River, eggs hatch after 20 to 40 days, depending on temperature, then larvae are carried downstream and dispersed by estuarine, tidal, and ocean currents. Larval eulachon may remain in low salinity, surface waters of estuaries for several weeks or longer before entering the ocean.

Water quality concerns associated with stormwater runoff are consistent with nationwide observations about the link between human land-use and elevated land-based sources of pollution. Toxic stormwater runoff in particular, are one of the most important threats to the biological integrity of basins, lakes, estuaries, and nearshore marine environments (Interagency Ocean Policy Task Force 2010; McCarthy *et al.* 2008). In the U.S., concerns related to nonpoint source pollution have gained momentum over the past decade (Interagency Ocean Policy Task Force 2010; U.S. Commission on Ocean Policy 2004). This momentum recently culminated in the designation of "water quality and sustainable practices on land" as one of nine National Priority Objectives for the newly established National Ocean Council, together with ecosystem-based management, marine spatial planning, climate change and ocean acidification, and changing conditions in the Arctic (Interagency Ocean Policy Task Force 2010). For toxic runoff, however, the connections between unsustainable practices on land and the decline of ecological resilience in aquatic habits remain poorly understood.

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 USACE authorized about 428 transportation projects and 132 restoration actions in Oregon under programmatic consultations (NMFS 2008a; NMFS 2008b). The USACE, Bonneville Power Administration, and Bureau of Reclamation have consulted on large water management actions, such as operation of the FCRPS, the Umatilla Basin Project, and the Deschutes Project. The U.S. Bureau of Indian Affairs, U.S. Bureau of Land Management, and the U.S. Forest Service have consulted on Federal land management throughout Oregon, including restoration actions, forest management, livestock grazing, and special use permits. The Bonneville Power Administration, NOAA Restoration Center, and U.S. Fish and Wildlife Service 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.

Finally, the environmental baseline also includes the impacts of Federal actions that have been the subject of many consultations focused on water quality in the action area. For example:

- A series of restoration actions to remove PCB-contaminated electrical equipment from the Columbia River near Bradford Island (NMFS 2002)
- Consultation with U.S. EPA and Port of Portland on the proposed Superfund Phase 1 removal actions (NMFS 2008c).
- Clean-up of the McCormick and Baxter Creosoting Company Superfund Site on the Willamette River (NMFS 2006)
- Reform of fishery harvest practices to protect, rebuild, and enhance Columbia River fish runs while providing harvest for treaty Indian and non-treaty fisheries (NMFS 2008c)
- Continuing actions to monitor and improve juvenile downstream and adult upstream passage survivals through the FCRPS, improve tributary and estuarine habitat, reduce fish and bird predation, and use hatcheries to help protect wild stocks (NMFS 2008d)
- Consultation with the USACE on the effects of the configuration, operations and maintenance of the Willamette Valley projects (NMFS 2008a).
- Use Federal Aid Highway Program funds to improve transportation systems, including stormwater treatment, aquatic habitat restoration, and improved fish passage (NMFS 2012c)
- Approve certain Oregon administrative rules related to revised water quality criteria for toxic pollutants (NMFS 2012d)
- Watershed management and annual monitoring of progress by the U.S. Forest Service and Bureau of Land Management under the PACFISH /INFISH Biological Opinions (USDA-Forest Service 2013)
- Consultation with USACE on actions authorized or carried out by USACE for maintenance or improvements to stormwater, transportation or utility actions (NMFS 2014a)
- Consultation with USACE on action authorized or carried out by USACE for restoration actions (NMFS 2013x)
- A jeopardy opinion on the operation of the FCRPS identifies reasonable and prudent alternatives (RPAs) to be carried out to reduce the detrimental impacts of the series of impoundments and hydroelectric operations to a level that avoids jeopardy to species that rely on the Snake and Columbia Rivers
- A jeopardy opinion on the National Flood Insurance Program identifies RPA to be carried out to reduce the detrimental impacts of FEMA’s development standards to a level that avoids jeopardy to species throughout the same action area as identified in this opinion.

The action area for this programmatic consultation includes the combined action areas of conservation enhancement actions for which an exact location within the region is not yet known. For this reason, it was not possible to define the precise site-specific conditions of fish or critical habitats throughout the extensive action area, the factors responsible for that condition, or the conservation role of those specific areas. However, NMFS assumed that the proposed HUD projects will occur in areas that (1) are occupied by listed species, and (2) have degraded baseline conditions due in part to the baseline presence of untreated runoff.

2.5 Effects of the Action on the Species and their Designated Critical Habitat

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

HUD or their RE will evaluate each individual construction project prior to receiving funds to ensure that: (a) The anticipated range of effects is within the range considered in this opinion; (b) the action is consistent with NMFS' Stormwater Design Criteria (Appendix A, or the most recent version); and (c) project and program level monitoring and reporting requirements are met. Moreover, construction of each project may only begin after NMFS approval as outlined in the proposed action, elements 4 (Review and Approval) and 7 (Notification), as described in Appendix A. Although this process will not, by itself, affect a listed species or critical habitat, it informs the effects analysis of the HUD program.

As noted in Section 1.3, HUD proposes to fund, or carry out, actions to construct or redevelop housing and other public facilities in Oregon. This opinion will not cover development of complex infrastructure, such as a new road system or wastewater treatment facility. Moreover, all proposed construction activities will occur at upland sites that are disconnected and remote from any floodplain, riparian, or aquatic habitats and will not require entry into, or any disturbance of, those habitats. Because the construction will be isolated in upland, the only effect of these projects will be indirect effects caused by the development or redevelopment of impervious surfaces and stormwater drainage systems. Those impervious surfaces will impede the infiltration of water into the soil, alter the natural flow of water, and accelerate the delivery of pollutants in post-construction stormwater runoff to rivers and estuaries occupied by listed species.

Pollutants in the post-construction stormwater runoff produced by each HUD project will come from many diffuse sources. The runoff itself comes from rainfall or snowmelt moving over and through the ground. As the runoff travels along its path, it picks up and carries away natural and anthropogenic pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters (U.S. EPA 2016b). Pollutants in post-construction stormwater runoff from residential areas similar to HUD projects typically include (Buckler and Granato 1999; Colman *et al.* 2001; Driscoll *et al.* 1990; Kayhanian *et al.* 2003; Van Metre *et al.* 2006):

- Excess fertilizers, herbicides, insecticides and sediment from landscaping areas

- Oil, grease, PAHs and other toxic chemicals from roads and parking areas used by motor vehicles
- Bacteria and nutrients from pet wastes and faulty septic systems
- Metals (arsenic, copper, chromium, lead, mercury, and nickel) and other pollutants from the decay of building and other infrastructure
- Atmospheric deposition from surrounding land uses
- Erosion of sediment and attached pollutant due to hydromodification

Those pollutants will become more concentrated on impervious surfaces until they either degrade in place or are transported by wind, precipitation, or active site management. Although stormwater discharge from most proposed projects will be small in comparison to the flow of the nearby waterways, it will have an incremental impact on pollutant levels. The adverse effects of stormwater runoff from HUD projects will occur primarily at the watershed scale due to persistent additions of pollutants or the compounding effects of many environmental processes. Because the poor state of stormwater monitoring and modeling make it impossible to link a particular discharge from a HUD project to specific water body impairment. The best measureable proxies for stormwater pollutant loading are impervious cover and flow (NRC 2009), variables that can be easily quantified for residential developments, and for all other types of development actions that result in construction of impervious surfaces.

Stormwater runoff from the proposed projects will contribute to the total incremental effect on the environment caused by all development activities within the range of ESA-listed species in Oregon. At this scale, the additive effect of persistent pollutants contributed by many small, unrelated land developments has a greater impact on natural processes than the input from larger, individual projects, and the impacts of many small and large projects are all compounded together (NRC 2009; Vestal and Rieser 1995).

The following brief summaries from toxicological profiles (ATSDR 1995; ATSDR 2004a; ATSDR 2004b; ATSDR 2005; ATSDR 2007) show how the environmental fate of each contaminant in the Columbia River and the subsequent exposure of listed species and critical habitats varies widely, depending on the transport and partitioning mechanisms affecting that contaminant, and the impossibility of linking a particular discharge to specific water body impairment (NRC 2009):

- DDT and its metabolites, dichlorodiphenyldichloroethylene (DDE) and dichlorodiphenyltrichloroethane (DDD) (all collectively referred to as DDx) may be transported from one medium to another by the processes of solubilization, adsorption, remobilization, bioaccumulation, and volatilization. In addition, DDx can be transported within a medium by currents, wind, and diffusion. These chemicals are only slightly soluble in water, therefore loss of these compounds in runoff is primarily due to transport of particulate matter to which these compounds are bound. For example, DDx have been found to fractionate and concentrate on the organic material that is transported with the clay fraction of the wash load in runoff. Sediment is the sink for DDx released into water where it is can remain available for ingestion by organisms, such as bottom feeders, for many years.

- The environmental fate of each type of PAH depends on its molecular weight. In surface water, PAHs can volatilize, photolyze, oxidize, biodegrade, bind to suspended particles or sediments, or accumulate in aquatic organisms, with bioconcentration factors often in the 10-10,000 range. In sediments, PAHs can biodegrade or accumulate in aquatic organisms or non-living organic matter. Some evaporate into the air from the surface but most do not easily dissolve in water, some evaporate into the air from surface waters, but most stick to solid particles and settle into sediments. Changes in pH and hardness may increase or decrease the toxicity of PAHs, and the variables of organic decay further complicate their environmental pathway (Santore *et al.* 2001).
- PCBs are globally transported and present in all media. Atmospheric transport is the most important mechanism for global dispersion of PCBs. PCBs are physically removed from the atmosphere by wet deposition (*i.e.*, rain and snow scavenging of vapors and aerosols); by dry deposition of aerosols; and by vapor adsorption at the air-water, air-soil, and air-plant interfaces. The dominant source of PCBs to surface waters is atmospheric deposition; however, redissolution of sediment-bound PCBs also accounts for water concentrations. PCBs in water are transported by diffusion and currents. PCBs are removed from the water column by sorption to suspended solids and sediments as well as from volatilization from water surfaces. Higher chlorinated congeners are more likely to sorb, while lower chlorinated congeners are more likely to volatilize. PCBs also leave the water column by concentrating in biota. PCBs accumulate more in higher trophic levels through the consumption of contaminated food.
- Due to analytical limitations, investigators rarely identify the form of a metal present in the environment. Nonetheless, much of the copper discharged into waterways is in particulate matter that settles out. In the water column and in sediments, copper adsorbs to organic matter, hydrous iron and manganese oxides, and clay. In the water column, a significant fraction of the copper is adsorbed within the first hour of introduction, and in most cases, equilibrium is obtained within 24 hours.
- For zinc, sorption onto hydrous iron and manganese oxides, clay minerals, and organic material is the dominant reaction, resulting in the enrichment of zinc in suspended and bed sediments. The efficiency of these materials in removing zinc from solution varies according to their concentrations, pH, redox potential, salinity, nature and concentrations of complexing ligands, cation exchange capacity, and the concentration of zinc. Precipitation of soluble zinc compounds appears to be significant only under reducing conditions in highly polluted water.
- A significant fraction of lead carried by river water occurs in an undissolved form, which can consist of colloidal particles or larger undissolved particles of lead carbonate, lead oxide, lead hydroxide, or other lead compounds incorporated in other components of surface particulate matters from runoff. Lead may occur either as sorbed ions or surface coatings on sediment mineral particles, or it may be carried as a part of suspended living or nonliving organic matter in water. The ratio of lead in suspended solids to lead in dissolved form has been found to vary from 4:1 in rural streams to 27:1 in urban streams. Sorption of lead to polar particulate matter in freshwater and estuarine environments is an important process for the removal of lead from these surface waters.

Pollutants travel long distances in rivers either in solution, adsorbed to suspended particles, or else they are retained in sediments, particularly clay and silt, which can only be deposited in areas of reduced water velocity, such as behind dams or backwater and off-channel areas, until they are mobilized and transported by future sediment moving flows (Alpers *et al.* 2000a; Alpers *et al.* 2000b; Anderson *et al.* 1996). Santore *et al.* (2001) indicates that the presence of natural organic matter and changes in pH and hardness affect the potential for toxicity (both 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 runoff discharges into a stream to the downstream terminus.

Treatment of post-construction stormwater runoff reduces the amount of these contaminants entering the freshwater habitat of listed species. The treatment protocols proposed by HUD will be 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.

Stormwater infiltration treatment practices, such as such as bioretention, bioslopes, infiltration ponds, and porous pavement, supplemented with appropriate soil amendments as needed, as proposed by HUD, are highly effective treatments to reduce or eliminate contaminants from runoff (Barrett *et al.* 1993; Center for Watershed Protection and Maryland Department of the Environment 2000 (revised 2009); Hirschman *et al.* 2008; National Cooperative Highway Research Program 2006; Spromberg, et al. 2016; Washington State Department of Ecology 2004; Washington State Department of Ecology 2012).

Flow control best management practices (BMPs) proposed by HUD will control the volume rate, frequency, and flow duration of stormwater surface runoff. The need to provide flow control BMPs depends on whether a development site discharges to a stream system or wetland, either directly or indirectly. Stream channel erosion control can be accomplished by BMPs that detain runoff flows or that physically stabilize eroding streambanks. However, because HUD does not propose to complete any streambank stabilization, it will focus only on appropriate detention methods.

Although HUD proposes to capture, manage, and treat runoff up to the design storm level from most proposed projects, treatment will not eliminate all pollutants in the post-construction runoff produced at HUD project sites. Thus, adverse effects of post-construction stormwater runoff will persist for the design life of each HUD project completed under the proposed action.

2.5.1 Effects on Critical Habitat

Designated critical habitat within the action area for the ESA-listed fish species considered in this opinion will consist primarily of freshwater rearing sites, freshwater migration corridors, estuaries, and their essential physical and biological features. The effects of the proposed action on these features are summarized below as a subset of the habitat-related effects of the action that were discussed more fully above. These effects will occur during and after each discharge of runoff that will occur throughout the design life of each project, although the duration and severity of each effect will vary with site and event specific characteristics, such as the precipitation volume and discharge of stream flow in the receiving stream.

2.5.1.1 Pacific salmon and steelhead

Except for SR sockeye salmon and SR fall-run Chinook salmon, substrate or water quality is a factor limiting the recovery of all Pacific salmon considered in this opinion, regardless of whether they show a subyearling, yearling or mixed life history pattern.

1. ***Freshwater spawning sites***
    a. Substrate. Pollutants in stormwater runoff are an indirect effect from the proposed funding. Pollutants entering waterways will add to, and compound with, other pollutants already present in ways that adversely affect the substrate in salmon spawning areas because the particulate forms of those pollutants are either immediately bioavailable via discharge, through re-suspension, are a delayed source of toxicity through bioaccumulation, or are available when water quality conditions favor dissolution at a later date. Specifically, contaminated sediments will influence intra-gravel life stages, food sources, and fish through direct ingestion of prey, plankton, detritus or sediment while feeding, or by deposition of particulate forms of pollutants on the gill surfaces or sensory organs. As described in section 2.4 above, most pollutants in stormwater runoff adsorb to organic particulates (i.e., bind with sediment) and settle out in the substrate. There the pollutants undergo a complex process of biogeochemical cycling driven by physical forces related to water flow and circulation, sediment re-suspension, deposition, and bed dynamics, chemical fate and transport, and biotic processes including food web relationships and bioaccumulation, that transport the pollutants to the estuary and ocean.
    b. Water quality. Pollutants in stormwater runoff indirectly resulting from the proposed funding will add to, and compound with, other pollutants already present in spawning habitats, in ways that reduce water quality. The water column is an important connection between many of the biogeochemical processes that move stormwater pollutants through the action area in suspension, solution, or the bodies of aquatic organisms, and is a medium that brings those pollutants into contact with freshwater spawning sites where they contact salmon that are spawning, incubating, and undergoing larval development.
    c. Water quantity. Where stormwater flow control is used, altered timing and location of water sourcing to streams is likely to occur, particularly in smaller tributaries. Hydromodification resulting from stormwater inputs can increase erosion, scour, and habitat forming processes to the detriment of spawning habitat quality at the point of discharge and areas downstream of a discharge. Scour can render suitable spawning habitat less suitable or unsuitable. Erosion can cause sedimentation of spawning gravels, depriving eggs of sufficient oxygen or resulting in burial.
2. ***Freshwater rearing.*** All species of Pacific salmon will be subject to these effects, although species with a subyearling life history will be most affected due to their habitat preference for shallow and backwater habitats, where pollutants from stormwater runoff are more concentrated. Species that show a yearling life history

pattern may have fewer effects due to their preference for deeper water conditions, where suspended sediments and contaminants are less abundant

a. Floodplain connectivity. To the degree that funded projects are located in floodplains, displacement of storage of floodwater and therefore access to floodplain refugia during high overbank conditions is probable. Additional indirect effects of funded projects being located in floodplains includes future "flood protection" actions, such as bank armoring and floodwall or levee construction, all of which inhibit or prevent habitat forming processes and floodplain connectivity.
b. Forage. Direct pollutants in stormwater runoff from funded projects into rivers will add to, and compound with, other pollutants already present in ways that adversely affect the amount of food available for juvenile salmon by injuring or killing their prey, thus reducing the amount of energy available for young salmon to meet the physiological demands of rearing and migration. Similarly, the differential impact of stormwater runoff on prey species is likely to change their relative abundance and their community composition, thus further altering the foraging efficiency of juvenile fishes. Consumption of contaminants ingested inside the bodies of prey, or with plankton, detritus or sediment that is also ingested while feeding, provides a major pathway into the body of salmon where they are likely to adversely affect juvenile growth and development, suppress their immune systems, and impair sensory functions thereby reducing their survival.
c. Natural cover. To the degree that funded projects remove native riparian vegetation, natural cover will be reduced either permanently, or if replanting occurs, then reduced for a period of years until new vegetation reaches maturity.
d. Water quality. Pollutants in stormwater runoff resulting from funding will add to, and compound with, other pollutants already present in rearing habitats, in ways that reduce water quality, as described for Freshwater spawning sites, above.
e. Water quantity. Where stormwater flow control is used, altered timing and location of water sourcing to streams is likely to occur, particularly in smaller tributaries. Hydromodification resulting from stormwater inputs can increase erosion, scour, and habitat forming processes to the detriment of rearing habitat quality at the point of discharge and areas downstream of a discharge. Scour can remove habitat complexity, resulting in less refugia from high stream velocity; increased turbidity in the water column, which can directly injure fish and impair forage success; and remove habitat elements from rearing areas, decreasing the abundance of epibenthic nutrient sources and prey species.

3. ***Freshwater migration corridors***

a. Forage. Direct pollutants in stormwater runoff from funded projects into rivers will add to, and compound with, other pollutants already present in ways that adversely affect foraging, similar to effects of forage at freshwater rearing sites, discussed above.

b. Free of artificial obstruction. Direct – No anticipated effect. Indirect – Migration can be impaired due to pollutant-diminished sensory abilities.
c. Natural cover. Direct – No anticipated effect. Indirect – To the degree that funded projects remove native riparian vegetation, natural cover will be reduced either permanently, or if replanting occurs, then reduced for a period of years until new vegetation reaches maturity. There is also the possibility of impaired predator avoidance due to pollutant-diminished sensory abilities.
d. Water quality. Pollutants in stormwater runoff resulting from funding will add to, and compound with, other pollutants already present in migratory habitats, in ways that reduce water quality. The water column is an important connection between many of the biogeochemical processes that move stormwater pollutants through the action area in suspension, solution, or the bodies of aquatic organisms, and is a medium that brings those pollutants into contact with freshwater migratory sites where they contact salmon that are undergoing growth, development, and smoltification.
e. Water quantity. Where stormwater flow control is used, altered timing and location of water sourcing to streams is likely to occur, particularly in smaller tributaries. Hydromodification effects are similar to those described for freshwater rearing, above.

4. ***Estuarine areas***

a. Forage. Similar to effects on forage at freshwater rearing sites, but lessening as salmon move seaward toward the ocean and shift their prey base from epibenthic species to marine planktonic sources.
b. Free of artificial obstruction. As described above.
c. Natural cover. As described above.
d. Salinity. No effects are likely to occur.
e. Water quality. While research is lacking, it is assumed that water quality in the estuary will be systemically impaired due to pollutant import from upstream sources. The degree to which estuarine habitat will be impaired is unknown, as the greater habitat area, volume of water, salinity, and flushing to the marine environment may attenuate some of the assumed effects.
f. Water quantity. Where stormwater flow control is used, altered timing and location of water sourcing to downstream receiving waters is likely to occur, even in estuarine areas. Hydromodification effects are similar to those described for freshwater rearing, above.

In summary, the effects of the proposed action are likely to have a small adverse impact on PBF conditions that salmon need for spawning substrate and spawning water quality, forage, and water quality at sites used for freshwater rearing, in freshwater migration corridors, and in estuarine areas. Those adverse impacts would likely be greater on PBFs designated for coho (Stromberg et al. 2016), and for species and populations with a sub-yearling life history, than species with a yearling life history, although all impacts would lessen in the estuary as freshwater influences subside and marine influences increase.

2.5.1.2 Southern Green Sturgeon

As long-lived, benthic dwelling species that spend an appreciable amount of their life cycle in bays, estuaries, and lower elevation mainstem of rivers, southern green sturgeon are vulnerable to the effects of pollutants, particularly in suspended sediments and bioaccumulation of contaminants in their prey, although exposure to pollutants has not been identified as limiting factor for this species.

1. ***Freshwater riverine systems***
    a. Food resources. Pollutants in stormwater runoff that are an indirect effect of the proposed funding will add to, and compound with, other pollutants already present there in ways that adversely affect the amount of food available for southern green sturgeon by injuring or killing their prey. This will reduce the amount of energy available for young southern green sturgeon to meet the physiological demands of rearing and migration. Similarly, the differential impact of stormwater runoff on prey species is likely to change their relative abundance and their community composition, thus further altering the foraging efficiency of mature and sub-adult fishes. Consumption of contaminants ingested inside the bodies of prey, or with plankton, detritus or sediment that is also ingested during feeding, provides a major pathway into the body of southern green sturgeon where they are likely to adversely affect mature and sub-adult fish growth and development, suppress their immune systems, and impair sensory functions thereby reducing their survival.
    b. Migratory corridor. Pollutants in stormwater runoff resulting from the proposed project will add to, and compound with, other pollutants already present in migratory habitats, in ways that reduce water quality, similar to those described for salmon and steelhead freshwater migration corridors, above.
    c. Sediment quality. Stormwater runoff indirectly resulting from the proposed funding will add pollutants to, and compound with, other pollutants already present in rivers in ways that adversely affect the sediment quality in freshwater riverine systems used by southern green sturgeon. The particulate forms of those pollutants are either immediately bioavailable via discharge, through re-suspension, are a delayed source of toxicity through bioaccumulation, or are available when water quality conditions favor dissolution at a later date. Specifically, contaminated sediments will influence food sources and fish through direct ingestion of prey, plankton, detritus or sediment while feeding, or by deposition of particulate forms of pollutants on the gill surfaces or sensory organs. As described in section 2.5 above, most pollutants in stormwater runoff adsorb to organic particulates and settle out in sediments. There the pollutants undergo a complex process of biogeochemical cycling driven by physical forces related to water flow and circulation, sediment re-suspension, deposition, and bed dynamics, chemical fate and transport, and biotic processes including food web relationships and bioaccumulation that transport the pollutants to the estuary and ocean.
    d. Substrate type or size. No effects are likely to occur.

e. Water depth. No effects are likely to occur.
f. Water flow. Given the volume of the Columbia River, where green sturgeon are known to reside as adults and subadults, effects from detention and discharge are unlikely to be discernable.
g. Water quality. Pollutants in stormwater runoff indirectly resulting from the proposed funding will add to, and compound with, other pollutants already present in ways that adversely affect water quality in freshwater riverine systems used by southern green sturgeon. The water column is an important connection between many of the biogeochemical processes that move stormwater pollutants through the action area in suspension, solution, or the bodies of aquatic organisms, and is a medium that brings those pollutants into contact with southern green sturgeon.

2. ***Estuarine***

a. Food resources. Similar to effects on food resource at freshwater riverine sites, but lessening as southern green sturgeon move seaward toward the mouth of rivers and the concentration of pollutants is reduced by tidal flushing.
b. Migratory corridor. Pollutants in stormwater runoff resulting from the proposed funding will add to, and compound with, other pollutants already present in migratory habitats, in ways that reduce water quality, similar to those described for salmon and steelhead freshwater migration corridors, above. While research is lacking, it is assumed that water quality in the estuary will be systemically impaired due to pollutant import from upstream sources. The degree to which estuarine habitat will be impaired is unknown, as the greater habitat area, volume of water, salinity, and flushing to the marine environment may attenuate some of the assumed effects.
c. Sediment quality. Stormwater runoff indirectly resulting from the proposed project will add pollutants to, and compound with, other pollutants already present in estuaries in ways that adversely affect the sediment quality, as described under freshwater riverine systems, above. The degree to which estuarine sediments will be impaired is unknown, as the greater habitat area, volume of water, salinity, and flushing to the marine environment may attenuate some of the assumed effects.
d. Water flow. No effects are likely to occur.
e. Water depth. No effects are likely to occur.
f. Water quality. Similar to effects on water quality at freshwater riverine sites, but lessening as southern green sturgeon move seaward toward the mouth of rivers and the concentration of pollutants is reduced by tidal flushing.

3. ***Coastal Marine Areas***

a. Food Resources. Similar to effects on food resources at estuarine areas, but further lessening as southern green sturgeon move into the open ocean beyond the river mouth and the influence of its freshwater plume.
b. Migratory Corridor. No effects likely to occur.
c. Water Quality. Similar to effects on water quality at estuarine areas, but further lessening as southern green sturgeon move into the open ocean beyond the river mouth and the influence of its freshwater plume.

In summary, the effects of the proposed funding is likely to have a very small adverse impact on PBF conditions that southern green sturgeon need for food resources, sediment quality, and water quality at freshwater riverine sites, estuarine sites, and coastal marine areas. Those adverse impacts are likely to lessen in the estuary, as freshwater influences subside and marine influences increase, and end in coastal marine areas beyond influences of freshwater plumes.

2.5.1.3 Eulachon

Although eulachon only spend a brief portion of their lifespan in freshwater, water quality has been identified as a factor limiting their recovery.

1. ***Freshwater spawning and incubation***
    a. Flow. Where stormwater flow control is used, altered timing and location of water sourcing to streams is likely to occur, particularly in smaller tributaries. Hydromodification resulting from stormwater inputs can increase erosion, scour, and habitat forming processes to the detriment of rearing habitat quality at the point of discharge and areas downstream of a discharge. Scour can remove habitat complexity, resulting in less refugia from high stream velocity; increased turbidity in the water column, which can directly injure fish and impair forage success; and remove habitat elements from rearing areas, decreasing the abundance of nutrient sources and prey species.
    b. Water quality. Pollutants in stormwater runoff from HUD projects will add to, and compound with, other pollutants already present in ways that adversely affect the water column in eulachon mainstem spawning areas. The water column is an important connection between many of the biogeochemical processes that move stormwater pollutants through the action area in suspension, solution, or the bodies of aquatic organisms, and is a medium that brings those pollutants into contact with freshwater spawning sites where they contact eulachon that are spawning, incubating, and undergoing larval development.
    c. Water temperature. No effects are likely to occur.
    d. Substrate. Pollutants in stormwater runoff from projects will add to, and compound with, other pollutants already present in ways that adversely affect eggs and larvae in the substrate of eulachon mainstem spawning areas because the particulate forms of those pollutants are either immediately bioavailable via discharge, through re-suspension, or are available when water quality conditions favor dissolution at a later date. As described in section 2.5 above, most pollutants in stormwater runoff adsorb to organic particulates and settle out in sediments where they undergo a complex process of biogeochemical cycling. Those processes are driven by physical forces related to water flow and circulation, sediment re-suspension, deposition, and bed dynamics, chemical fate and transport, and biotic processes including food web relationships and bioaccumulation, that transport the pollutants to the estuary and ocean.

2. ***Freshwater migration***
    a. *Migratory Corridor*. To the degree that funded projects remove native riparian vegetation, natural cover will be reduced either permanently, or if replanting occurs, then reduced for a period of years until new vegetation reaches maturity. There is also the possibility of impaired predator avoidance due to pollutant-diminished sensory abilities.
    a. Water Flow. Where stormwater flow control is used, altered timing and location of water sourcing to streams is likely to occur, particularly in smaller tributaries. Hydromodification effects are similar to those described for freshwater spawning and incubation, above.
    b. Water quality. Pollutants in stormwater runoff resulting from funding will add to, and compound with, other pollutants already present in migratory habitats, in ways that reduce water quality, similar to water quality impacts at freshwater spawning and incubation sites, described above.
    c. Water temperature. No effects are likely to occur.
    d. Food. Pollutants in stormwater runoff from projects will add to, and compound with, other pollutants already present there in ways that adversely affect the amount of food available for juvenile eulachon by injuring or killing their prey, thus reducing the amount of energy available for young eulachon to meet the physiological demands of rearing and migration. Similarly, the differential impact of stormwater runoff on prey species is likely to change their relative abundance and their community composition, thus further altering the foraging efficiency of juvenile fishes. Consumption of contaminants ingested inside the bodies of prey, or with plankton, detritus or sediment that fish also ingest while feeding, provides a major pathway into the body of eulachon where those contaminants are likely to impair juvenile fish growth and development, suppress their immune systems, and impair sensory functions thereby reducing their survival.

In summary, the effects of the proposed action are likely to have a very small adverse impact on PBF conditions that eulachon need for water quality and substrate in freshwater spawning areas, and for water quality and food in freshwater migration areas. Those adverse impacts are likely to lessen in the estuary, as freshwater influences subside and marine influences increase, and end in coastal marine areas beyond influences of freshwater plumes.

2.5.2 Effects to Listed Species

As discussed above, stormwater runoff delivers a wide variety of pollutants to aquatic ecosystems, and many of the pollutants are unregulated and unevaluated. Fish exposure to these ubiquitous pollutants in the freshwater and estuarine habitats is likely to cause multiple adverse effects to salmon and steelhead, sturgeon, and eulachon, even at pre-project, ambient levels (Hecht *et al.* 2007; Laetz *et al.* 2009; Macneale *et al.* 2010; Sandahl *et al.* 2007; Spromberg and Meador 2006), and are among the identified threats to sturgeon. Contaminants also accumulate in both the prey of and tissues of juvenile salmon. Depending on the level of concentration, those contaminants can 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). Even at very low levels, chronic exposures to those contaminants have a wide range of adverse effects on the ESA-listed species considered in this opinion (Carls *et al.* 2008; Comeleo *et al.* 1996; Feist *et al.* 2011; Hecht *et al.* 2007; Sandahl *et al.* 2007; Spromberg and Meador 2006), including:

- Early development – gastrulation, organogenesis, hatching success
- Juvenile growth – foraging behavior, growth rate, condition index
- Smoltification (only in salmonids) – anion exchange, thyroxin blood hormone, salinity tolerance
- Disease induced mortality – immunocompetence, pathogens, histopathology
- Predation-induced mortality – predator detection, shelter use, schooling behavior
- Migration/distribution – use of rearing habitats, adult homing, spawning site selection
- Reproduction – courtship behavior, number of eggs produced, fertilization success

Although stormwater runoff from a specific HUD project cannot be demonstrated to have adverse effects on individual fish, the types of contaminants in that runoff have been shown to injure or kill individual fish. This occurs through a variety of behavioral, endocrine disrupting, and immunotoxic disease effects, either by themselves or through additive, interactive, and synergistic interactions with other contaminants (Baldwin *et al.* 2009; Feist *et al.* 2011; Hicken *et al.* 2011; Spromberg and Meador 2006; Spromberg and Scholz 2011) at ambient levels already present in Oregon's rivers and its estuaries (Fuhrer *et al.* 1996; Johnson *et al.* 2013; Morace 2006; Morace 2012; ODEQ 2012).

These effects of contaminants on individuals are influenced by multiple factors, such as life history stage at time of exposure, and the particular species exposed, geographic distribution of the species, the duration of exposure, and land use patterns where the projects occur, which influences the composition of chemicals to which the individual fish are exposed (Feist *et al.* 2011; Johnson *et al.* 2013; Scholz *et al.* 2011; Spromberg and Scholz 2011; Stehr *et al.* 2009).

The geographical distribution of species considered in this opinion and the general land use patterns within that distribution are in section 2. Juvenile Pacific salmon can generally be classified into one of two major life history types, subyearling and yearling, based on age at emigration from freshwater (Carter *et al.* 2009; Groot and Margolis 1991; Johnson *et al.* 2013). The difference is significant because it suggests that the distribution and duration of exposure varies based on life history type. To some degree, species with similar life history requirements in the action area are likely to have a similar response to the effects of the action. For example, yearlings spend their first year or longer in tributaries before using deeper mainstem channels to migrate to the sea, and they arrive at the estuary as larger fish than subyearlings. Subyearlings migrate to the ocean in their first year as fry or smolts and may spend several months or years rearing in backwater or channel margins of the mainstem and estuary before entering the ocean and these locations tend to have higher levels of contaminants. Therefore, subyearlings are likely to be more susceptible to bioaccumulative pollutants in shallow-water and estuarine habitats because of their longer residence times than yearlings, although both are equally vulnerable to acute exposures (NMFS 2011c). The Pacific salmon considered in this opinion typically have the following life histories:

Subyearling outmigrants: UWR Chinook salmon, CR chum salmon

Yearling outmigrants: UCR Chinook salmon, SR spring/summer-run Chinook salmon, LCR coho salmon, OC coho salmon, SONCC coho salmon, SR sockeye salmon, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, LCR steelhead, southern green sturgeon

Mixed outmigration pattern: LCR Chinook salmon, SR fall-run Chinook salmon

Eulachon have a very different life history than Pacific salmon and begin their passive migration to the sea as soon as they emerge for the egg. Wind, river currents, and the tidal ebb and flow necessary to flush water out of the Columbia River estuary may redistribute eulachon larvae between the mainstem and channel margins, and delay their ocean entry for several weeks.

Southern green sturgeon present their own life history pattern with respect to residence time and habitat use in the lower Columbia River, where they are present in the mainstem and its estuary during most parts of the year, although the total residence time there for individual sturgeon is unknown.

Analyses of concentration of persistent, bioaccumulating, organic pollutants (PCBs, DDT), PAHs, and polybrominated diphenyl ethers (PBDE, an organobromine compound used as a flame retardant) in juvenile Pacific salmon, their diet, and sediments in the lower Columbia River and estuary (Johnson *et al.* 2013; Sloan *et al.* 2010; Yanagida *et al.* 2012) frequently detected those contaminants at levels that, in some cases, were above estimated thresholds for effects on growth and survival. Comparing those results to the level of contaminants in hatchery fish confirmed that listed Pacific salmon had been exposed to these chemicals during outmigration in the lower Columbia River and that these chemicals are bioaccumulating in their tissues (Johnson *et al.* 2013). In general, contaminants associated with industrial and wastewater sources (*e.g.,* PCBs) were detected at higher concentrations in samples from subyearling fish, prey and sediments collected in urban areas, while contaminants more associated with rural areas (*e.g.,* DDT) were significantly higher in yearling fish originating in the interior Columbia and Snake River basins. Among all salmon analyzed by Johnson *et al.* (2013), 3.2% had critical body residues that were above guidelines for DDT toxicological thresholds. However, those guidelines were not developed for salmon and may not be fully protective of sublethal endpoints, while 32% were above PCB toxicological effects thresholds that were established specifically using a wide range of toxicological studies on juvenile trout and salmon with effects ranging from enzyme induction to mortality.

No similar data or analyses are available for eulachon or southern green sturgeon. Nonetheless, eulachon life history is somewhat similar to the juvenile salmon subyearling strategy in that eulachon larvae have a very small body size, and based on migration patterns, have little or no exposure to tributary condition. However, eulachon may occupy shallow backwater or channel margin habitats in the lower mainstem or estuary for days or weeks before ocean entry, where potential for exposure would be highest. On the other hand, before ocean entry, eulachon larvae obtain nutrition primarily by absorbing their yolk sac and not through active feeding, thus eliminating a primary source of contaminant exposure. As a result, eulachon are less likely to absorb or bioaccumulate contaminants than juvenile salmon. Southern green sturgeon are unique among species considered in this opinion in that all individuals in the action area are likely to be mature or subadult, rest and feed in benthic regions of the mainstem lower river and estuary for months at a time, and may repeat that behavior for an indeterminate number of years throughout their long lives. Thus, the life history of sturgeon makes them particularly susceptible to the adverse effects of persistent bioaccumulating contaminants in sediments and prey.

Feist *et al.* (2011) found that salmonid spawner mortality was most closely and positively correlated with the relative proportion of local roads, impervious surfaces, and commercial property within a basin. Adult coho salmon returning from the ocean to spawn in urban basins of the Puget Sound region, have been documented for more than a decade to be prematurely dying at high rates (up to 50% of the total runs) when stormwater runoff enters streams where they are present. Injury and death caused by such exposure also occur among juveniles (Spromberg et al. 2016). The current weight of evidence indicates that coho deaths are caused by toxic chemical contaminants in land-based runoff to urban streams during the fall spawning season, and it appears that the mechanism of their mortality is likely to be anemic hypoxia (Spromberg et al. 2016). This mortality likely also occurs in Oregon's urban streams. Oregon streams will likely feel the effects of urbanization greater as the state grows and more surfaces are made impervious.

Stormwater effects to ESA-listed species will occur during and after each discharge of runoff that will occur throughout the design life of each project funded with HUD monies. The duration and severity of each effect will vary with site and event specific characteristics, such as average traffic volume (determining the amount of pollutant to be carried by stormwater, precipitation volume (determining the concentration of pollutant in the stormwater), and the volume of stream flow in the receiving stream (determining the rate of dilution of the stormwater). Repeated and chronic exposures, even of very low levels, are still likely to injure or kill individual fish, by themselves and through synergistic interactions with other contaminants already present in the water (Baldwin *et al.* 2009; Feist *et al.* 2011; Hicken *et al.* 2011; Spromberg and Meador 2006; Spromberg and Scholz 2011).

To summarize, most of the contaminants of concern are either elemental or persistent compounds. Some of those will reach the ocean in solution or suspension within a half-life of a few days or weeks, while others are likely to be deposited in sediments that move toward the ocean much more slowly, with a half-life journey that will takes years or decades to complete. During that time, ESA-listed species will absorb or ingest some of those contaminants in quantities sufficient to cause injury or death due to modified behavior, disrupted endocrine functions, or immunotoxic disease effects, either by themselves or through additive, interactive, and synergistic interactions with other contaminants in the river. These adverse effects are likely to be greater for southern green sturgeon, because of their benthic feeding habit, and for Pacific salmon populations with subyearling, or mixed subyearling/yearling life histories. Juveniles of those species are more closely associated with low velocity habitats where contaminants are likely to be more concentrated in fine, suspended sediments and in their prey organisms. Species with those life histories include UWR Chinook salmon, CR chum salmon, LCR Chinook salmon, and SR fall-run Chinook salmon. Egg and larval stages of eulachon will be vulnerable to contaminants because of their benthic distribution, although adult eulachon are less vulnerable because of their relatively brief residence time in the river before dispersal into the ocean. LCR coho is the species most likely to experience mortality directly from exposure.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). We did not consider future Federal actions that are unrelated to the proposed action in this section because those 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 sections (section 2.2 and 2.3), and Environmental Baseline section (section 2.4), above. We expect most of those activities to continue for the foreseeable future, contributing to cumulative effects driven by economic conditions that characterize traditional natural resource-based industries, resource demands associated with settlement of local and regional population centers, and efforts by social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences. Although we cannot measure the relative influence of these future activities, we have incorporated it qualitatively into the environmental baseline for the affected watersheds.

The economic and environmental significance of the 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), although resource-based industries are likely to continue to have an influence on environmental conditions within the program-action area for the indefinite future. Because those industries have adopted management practices that avoid or minimize many of their most harmful impacts, as is evidenced by the conservation measures included with the proposed action, the level of cumulative effects anticipated from these activities is likely to be less intense than would have been anticipated 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 2013, the population of Oregon grew from approximately 3.4 to 3.8 million, primarily due to in-migration from other states (U.S. Census Bureau 2014). 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 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.

General resource demands 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).

Demand for cultural and aesthetic amenities also 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 2011e; 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 more 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.

Elsewhere, many actions have focused on completion of river restoration projects specifically designed to counter 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-listed species recovery has become a common and accepted part of the State's economic and environmental culture. We expect this trend to continue into the future as public awareness of environmental and at-risk species issues. However, funding for restoration activities from governmental and non-governmental sources is uncertain, while development demands are largely consistent or growing over time, and therefore more certain to occur.

The EPA, via the states, regulates stormwater effluent through a National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit. The ODEQ, under EPA's delegated authority, issues permits for the operation of the stormwater system, requiring municipalities to maintain publicly owned storm and surface water facilities for water quality. MS4 permits have "anti-backsliding" provisions, which require stormwater management plans (SWMP) to control pollutant discharges to the maximum extent practicable. Renewal permits require the permittees to ensure that all new development and redevelopment follow local construction and post-construction stormwater regulations. Over time, we expect some increase in discharges from new developments although ODEQ's goal is a net reduction in pollutant loadings.

NMFS also expects that State, tribal, local or private parties will continue taking actions to reduce toxic pollution and stormwater runoff to the Columbia River from all sources (U.S. EPA 2012a). This includes actions by the Columbia River Inter-Tribal Fish Commission, the Lower Columbia River Estuary Partnership, Willamette Partnership Project, and the Portland Harbor responsible parties together with non-Federal members of the Portland Harbor Natural Resource Trustee Council and others. These groups provide public education, toxic source reduction and clean-up actions, monitoring to better identify and control sources, research into ecosystem effects of toxic pollutants, and development of a regional data management system. Similar efforts in the upper Columbia and Snake River Basins, have produced a significant reduction in the volume of some pollutants delivered to the lower Columbia River and its estuary (Johnson *et al.* 2005; U.S. EPA 2009; U.S. EPA 2011). While there are reasons to expect continued reduction in pollutant deliveries to the river and, eventually, in the concentration of contaminants in the river itself, direct evidence to show that improvements in habitat conditions leads to improvement in population viability of ESA-listed species is lacking.

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 likely 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 likely to cause localized degradation of freshwater and estuarine habitat. Interest in restoration activities is growing along with greater environmental awareness among the public. At best, this will lead to localized improvements to freshwater and estuarine habitat. Otherwise, it is likely that cumulative effects will not have a strong positive or negative effect on population abundance trends, or the quality and function of critical habitat PBFs.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat due to implementation of the proposed action. In this section, we add the Effects of the Action (Section 2.5) to the Environmental Baseline (Section 2.4) and the Cumulative Effects (Section 2.6), taking into account the Status of the Species (Section 2.2) and Status of the Critical Habitats (Section 2.3). Then we formulate the agency's biological opinion as to whether the proposed action is likely to: (1) appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species.

2.7.1 Status of Species and Effects to Species at the Population Scale

As identified in Section 2.2, HUD's proposed action is likely adversely affect all 17 ESA-listed species considered in the opinion. Of those populations that have had a viability analysis completed, few rate as "viable." The overall risk of extinction varies among the component populations from low (1 to 5% chance of extinction in 100 years) to very high (greater than 60% chance of extinction in 100 years). Baseline conditions, described at section 2.4 affect all species and populations, and the baseline includes a variety of NMFS identified factors identified as limiting the recovery of these 17 species, most notably degraded habitat, including water quality, hatchery and harvest-related effects, and adverse effects related to mainstem hydropower development. 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 abundance levels.

We considered the direct and indirect effects of HUD's proposed action in the context of those extinction risks. Given the size of the action area, HUD projects will expose every population of the 17 species considered in this opinion to an additional, small increment of water quality degradation. Individual fish will respond to that exposure in different ways depending on their life history stage at exposure. That, in turn, will determine (1) the duration of the exposure (e.g., rearing fish are exposed longer than migrating fish), (2) the pathways of exposure (e.g., prey or water quality, and (3) the nature of effect (e.g. juveniles more likely to experience latent sub-lethal effects, returning adults are more likely to have olfactory detriments that can impair homing ability). Relevant environmental cycles influencing exposure include the probabilistic time necessary for existing pollutants to flush from the basin by river discharge as measured in a half-life estimated to last for days for dissolved pollutants, but will require decades for pollutants adsorbed or absorbed onto sediment.

Given these factors, we expect that the populations of the LWR and LCR species are likely to have the greatest level of exposure and response, i.e., UWR Chinook salmon and UWR steelhead, and LCR Chinook and coho salmon, LCR steelhead, and CR chum salmon. Of those, steelhead are likely to have the longest period of exposure. The responses are likely to include a very minor impairment of essential fish rearing and feeding behavior patterns for some individuals among each of the species considered.

The increment of water quality degradation that a HUD project will add to the baseline condition is very small and diffused throughout the aquatic environment. For this reason, the number of individual fish that ultimately will be injured or killed by HUD projects is also very small and not likely to be concentrated in a way that has a more intense effect on one population compared to another. Thus, post-construction stormwater runoff from individual HUD projects, and collectively by the full HUD program, is unlikely to affect the abundance, productivity, spatial structure or diversity of any population or species considered in this opinion.

Recovery plans are not available yet for southern green sturgeon or eulachon. However, recovery plans that address the needs of Pacific salmon affected by the action (NMFS 2007; NMFS 2009; NMFS 2013a, NMFS 2014b; ODFW and NMFS 2011) all call for measures to improve water quality and reduce the impact of residential and municipal development, including improved stormwater management in particular, as among the most potent and high priority recovery actions. Thus, HUD projects that include stormwater treatment to reduce impacts are consistent with actions identified in recovery plans as necessary to recover species considered in this opinion.

In summary, given the rangewide status of the species likely to be adversely affected by the proposed action, the environmental baseline in the action area, the effects of the proposed action on species, and cumulative effects in the action area, HUD's proposed action poses a very small risk to listed species considered in this opinion.

2.7.2 Critical Habitat at the Watershed Scale

Similar to the additive analysis presented in Section 2.7.1 above, we also consider the effects to critical habitat from the proposed action in the context of the status of critical habitat and baseline conditions. As noted in Sections 2.2 and 2.3, climate change and human development have affected, and continue to adversely affect, critical habitat creating limiting factors and threats to the recovery of the ESA listed species. The action area is designated as critical habitat for ESA-listed salmon, steelhead, southern green sturgeon, and eulachon. PBFs designated for the 17 listed species include those physical and biological features that support the following site types:

- Pacific salmon – freshwater spawning, freshwater rearing, freshwater migration, estuarine areas, nearshore areas
- Southern green sturgeon – adult and juvenile migration corridors, freshwater rearing
- Eulachon – freshwater riverine system, estuarine area, coastal marine area

Federal, tribal, state and local entities are actively carrying out habitat improvement projects. At the same time, human population growth and development pressures on aquatic systems are increasing, particularly in the Willamette Valley. Dam and reservoir development have significantly altered the Willamette and Columbia Rivers. Channelization, revetments, and large wood removal have also significantly diminished the complexity and productivity of aquatic habitats. The long-term consequences of those trends may further reduce fish populations and degrade the quality and function of critical habitat.

Within the WLC recovery domain, estuarine and nearshore marine conditions limit the recovery of LCR chum salmon and LCR Chinook salmon; stream substrate is limiting for LCR Chinook salmon, CR chum salmon, LCR coho salmon, and LCR steelhead; and water quality is limiting for LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, and LCR coho salmon. Similarly, within the IC recovery domain, estuarine and nearshore marine conditions are limiting for UCR Chinook salmon; stream substrate is limiting for UCR Chinook salmon, SR spring/summer-run Chinook salmon, UCR steelhead, MCR steelhead, and SRB steelhead; and water quality is a factor limiting recovery of SR spring/summer-run Chinook salmon, MCR steelhead, and SRB steelhead. Despite degraded PBFs, the action area has high conservation value for all of the listed salmonid species because it serves as an obligatory migration route for each ESU and DPS.

The effects of the proposed action are likely to cause a very small contribution to limiting factors related to estuarine and nearshore marine conditions, substrate and water quality, contaminant exposure, and water pollution when contaminated runoff from HUD projects is sufficient to reach waterways. The discharges will briefly reduce water quality and forage components of critical habitats during and after each discharge throughout the design life of the project.

However, the duration and severity of each effect will vary widely based on specific site, project and precipitation event characteristics, such as the discharge flow in the receiving water, the amount of impervious area in the project, the length of antecedent dry period, and the type and amount of precipitation.

As described in Section 2.5, the adverse effect that the proposed HUD projects will add to the baseline conditions of designated critical habitat is the additional pollutants delivered by post-construction stormwater runoff from each HUD project. However, the post-construction stormwater management plan required for each project will ensure that those effects will be minimal.

As noted in Sections 2.2 and 2.3, climate change is likely to affect all critical habitats considered in this opinion. These effects are expected negative, and are likely to result in a generally and consistently negative trend for summer stream flows, water temperatures, flood frequency and volumes that can scour redds and prematurely wash juvenile rearing fish out of preferred habitats, and ocean acidification that is likely to negatively affect food webs. "The habitat deterioration associate with climate change will…make salmon recovery targets much more difficult to attain" (Battin *et al* 2007).

As described in Section 2.6, the cumulative effects of state and private actions that are reasonably certain to occur within the action area also vary widely across the action area. Overall, they will reflect changes that reduce the impacts of traditional natural resource-based industries, reflect resource demands associated human population growth in local and regional population centers, and efforts by social groups dedicated to the river restoration and use of natural amenities. 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.

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 a yearling outmigration pattern, compared to those with a subyearling pattern. That is because the latter group is more reliant on shallow-water habitat that is vulnerable to 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 less vulnerable to projects completed under the proposed program. Similarly, critical habitat for eulachon is limited to the lower Columbia River and the Umpqua River where the size of those rivers helps to attenuate the impact of stormwater runoff.

In summary, projects completed under the proposed program will result in intermittent discharges of stormwater runoff to a small number of areas that are widely distributed throughout each recovery domain. HUD will design these projects to minimize and treat post-construction stormwater runoff to a degree that will ensure that they do not appreciably reduce the conservation value of designated critical habitat at the site or watershed scale.

2.8 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's biological opinion that the proposed program is not likely to jeopardize the continued existence of the 17 species listed below, or to destroy or adversely modify their designated critical habitats.

- LCR Chinook salmon
- UWR Chinook salmon
- UCR 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
- eulachon

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b) (4) and section 7(o) (2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

NMFS has not yet promulgated an ESA section 4(d) rule prohibiting take of threatened eulachon. Anticipating that such a rule may be issued in the future, we have included a prospective incidental take exemption for eulachon. The elements of this ITS that relate to eulachon would take effect on the effective date of any future 4(d) rule prohibiting take of eulachon.

The measures described below are non-discretionary, and must be undertaken by HUD or the RE so that they become binding conditions of any grant or permits issued to others conducting the work, as appropriate, for the exemption in section 7(o) (2) to apply. HUD or the RE has a continuing duty to regulate the activity covered by the ITS. If HUD or the RE (1) fails to assume and implement the terms and conditions or (2) fails to require their grantees or contractors to adhere to the terms and conditions of the ITS through enforceable terms that are added to the grant document, the protective coverage of section 7(o) (2) may lapse. To monitor the impact of incidental take, HUD and the RE must report the progress of the action and its impact on the species to NMFS as specified in the ITS [50 CFR 402.14(i) (3)].

2.9.1 Amount or Extent of Take

HUD and/or the RE propose to fund development and redevelopment actions which include construction that will occur at upland sites which are disconnected and remote from aquatic habitats, and no construction activity will require entry into, or any disturbance of, those habitats. Therefore, those construction actions, themselves, are unlikely to have any effect on ESA-listed species or critical habitats. However, each project will result in the production of stormwater runoff that will deliver a wide variety of pollutants into aquatic habitats at times when those habitats are occupied by individuals of the 17 ESA-listed species considered in this consultation.

Stormwater runoff from the projects that HUD proposed to fund is likely to expose juveniles and adults to dissolved and particulate metals (e.g., copper, lead, zinc), PAHs, pesticides, sediment, and other pollutants of concern, resulting in harm to those species due to impaired growth, migration, and reproduction. This take cannot be accurately quantified as a number of ESA-listed species because, although the relationship between numerical concentrations of stormwater pollutants are easily demonstrated in the lab, the pollutants in actual runoff come from many small sources that cannot be distinguished after they reach a given waterbody.

The distribution of those pollutants also vary widely within that waterbody as a function of surrounding land use, pre-rainfall conditions, rainfall intensity and duration, and mixing from other drainage areas. Stormwater runoff events are often relatively brief, especially in urban streams, so that large inputs of runoff and pollutants can occur and dissipate within a few hours. Moreover, the distribution and abundance of fish that occur within the action area is inconsistent over time, affected by habitat quality, interactions with other species, harvest programs and other influences that cannot be precisely determined by observation or modelling.

For these reasons, we identify an extent of take based on HUD programs that are expected to cause harm, namely funding development and redevelopment of housing and other infrastructure that will increase the volume of post-construction stormwater runoff discharged into streams that are occupied by species considered in this opinion. The extent of take will be quantified as follows:

- All REs (100%) who apply for HUD funding in Oregon must also receive pre-consultation guidance from NMFS regarding use of this opinion to complete the ESA part of their environmental review, including NMFS requirements for review and approval of the post-construction stormwater management plan.

- All (100%) of HUD-funded projects must include a written record of the environmental review that includes a stormwater management plan that was reviewed and approved by NMFS before any HUD funds are obligated for that project.

Tracking whether REs receive pre-consultation guidance from NMFS and subsequently design their projects to comply with NMFS' stormwater requirements before any HUD/RE funds are obligated for those projects will not provide a specific measurement of watershed health. However, those data are proportional to the extent of take because they measure the level of program activity and its effectiveness, including the amount of post-construction stormwater runoff that will be produced and treated by HUD-funded projects. These indicators are valid reinitiation triggers because HUD, REs, and NMFS can track them in real time and it will be obvious when these indicators are exceeded.

If HUD fails to (1) achieve a 100% rate for ESA pre-consultation guidance for REs, or (2) achieve a 100% completion rate for the environmental review of projects that require an ESA-compliant stormwater management plan before HUD obligates funds for that project, then HUD will exceed an indicator for extent of take and trigger the reinitiation provisions of this opinion.

2.9.2 Effect of the Take

In this biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

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

1. Minimize incidental take due to post-construction stormwater runoff by ensuring that no HUD funds are obligated for projects covered by this opinion before the environmental review process is complete.

2. Ensure completion of an annual program report and participate in 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.

2.9.4 Terms and Conditions

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

1. The following term and condition implements reasonable and prudent measure 1:
   a. Quarterly ESA Pre-consultation Guidance for REs.
      i. Offer ESA Pre-consultation guidance four times per year, or otherwise as necessary, for REs receiving HUD funding to complete projects covered by this opinion.
      ii. Collaborate with NMFS to ensure the quarterly training will provide attendees with a clear understanding of:
         (1) The applicable HUD regulations for environmental review
         (2) The process to make an ESA effects determination
         (3) How to use NMFS' Stormwater Design Criteria (Appendix A, or the most recent version) to develop a post-construction stormwater management plan (PCSMP).
      iii. HUD will maintain a record of people in attendance at each training meeting, with appropriate contact information.
   b. Environmental Review.
      i. HUD or the RE must ensure that the environmental review process for every HUD project covered by this opinion includes a written record of the ESA effects determination ("no effect," or "likely to adversely affect").
      ii. HUD projects with a "likely to adversely affect" determination must also include a PCSMP as described in NMFS' Stormwater Design Criteria (Appendix A, or the most recent version).
         (1) HUD or the RE must submit any PCSMP to NMFS for review to ensure that the effects of carrying out of that plan will be within range of effects considered in this opinion.
         (2) NMFS will notify HUD or the RE within 30 calendar days as to whether it approved the PCSMP or not.
      iii. HUD or the RE will not obligate any funds for development projects within the range of species considered in this opinion before the environmental review process is complete, including review and approval of the PCSMP by NMFS.

2. The following terms and conditions implement reasonable and prudent measure 2:
   a. Quarterly Training Reports. After each quarterly meeting, HUD will provide NMFS with a list of the attendees and an evaluation of the training with suggestions or modifications to help make future training meetings more effective.
   b. Annual Coordination Meeting. HUD will facilitate an annual meeting for REs by March 31 of each year, where REs with completed projects will describes compliance with this opinion during the prior calendar year. The meeting topics will include, at a minimum, an assessment of overall program activity, suggestions or modifications to improve program efficiency and accountability, and any other data or analyses HUD deems necessary or helpful to assess habitat trends resulting from actions authorized under this opinion.

2.10 Conservation Recommendations

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

> Evaluate the effectiveness of RE compliance with NMFS' stormwater management requirements. The evaluation should be based on statistically valid sampling, RE interviews, and project-level audits, and should be used to identify opportunities to improve RE training and the environmental review process.

Please notify NMFS if HUD carries out this recommendation so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

2.11 Reinitiation of Consultation

This concludes formal consultation for HUD programs identified in this opinion.

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

If HUD or an RE fails to provide specified information annually during a HUD-coordinated annual meeting, NMFS may consider that a modification of the action that causes an effect on listed species not previously considered and causes the Incidental Take Statement of the opinion to expire. To reinitiate consultation, contact the Oregon Washington Coastal Area Office of NMFS.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (Section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based on descriptions of EFH for Pacific coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Pacific coast salmon (PFMC 2014) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The PFMC described and identified EFH for groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 2015). 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, groundfish and coastal pelagic species.

3.2 Adverse Effects on Essential Fish Habitat

For purposes of MSA, "adverse effect" means any impact which reduces quality or quantity of EFH. Adverse effects may include direct (*e.g.,* contamination, physical disruption), indirect (*e.g.,* loss of prey, reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.910(a)). Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will have the following adverse effects on EFH designated for Pacific Coast salmon, groundfish, and coastal pelagic species.

- Degradation of freshwater and estuarine water quality required for spawning, incubation, rearing, and migration as described in the opinion, above.

HUD or an RE is required to complete a supplemental EFH consultation with NMFS if it substantially revises its plans for this action in a manner that may adversely affect EFH or if new information becomes available that affects the basis for NMFS's EFH conservation recommendations (50 CFR 600.920(k)).

3.3 Essential Fish Habitat Conservation Recommendations

Because the properties of EFH that are necessary for the spawning, breeding, feeding or growth to maturity of managed species in the action area are the same or similar to the biological requirements of ESA-listed species as analyzed above, NMFS has provided two conservation recommendations.

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

1. Follow term and condition #1 (complete environmental review to ensure compliance with NMFS stormwater design criteria before obligating funds) to minimize adverse effects on EFH designated for groundfish, coastal pelagics, and Pacific salmon by minimizing adverse impacts to water quality.

2. Follow term and condition #2 (monitoring and reporting).

3.4 Statutory Response Requirement

As required by section 305(b) (4) (B) of the MSA, HUD or an RE 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's 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

HUD 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's EFH conservation recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these Data Quality Act components, documents compliance with the act, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users are the U.S. Department of Housing and Urban Development and HUD's designated responsible entities. An individual copy was provided to HUD staff and will be available to REs via HUD's website. The format and naming adheres to conventional standards for style.

Consultation by Federal agencies with NMFS is required under section 7 of the ESA whenever a Federal agency approves, funds, or carries out an action that might affect an ESA-listed species. This consultation and opinion was required under the ESA to determine whether HUD funded housing projects in Oregon would result in jeopardy for ESA-listed species. This opinion provides non-discretionary terms and conditions designed to avoid and minimize impacts to listed species that may occur during implementation of certain restoration actions.

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 ESA Consultation Handbook, ESA regulations (50 CFR 402.01, *et seq.*) and the MSA implementing regulations regarding EFH (50 CFR 600.920(j)).

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

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

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

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APPENDICES

APPENDIX A: NMFS Stormwater Design Criteria for HUD Projects in Oregon

July 25, 2016

The following administrative elements and design criteria comprise the actions required of HUD and/or Responsible Entities to comply with the Terms and Conditions detailed in Section 2.9.4 of the Opinion.

1. HUD Environmental Review. To demonstrate compliance with ESA requirements for consultation with NMFS in Oregon, the environmental review for a HUD project must include:
   a. An effects determination.
      i. Projects that infiltrate 100% of the design storm onsite, as certified by a qualified engineer, will have "no effect" on ESA-listed fish species or their critical habitat, and no further consultation with NMFS is required.
      ii. Projects that cannot infiltrate 100% of the design storm on-site are "likely to adversely affect" (LAA) ESA-listed species and critical habitat.
   b. Projects that are "likely to adversely affect" ESA-listed species and critical habitats must also develop and carry out a post-construction stormwater management plan (PCSMP) as described below. These plans must be reviewed and approved by NMFS.

2. NMFS Review and Approval Process. To request NMFS review and approval of a PCSMP, HUD or the RE must submit the proposed stormwater management plan and the Action Notification Form (as described in Appendix B, Part 1 and Part 2) at least 60-days before the anticipated completion of the environmental review for the subject project.

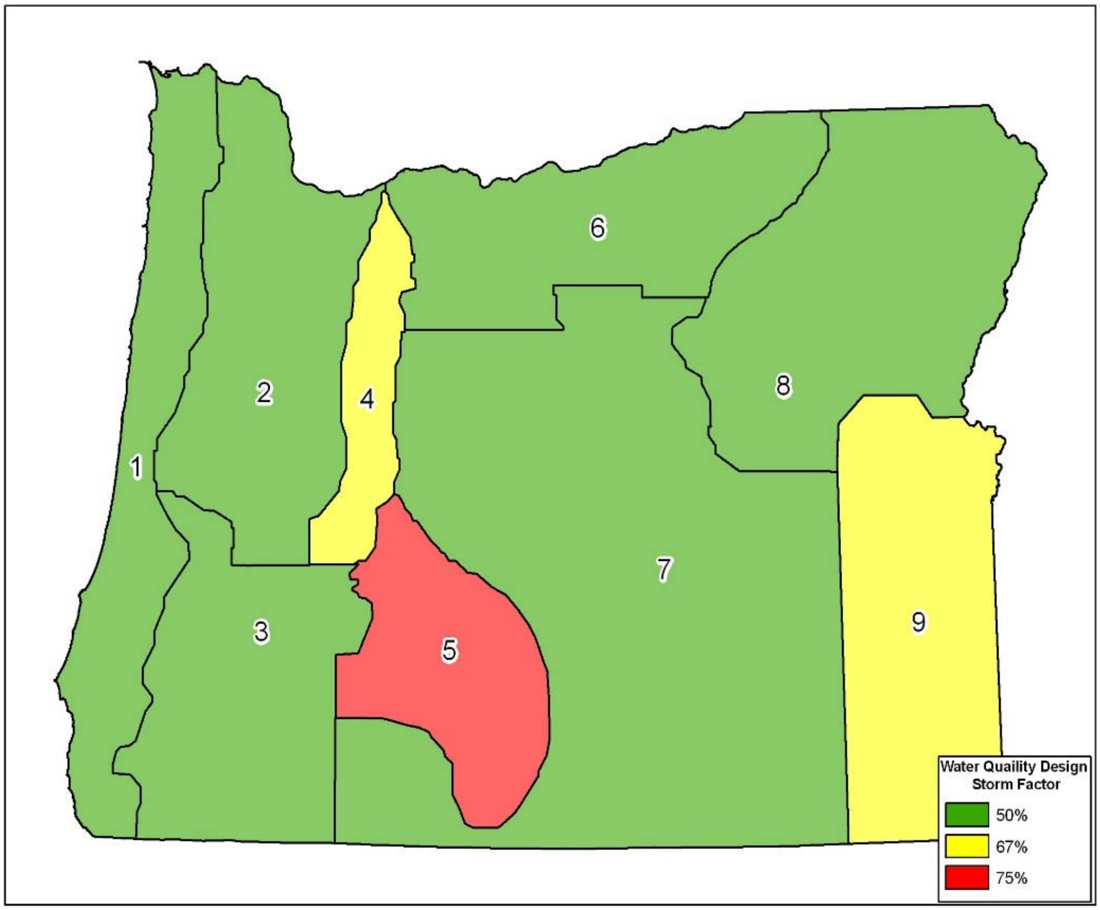
3. Stormwater Management Plan. A PCSMP must include the following information:
   a. All plans, drawings, and the Stormwater Information Form (Appendix B) must be signed by a licensed, professional engineer.
   b. A site map for the project that identifies all:
      i. Impervious areas;
      ii. Low-impact development (LID) practices by type and capacity;
      iii. Manufactured stormwater treatment technologies by type and capacity;
      iv. Other structural source control practices by type and capacity (e.g., special practices for known or suspected contaminated sites); and
      v. All runoff discharge points and conveyance paths to the nearest receiving water.
   c. A description of how those LID and other practices will manage all precipitation on-site up to the design storm, and provide adequate treatment for runoff that will be discharged from the site.
   d. A description of the proposed maintenance activities and schedule for the treatment facilities including the party responsible maintenance and contact information for the responsible party.

e. 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.

4. **Stormwater Management Practices**. Post-construction stormwater management consists of low impact development practices (LID) (water balance) that emphasize the use of on-site features to increase evapotranspiration and infiltration that will improve water quality and reduce hydromodification (i.e., alteration of the natural flow of water through the watershed). Examples of LID practices include:
   a. Minimize impervious area
      i. Share parking spaces
      ii. Minimize pavement widths
      iii. Minimize front setbacks
      iv. Share driveways
      v. Minimize building footprint
      vi. Minimize roadway cross sections
      vii. Minimize new pavement
   b. Limit disturbance
      i. Construction sequencing
      ii. Conserve soils with best drainage
      iii. Cluster development
      iv. Tree protection
      v. Minimal foundation
   c. Landscape and hardscape areas
      i. Restored soils
      ii. Tree planting
      iii. De-pave existing pavement
      iv. Contained stormwater planters
      v. Vegetated roof
      vi. Porous pavement
      vii. Infiltration garden
      viii. Soakage trench
      ix. Drywell
      x. Water quality conveyance swale
      xi. Vegetated filter strips
      xii. Downspout disconnection
      xiii. Lined rain garden, LID swale, Stormwater planter

5. <u>Design Storm</u>. All stormwater treatment practices and facilities that result in off-site conveyance must be designed to accept and provide water quality treatment for 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.)

Figure 1. Water Quality Design Storm by Oregon Climate Regions



Regions: (1) Oregon Coast; (2) Willamette Valley; (3) Southwestern Valleys; (4) Northern Cascades; (5) High Plateau; (6) North Central; (7) South Central; (8) Northeast; (9) Southeast.
Source: Oregon Dept. of Transportation (2008).

6. <u>Hydromodification</u>. If a HUD funded project 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 square miles, and does not discharge directly into a lake, reservoir or estuary, then flow control treatment and practices must be designed to maintain the frequency and duration of flows generated by storms within the following endpoints:
   a. Lower discharge endpoint, by U.S. Geological Survey (USGS) flood frequency zone:
      i. Western Region = 42% of 2-year event
      ii. Eastern Region
         (1) Southeast, Northeast, North Central = 48% of 2-year event
         (2) Eastern Cascade = 56% of 2-year event

b. Upper discharge endpoint
    i. Entrenchment ratio[5] <2.2 = 10-year event, 24-hour storm
    ii. Entrenchment ratio >2.2 = bank overtopping event

7. Conveyance. When conveyance is necessary to discharge treated stormwater directly into surface water or a wetland, the following requirements apply:
    a. Maintain natural drainage patterns.
    b. To the maximum extent feasible, ensure that water quality treatment for the HUD funded project is completed before commingling with offsite runoff during conveyance.
    c. 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.

8. Action Completion Report. HUD or the RE must submit the Project Completion Report (Appendix B, Part 3) within 60-days of end of construction. The Project Completion Report should include all information necessary to document that the project was constructed in compliance with the provisions of this opinion, including such materials as final plans or as-built drawings.

9. Failure to Report May Trigger Reinitiation. NMFS may recommend reinitiation of this consultation if HUD or the RE fails to provide all applicable notifications and completion reports or fails to attend quarterly and annual meetings, as specified.

[5] Entrenchment ratio is a measurement of the vertical containment of a stream or river. It is calculated as the floodprone width, divided by the surface bankfull discharge width. The lower the entrenchment ratio, the more vertical containment of flood flows exists. Higher entrenchment ratios depict more floodplain development (U.S. EPA 2016a).

APPENDIX B: E-mail Guidelines and Action Notification Form

For Use with the HUD Programmatic Opinion

July 25, 2016

Use of the HUD Programmatic E-mail Box

Use the HUD programmatic e-mail box at HUDBiOp.wcr@noaa.gov to request that NMFS review and approve the post-construction stormwater management plan (PCSMP) for a HUD funded project, to withdraw a request for review, and to submit the project completion forms.

The mailbox will send you an automatic reply after receipt of any message, but you will not receive any other communication from the programmatic e-mail box. Please direct all other communications or questions to the appropriate NMFS biologist or branch chief.

Please only submit one request for review, withdrawal, or completion report per e-mail. Please remember to attach all supporting information, including:

E-mail Title

In the subject line of the email (see below for requirements), clearly the type of action you are requesting (i.e., Action Notification, Withdrawal, etc.), Project Name, Applicant (HUD Office or Responsible Entity) Name, County, and Waterway (to which the project will discharge).

Use caution when entering the necessary information in the subject line. If these titling conventions are not used, NMFS will not accept the e-mail.

Examples:

> *Action Notification:* *HUD Project Name, Housing & Community Development, Multnomah County, Willamette River*
>
> *Withdrawal:* *HUD Project Name, City of Medford, Jackson County, Bear Creek*
>
> *Project Completion:* *HUD Project Name, Housing & Community Development, Washington County, Tualatin River*

Action Notification and Stormwater Information Forms

HUD or the RE must submit an Action Notification Form, a complete Stormwater Information Form, and a complete PCSMP to the HUD programmatic e-mailbox to request that NMFS review and approve the PCSMP for a HUD project. Within 7 calendar days, NMFS will tell the requestor which staff person was assigned to complete the review, and within 30 calendar days NMFS will determine whether the proposed stormwater plan is approved or not.

If asked, the consultation biologist will provide an estimate of the time necessary to complete the review based on the complexity of the proposed action and work load considerations at the time of the request.

NMFS may delay its review if the Action Notification Form, the Stormwater Information Form, or the PCSMP is incomplete or unsatisfactory. Please contact NMFS early during the development phase of a project if you have any questions about how these guidelines may affect your project.

Withdrawing a Request for Review

If it is necessary to withdraw a request for review, submit a separate email with the word WITHRAWN at the beginning of the e-mail subject line, but otherwise follow the email titling conventions as described above. State the reason for the withdrawal in the email. If HUD or an RE re-submits a request for NMFS review that has been previously withdrawn, NMFS will process the resubmittal as if it was a new action notification.

Action Completion Report. HUD or the RE must submit the Action Completion Form to NMFS within 60 days of finishing construction of the stormwater management facilities for a HUD project. Failure to submit the action completion form may result in NMFS recommending reinitiation of this consultation.

Action Notification Form

HUD Programmatic Opinion

Submit this form to NMFS 60 days prior to the anticipated completion of the project's environmental review. Submit by email to: ***HUDBiOp.wcr@noaa.gov***.

DATE OF REQUEST		**NMFS TRACKING # WCR-2016-4853**		
Project Name				
Consultation Type	☐ ESA ONLY	☐ EFH ONLY	☐ BOTH ESA & EFH	
HUD Office/Responsible Entity	HUD /			
	Name:			
	Phone:			
	Email:			
6th Field HUC & Name				
Latitude & Longitude (in signed degrees format: DDD.dddd)				
Proposed Construction Period:	***Start Date:***		***End Date:***	

NMFS Species & Critical Habitat Present in Action Area

ESA-listed species occurring in the action area

- ☐ UWR Chinook
- ☐ UWR Steelhead
- ☐ LCR Chinook
- ☐ LCR Coho
- ☐ LCR steelhead
- ☐ CR chum
- ☐ MCR Steelhead
- ☐ UCR Chinook
- ☐ UCR steelhead
- ☐ Oregon Coast coho
- ☐ Southern Oregon/ Northern California Coasts coho
- ☐ SR Spring/ summer-run Chinook
- ☐ SR fall-run Chinook
- ☐ SR steelhead
- ☐ SR sockeye
- ☐ Southern DPS Green sturgeon
- ☐ Eulachon

EFH Species occurring in the action area

- ☐ Pacific Salmon, Chinook
- ☐ Pacific Salmon, coho
- ☐ Coastal Pelagics
- ☐ Groundfish

Project Description

Add more rows or attach additional pages, as necessary

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Stormwater Information Form

HUD Programmatic Opinion

If you are submitting a project that includes a stormwater plan for review, please fill out the following cover sheet **to be included with** any stormwater management plan and any other supporting materials. Submit this form with the Action Implementation Form to NMFS at ***HUDBiOp.wcr@noaa.gov***.

PROJECT INFORMATION	**NMFS TRACKING # WCR-______________ (NUMBER PROVIDED BY NMFS)**	
Name of Project		
Street Address of Project		
Lat/Long of Project Location (DDD.dddd)		
Type of project (i.e., residential, commercial, industrial, etc.)		
Nearest receiving water occupied by ESA- listed species or designated critical habitat		
Have you contacted anyone at NMFS?	☐ **Yes** ☐ **No**	**If Yes, Who:**
Applicant/Consultant name		
Applicant/Consultant email		

STORMWATER DESIGNER AND/OR ENGINEER CONTACT INFORMATION	
Name:	
Phone:	
Email:	

SUMMARY OF DESIGN ELEMENTS		
1	**2 year, 24 hour storm from NOAA Precipitation Atlas** http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm	_____ **Inches**
2	**Design storm fully treated** (Climate Zones 1,2,3,6,8 = 50%; Zone 4 = 67%; Zone 5 = 75% of 2-yr, 24-hr Storm) For water quality design storm zones, see: http://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/pages/storm_management_program_wqsd.aspx	☐ **Yes** ☐ **No**
	24-hour design storm	_____ **Inches**

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SUMMARY OF DESIGN ELEMENTS (CONTINUED)			
3	**Total contributing impervious area including all contiguous surface** (e.g. roads, driveways, parking lots, sidewalks, roofs, and similar surfaces)	_____ **Acres**	
	Proposed new impervious area	_____ **Acres**	
	Existing impervious area	_____ **Acres**	
	Acres of total impervious area _________ **x** **design storm** _______ **=** _________ **ft^3 to be treated**		
4	**Peak discharge of design storm**	______ **cfs**	
5	**Total stormwater to be treated**	________ **ft^3**	______ **cfs**
6	**Stormwater Design Manual Used and Year/Version** (example: City of Portland, Clean Water Services, King County, Western Washington) **Describe which elements of your stormwater plan came from this manual**		
7	**Have you treated all stormwater to the design storm within the contributing impervious area?** **If no, why not, and how will you offset the effects from remaining stormwater?**	☐ **Yes** ☐ **No**	

WATER QUALITY		
8	**Low Impact Development (LID) methods incorporated?** (e.g. site layout, vegetation and soil protection, reforestation, integrated management practices such as amended soils, bioretention, permeable pavement, rainwater collection, tree retention) **Please describe:**	☐ **Yes** ☐ **No**
	How much of total stormwater is treated using LID Template for calculating LID treatment available at: http://www.deq.state.or.us/wq/tmdls/lidmanual.htm	________ **ft^3**

WATER QUALITY (CONTINUED)	
9	**Treatment train, including pretreatment and bioretention methods used to treat water quality** **Why this treatment train was chosen for the project site** **Page in stormwater plan where more details can be found**

WATER QUANTITY			
10	**Does the project discharge directly into a major water body*?** If yes, detention not required *Willamette River below Eugene, Columbia River, large lakes, ocean (verify with		☐ **Yes** ☐ **No**
11	**Pre-development runoff rate** (i.e., before human-induced changes to the unimproved property)	**2-year, 24-hour storm**	______ **cfs**
		10-year storm	______ **cfs**
	Post-development runoff rate (i.e., after proposed developments)	**2-year, 24-hour storm**	______ **cfs**
		10-year storm	______ **cfs**
	Post-development runoff rate must be less than or equal to pre-development runoff rate		
12	**Methods used to treat water quantity** **Page in stormwater plan where more details can be found**		

MAINTENANCE AND INSPECTION PLAN

13	**Have you included a stormwater maintenance plan with a description of the onsite stormwater system, inspection schedule and process, maintenance activities, legal and financial responsibility, and inspection and maintenance logs?** **Page in stormwater plan where plan can be found**	☐ **Yes** ☐ **No*** *NOAA review cannot be complete without a main-tenance and inspection plan.

14	**Contact information for the party/parties that will be legally responsible for performing the inspections and maintenance or the stormwater facilities:**	
	Name	
	Responsibility	
	Phone	
	Email	
	Name	
	Responsibility	
	Phone	
	Email	
	Name	
	Responsibility	
	Phone	
	Email	

OTHER RELEVANT INFORMATION

Action Completion Report

Submit this form within 60 days of completing all work to NMFS at ***HUDBiOp.wcr@noaa.gov***.

DATE OF NOTIFICATION		**NMFS TRACKING # WCR-____________** **(NUMBER PROVIDED BY NMFS)**
Project Name		
HUD Office/Responsible Entity	/	
Responsible Entity Contact	Name:	
	Phone:	
	Email:	
Construction Completion Date		

Please include the following:

1 **An explanation of the stormwater system as built or installed by the construction contractor, including any on-site changes from the original plans.**

____

____

____

Add more rows, as necessary

2 **Photographs of the constructed stormwater facility, including photos of the outfall structure, vegetation, facility location relative to other site features, etc.**

3 **A map showing the stormwater facility's location(s)**

4 **As built design drawings for the stormwater facility and site stormwater collection system (PDF versions only please. No CAD files)**

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APPENDIX C: Low-Impact Development (LID) References

Cahill, M. 2016. Low Impact Development in Western Oregon: A Practical Guide for Watershed Health. Green Girl LLC, Portland Oregon. A Report for Oregon Department of Environmental Quality, Portland, Oregon.

City of Portland. 2016. Stormwater Management Manual. Bureau of Environmental Services. (August)

Clean Water Services. 2009. Low Impact Development Approaches Handbook. Hillsboro, Oregon. (July)

Hinman, C. 2005. Low Impact Development: Technical Guidance Manual for Puget Sound. A Report for the Puget Sound Action Team and Washington State University, Pierce County Extension. Olympia, Washington. (January)

National Association of Home Builders. 2003. The Practice of LID Development. A Report for HUD and the Partnership for Advancing Technology in Housing. 2003. Washington, D.C. (July)

Transportation Research Board. 2006. National Cooperative Highway Research Program (NCHRP) Report 565. Evaluation of Best Management Practices for Highway Runoff Control. Washington, D.C.

U.S. EPA. 2000. Low-Impact Development (LID): A Literature Review. Office of Water, Washington, D.C. (October)

Washington State Department of Ecology. 2011. Technical Guidance Manual for Evaluating Emerging Stormwater Treatment Technologies: Technology Assessment Protocol – Ecology (TAPE). Lacey, Washington.

Washington State Department of Ecology. 2014. Stormwater Management Manual for Western Washington. Water Quality Program. Lacey, Washington. (December)