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

Refer to NMFS Tracking No.:
2010/00293

January 2, 2013

Daniel M Mathis
Federal Highway Administration
Suite 501, Evergreen Plaza
711 South Capitol Way
Olympia, Washington 98501-1284

Michelle Walker
Corps of Engineers, Seattle District
Regulatory Branch CENWS-OD-RG
Post Office Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Washington State Department of Transportation Preservation, Improvement, and Maintenance Activities

Dear Mr. Mathis and Ms. Walker: Dan

The enclosed document contains a revised version of the programmatic Biological Opinion (Opinion) sent to you on December 10, 2012. The original version incorrectly stated the individual project limit for riparian impacts. We apologize for any inconvenience. Please accept this version as the final Opinion for this consultation. If you have questions regarding this consultation, please contact Michael Grady of the Washington State Habitat Office at (206) 526-4645, or by email at Michael.Grady@noaa.gov.

Sincerely,

for William W. Stelle, Jr.
Regional Administrator

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Regional Administrator

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Section 7(a)(2) "Not Likely to Adversely Affect" Determination, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation

Washington State Department of Transportation Preservation, Improvement, and Maintenance Activities
NMFS Consultation Number: 2012/00293

Action Agency: Federal Highway Administration and US Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	N/A
Puget Sound Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	No
yelloweye rockfish (*Sebastes ruberrimus*)	Threatened	No	No	N/A
canary rockfish (*S. pinniger*)	Threatened	No	No	N/A
bocaccio (*S. paucispinis*)	Endangered	No	No	N/A
Lower Columbia River Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	No
Upper Columbia River spring-run Chinook Salmon (*O. tshawytscha*)	Endangered	Yes	No	No
Snake River fall-run Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	No
Snake River spring/summer-run Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	No
Upper Willamette River Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	No
Columbia River Chum Salmon (*O. keta*)	Threatened	Yes	No	No
Hood Canal Summer-Run Chum Salmon (*O. keta*)	Threatened	Yes	No	No
Lower Columbia River Coho Salmon (*O. kisutch*)	Threatened	Yes	No	N/A
Snake River Sockeye Salmon (*O. nerka*)	Endangered	Yes	No	No
Snake River basin Steelhead (*O. mykiss*)	Threatened	Yes	No	No
Upper Columba River Steelhead	Threatened	Yes	No	No
Middle Columba River	Threatened	Yes	No	No

Steelhead				
Lower Columba River Steelhead	Threatened	Yes	No	No
Upper Willamette River Steelhead	Threatened	Yes	No	No
Southern Pacific Eulachon (*Thaleichthys pacificus*)	Threatened	Yes	No	No
Southern Green Sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	No
Southern Resident killer whales (*Orcinus orca*).	Endangered	No	No	No
Eastern Steller Sea Lion (*Eumetopias jubatus*)	Threatened	No	No	No
Humpback Whale (*Megaptera novaeangliae*)	Endangered	No	No	N/A

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

Consultation Conducted By: National Marine Fisheries Service, Northwest Region

Issued By:

for William W. Stelle, Jr.
Regional Administrator

Date: January 2, 2013

TABLE OF CONTENTS

1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (Opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, et seq.), and implementing regulations at 50 CFR 402. The NMFS 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. The opinion and EFH conservation recommendations are both in compliance with the Data Quality Act (44 U.S.C. 3504(d)(1) et seq.), and they underwent pre-dissemination review.

1.2 Consultation History

Since November 2010, the Washington State Department of Transportation (WSDOT), the Federal Highway Administration (FHWA), and the NMFS have been developing a programmatic approach to streamline ESA consultations for routine transportation projects in Washington State.

On January 30, 2012, the FHWA submitted a biological assessment (BA) to the NMFS for the WSDOT's Preservation, Improvement, and Maintenance Activities program, and requested consultations under both the ESA and MSA. The program will be carried out by the WSDOT and funded by FHWA and/or permitted by the US Army Corps of Engineers (USACE) (under section 10 of the Rivers and Harbors Act of 1899 and/or section 404 of the Clean Water Act). On March 29, 2012, the USACE submitted a letter to NMFS requesting to be a co-lead agency for this consultation. This opinion is based in part on information provided in the January 30, 2012 BA and information WSDOT and FHWA provided to NMFS between November 2010 and October 2012. NMFS may terminate the use of this opinion and withdraw take coverage if any of the commitments in the Proposed Action and Terms and Conditions sections are not met. A complete record of this consultation is on file at Washington State Habitat Office in Lacey, Washington.

Table 1. FHWA ESA Determinations[1]

Species	Federal Status	Species Determination	Critical Habitat Determination	Listing/ Designation Date
Puget Sound steelhead (*Oncorhynchus mykiss*)	Threatened	LAA[2]	N/A	6/28/05 (70 FR 37160)
Puget Sound Chinook salmon (*O. tshawytscha*)	Threatened	LAA	LAA	6/28/05 (70 FR 37160)/ 9/2/05 (70 FR 52630)
Puget Sound/Georgia Basin yelloweye rockfish	Threatened	NLAA[3]	N/A	4/28/10 (75 FR 22276)

(*Sebastes ruberrimus*)				
Puget Sound/Georgia Basin canary rockfish (*S. pinniger*)	Threatened	NLAA	N/A	4/28/10 (75 FR 22276)
Puget Sound/Georgia Basin bocaccio (*S. paucispinis*)	Endangered	NLAA	N/A	4/28/10 (75 FR 22276)
Lower Columbia River Chinook Salmon (*O. tshawytscha*)	Threatened	LAA	LAA	6/28/05 (70 FR 37160)/ 9/2/05 (70 FR 52630)
Upper Columbia River spring-run Chinook Salmon (*O. tshawytscha*)	Endangered	LAA	LAA	6/28/05 (70 FR 37160)/ 9/2/05 (70 FR 52630)
Snake River fall-run Chinook Salmon (*O. tshawytscha*)	Threatened	LAA	LAA	6/28/05 (70 FR 37160)/ 12/28/93 (50 FR 68534)
Snake River spring/summer-run Chinook Salmon (*O. tshawytscha*)	Threatened	LAA	LAA	6/28/05 (70 FR 37160)/ 10/25/99 (50 FR 57399)
Upper Willamette River Chinook Salmon (*O. tshawytscha*)	Threatened	LAA	LAA	6/28/05 (70 FR 37160)/ 9/2/05 (70 FR 52630)
Columbia River Chum Salmon (*O. keta*)	Threatened	LAA	LAA	6/28/05 (70 FR 37160)/ 9/2/05 (70 FR 52630)
Hood Canal Summer-Run Chum Salmon (*O. keta*)	Threatened	LAA	LAA	6/28/05 (70 FR 37160)/ 9/2/05 (70 FR 52630)
Lower Columbia River Coho Salmon (*O. kisutch*)	Threatened	LAA	N/A	6/28/05 (70 FR 37160)
Snake River Sockeye Salmon (*O. nerka*)	Endangered	LAA	LAA	6/28/05 (70 FR 37160)/ 12/28/93 (50 FR 68534)
Snake River basin Steelhead (*O. mykiss*)	Threatened	LAA	LAA	1/5/06 (71 FR 834)/ 9/2/05 (70 FR 52630)
Upper Columba River Steelhead	Threatened	LAA	LAA	1/5/06 (71 FR 834)/ 9/2/05 (70 FR 52630)
Middle Columba River Steelhead	Threatened	LAA	LAA	1/5/06 (71 FR 834)/ 9/2/05 (70 FR 52630)
Lower Columba River Steelhead	Threatened	LAA	LAA	1/5/06 (71 FR 834)/ 9/2/05 (70 FR 52630)
Upper Willamette River Steelhead	Threatened	LAA	LAA	1/5/06 (71 FR 834)/ 9/2/05 (70 FR 52630)
Southern Pacific Eulachon (*Thaleichthys pacificus*)	Threatened	LAA	LAA	3/18/10 (75 FR 13012)/ 10/20/11 (50 FR 65324)
Southern Green Sturgeon (*Acipenser medirostris*)	Threatened	LAA	LAA	6/6/06 (71 FR 177570)/ 10/9/2009 (50 FR 52300)
Southern Resident killer whales (*Orcinus orca*).	Endangered	NLAA	NLAA	11/18/05 (70 FR 69903)/ 11/29/06 (71 FR 69054)
Eastern Steller Sea Lion (*Eumetopias jubatus*)	Threatened	NLAA	No Effect	6/4/97 (62 CFR 24345)/ 8/27/93 (58 CFR 45269)
Humpback Whale (*Megaptera novaeangliae*)	Endangered	NLAA	N/A	12/2/70 (35 FR 18319)

[1] The NMFS agreed with these determinations and initiated consultation accordingly.
[2] LAA = likely to adversely affect
[3] NLAA = not likely to adversely affect

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

Administration

This Opinion analyzes the effects of the implementation of a program for road preservation, improvement, and maintenance activities, carried out by WSDOT and funded by FHWA and/or permitted by the USACE (under section 10 of the Rivers and Harbors Act of 1899 and/or section 404 of the Clean Water Act).

Under the administrative portion of this program, FHWA, WSDOT, and the USACE will evaluate each individual project to ensure:

1. The range of effects is within those considered in this Opinion;

2. They are carried out consistent with the criteria described in this section; and

3. They meet monitoring and reporting requirements.

In order to administer the program covered in this Opinion, the WSDOT, FHWA, USACE, and NMFS will meet by March 31 of each year to:

1. Review the projects approved during the prior calendar year;

2. Discuss any changes that will improve conservation under this Opinion or make the program more efficient; and

3. Review any new species listings, critical habitat designations, and changes of status of currently listed species.

The WSDOT, FHWA, USACE, and NMFS will process individual projects covered in this Opinion using the following procedures:

1. The WSDOT will contact the NMFS liaison or other assigned NMFS staff at least 60 days, or as soon as possible, prior to submitting the project notification form (PNF) to discuss the specifics of the individual project and to verify that it is covered under this Opinion.

2. The WSDOT will submit a PNF via email[1] to NMFS and all federal agencies funding or authorizing the individual project. The PNF will contain sufficient

[1] Electronic files (PAFs, monitoring plans, etc.) too large to be sent via email may be posted to a File

detail about the action design and construction to ensure the proposed action is consistent with all provisions of this Opinion.

3. Within 30 days, NMFS will notify, via email, WSDOT and all federal agencies funding or authorizing the individual project, as to whether the project is approved for coverage or is not eligible for coverage under this Opinion. If approved, the email will describe any materials or information that WSDOT will need to provide prior to the start of construction, and will identify the monitoring and reporting requirements that apply to the individual project. It will also provide authorization and justification for any exceptions to the provisions of this Opinion as described below. Fast Track projects, described in section 1.3.3 below, do not require a project approval email. Therefore, WSDOT will request clarification on which of the pre-construction submittals and monitoring and reporting requirements apply to the individual project during the pre-submittal communication described above in number 1 of this section.

4. Prior to the start of construction, WSDOT will submit any materials or information required in the project approval email.

5. For every individual project covered under this Opinion, WSDOT will submit to NMFS via email, a project completion form (PCF) with the following information after construction is completed:

    a) The results of any monitoring required in the project approval email;

    b) Post-construction project photographs; and

    c) Any violations of WDFW's Hydraulic Project Approval and/or Washington State Department of Ecology's requirements.

<u>Activities</u>

In order to preserve, improve, and maintain highways in Washington State, WSDOT carries out approximately 120 individual projects per year funded by the following programs:

1. Pavement Preservation (Preservation)
2. Slide Abatement and Repair (Maintenance and Preservation)
3. Bank Stabilization and Flood Damage Repair (Maintenance and Preservation)
4. Bridge Repair, Retrofit, Replacement, and Maintenance (Maintenance and Preservation)
5. Mobility Improvement (Improvement)
6. Safety Improvement (Improvement)
7. Facilities Preservation and Construction (Preservation)

Transfer Protocol (FTP) site. In these cases, WSDOT will notify NMFS via email and provide a link to the FTP site.

8. Environmental Retrofit and Enhancement (Improvement)
9. Drainage System Maintenance and Repair (Maintenance)

The distribution of projects throughout the State typically follows population density. Approximately 50 percent of projects will be in the Puget Sound region in any given year. The vast majority of individual projects, typically more than 75 percent, will not affect listed species under NMFS jurisdiction. Individual projects which conduct any of the activities listed below may affect listed species. NMFS analyzed 66 WSDOT project consultations from 2007 to 2012. There were only four occurrences of multiple projects within the same sixth field hydraulic unit code (HUC). In each of these four cases, two projects occurred in the same sixth field HUC during those five years. NMFS expects the individual projects covered in this Opinion will be similarly distributed throughout the State.

Individual projects covered in this Opinion may implement one or more of these activities. For instance, a Mobility project could add pollution-generating impervious surface (PGIS), replace a culvert, and remove riparian vegetation. For each activity, the NMFS describes the individual projects that are covered, those that are excluded, the requirements for each covered activity, and exceptions to those requirements that NMFS may approve in the individual project approval email. Section 1.3.2.9 lists additional projects that are excluded from this Opinion.

In order for individual projects to qualify for many of the exceptions below, they must have a net long-term benefit to listed species. Projects can meet this standard in two ways. Some projects, such as replacing barrier culverts with fish-passable culverts, inherently have long-term benefits to listed species. The purpose of providing exceptions for these projects is to expedite projects which promote the survival and recovery of listed species even if they have short-term adverse effects.

Many routine WSDOT projects have short-term adverse effects to listed species and may also maintain existing degraded habitat conditions. These projects can also provide net long-term benefit to listed species by conducting on- or off-site restoration where the benefits of the restoration to listed species outweigh the adverse effects of the project. In this case, the purpose of allowing an exception is to provide WSDOT an incentive to improve the habitat conditions for listed species. Projects which meet the net long-term benefit standard in this way may have additional reporting requirements for the restoration activities. The NMFS will detail these requirements in the project approval email.

New Pollution Generating Impervious Surface (PGIS)

The WSDOT creates new PGIS when expanding existing and constructing new infrastructure. Placement of new PGIS typically includes grading, filling, and removal of upland and/or riparian vegetation. The WSDOT constructs stormwater Best Management Practices (BMPs), as described in the WSDOT Highway Runoff Manual (HRM), to treat the quantity and quality of stormwater from new, and in some cases, existing PGIS (WSDOT 2011a).

Covered Projects. This Opinion covers projects that add up to five acres of PGIS. Based on a review of 71 WSDOT projects which have under gone section 7 consultation in the last five years, NMFS expects individual projects covered under this Opinion will average approximately 0.25 acre of new PGIS. Statewide, the total new PGIS of all individual projects approved in any single calendar year will not exceed 20 acres. Individual projects that infiltrate stormwater from 100 percent of new and existing PGIS within the project limits will not count against the 20-acre limit.

Excluded Projects. This Opinion does not cover projects that create over five or more acres of new PGIS (see section 1.3.2.9). These types of projects, such as new interchanges and highway bypasses, have a greater likelihood of degrading baseline water quality conditions of streams with listed species. They are also likely to have indirect, growth-inducing effects which are beyond the scope of this Opinion.

Requirements for Covered Projects. All individual projects covered under this Opinion which add more than 500 square feet of new PGIS to any threshold discharge area (TDA) will meet the following requirements:

1. Projects with two acres of new PGIS or less will treat or infiltrate stormwater from all new and rebuilt PGIS;

2. Projects with between two and five acres of new PGIS will treat or infiltrate stormwater from all new, rebuilt, and existing PGIS within the project limits;

3. The projects will not measurably affect base flows, peak flows, or duration of flows in any waterbody; and

4. The WSDOT will analyze the effects of stormwater pollutants using the most recent versions of the Highway Runoff Dilution and Loading Model User's Guide (for western Washington) or the Stormwater Water Quality Analysis Process for Eastern Washington (whichever is applicable to the individual project) and submit the results to NMFS as part of the PNF (WSDOT 2011b; WSDOT 2009b).

Exceptions. The NMFS may approve a smaller area of treatment for individual projects under the following conditions:

1. The construction of the stormwater BMPs will impact sensitive habitats such as wetlands;

2. The concentration of dissolved zinc and dissolved copper will dilute to below the biological effects thresholds (see section 2.4.1.6 below) prior to reaching waters with listed species under NMFS jurisdiction; and

3. The project retrofits an equivalent area of PGIS for stormwater treatment at an off-site location.

Riparian Vegetation Removal

The WSDOT removes riparian vegetation for many types of projects including bank stabilization, bridge work, and culvert replacements. The WSDOT employs BMPs to avoid, minimize, and mitigate impacts to riparian vegetation.

Covered Projects. This Opinion covers projects that temporarily or permanently disturb riparian vegetation. Based on a review of 31 WSDOT project consultations from 2007 to 2012 where riparian impact data were available, individual projects covered under this Opinion will average approximately 0.5 acre of riparian vegetation impacts. Statewide, the total riparian impacts of all individual projects approved in any single calendar year will not exceed 20 acres.

Excluded Projects. This Opinion does not specifically exclude projects on the basis of riparian vegetation impacts provided they meet requirements listed below and the 20-acre limit is not exceeded in any calendar year.

Requirements for Covered Projects. All individual projects covered under this Opinion which impact riparian vegetation will meet the following requirements:

1. Projects may not disturb more than two acres of riparian vegetation;

2. Projects will restore all temporarily disturbed riparian areas with native riparian trees and/or shrubs;

3. Projects will ensure there is no permanent and appreciable loss of riparian function through on- or off-site restoration;

4. The WSDOT will identify the area and location of temporary and permanent riparian vegetation disturbance in the PNF;

5. For individual projects conducting riparian restoration, WSDOT will describe the restoration activities in the PNF or when the information becomes available; and

6. The WSDOT will report to NMFS via email in the PCF, the actual area of temporary and permanent riparian impacts and a summary of the restoration or mitigation work.

Bridge Construction

Bridge projects may involve one or more of the other activities described in this section (e.g. riparian vegetation removal, new PGIS, etc.). Because many bridge projects do not have adverse effects on listed species (e.g. those occurring in entirely upland areas not adjacent to a water body), this Opinion does not limit the number of bridge projects per year. The limitations are placed on the other activities described in this section which have adverse effects on listed species and critical habitat.

Covered Projects. This Opinion covers the following types of bridge projects:

1. New bridges that span a water body;

2. The repair, retrofit, and demolition of existing over-water bridges including replacing riprap scour protection on existing piers and abutments; and

3. The construction, repair, and demolition of bridges over land.

Excluded Projects. This Opinion does not cover the following types of bridge projects:

1. The construction of new or the replacement of existing piers or abutments below the ordinary high water mark (OHWM). New piers and abutments above the OHWM are allowed, but riprap scour protection for those piers must not extend below the OHWM;

2. Bridge removal projects that involve dropping bridge sections below the OHWM of a waterbody; and

3. Bridge replacement projects where WSDOT is not removing the existing bridge.

Requirements for Covered Projects and Exceptions. The requirements for bridge projects and exceptions to those requirements will be based on the other activities that each individual bridge project carries out.

In-water Pile Driving

For projects covered under this Opinion, WSDOT may use in-water impact pile driving to anchor large woody material[2] (LWM), construct temporary work bridges and platforms, and drive sheet piles for coffer dams when vibratory driving fails.

Covered Projects. Statewide, up to seven projects per year with impact pile driving may be covered under this Opinion. Each project may drive up to 40 piles no greater than 30 inches in diameter. The WSDOT estimates individual projects will drive up to eight piles per day and each pile will take up to 500 impact strikes to drive. One of the seven projects per year can impact drive sheet piles for a coffer dam when vibratory pile driving or other construction methods are not feasible.

Excluded Projects. The FHWA, WSDOT, and USACE did not include the following types of pile driving in the program analyzed in this Opinion:

[2] Trees or tree parts larger than four inches in diameter and longer than six feet and root wads, wholly or partially water ward of the ordinary high water line. (WAC 220-110-020(48).

1. Pile driving in marine and estuarine waters;

2. Driving piles larger than 30 inches in diameter; and

3. Installing creosote-treated or other pesticide-treated wood piles.

Requirements for Covered Projects. All individual projects covered under this Opinion which use impact pile driving in streams with listed species under NMFS jurisdiction will:

1. Use a vibratory hammer to drive piles to the maximum extent practicable;

2. Analyze the effects of impact pile driving using the Interim Criteria for Injury to Fish from Pile Driving Activities (FHWG 2008) or the most recent NMFS-approved guidance;

3. Calculate the area of the waterbody subjected to underwater sound above the injury thresholds and provide this information in the PNF;

4. The WSDOT will monitor underwater noise as described in the most recent NMFS-approved Underwater Noise Monitoring Plan (WSDOT 2012) template;

5. Use a confined or unconfined bubble curtain for impact pile driving (except for sheet piles and when driving in waters that are less than 3 feet deep); and

6. Submit the noise monitoring results to NMFS via email.

Exceptions. If NMFS confirms in project approval email that all life stages of listed species under NMFS jurisdiction will not be present in the action area of an individual project during impact pile driving, conditions 3-6 above do not apply.

Streambank Protection and Scour Repair

Covered Projects. The WSDOT installs riprap and other material in order to protect roadways, bridges, and culverts. State-wide, WSDOT may construct up to five streambank protection or scour repair projects per year under this Opinion.

Excluded Projects. This Opinion does not cover projects which place new armoring below the OHWM or construct new or extend (parallel or perpendicular to the shore) existing bulkheads in the nearshore of Puget Sound or the Straight of San Juan De Fuca unless the project removes armoring from an equivalent area of the surrounding shoreline.

Requirements for Covered Projects. All streambank protection and scour repair projects covered under this Opinion will:

1. Obtain pre-approval from NMFS via email prior to submitting the PNF;

2. For repair of existing riprap protection (including bridge scour repairs), keep the toe of the riprap within the footprint of the existing or as-built conditions and keep the linear extent (parallel to the stream bank) within five percent existing or as-built conditions;

3. For new or rebuilt streambank protection, WSDOT will use one of the techniques identified in the Appendix; and

4. Incorporate LWM into all new streambank protection designs.

Exceptions. The NMFS may approve extending the toe of riprap scour protection at bridge piers and abutments perpendicular to the stream bank if the individual project will result in a net long-term benefit to listed species through habitat restoration. The NMFS may also approve streambank protection designs without LWM for individual projects for safety or other site specific factors.

In-Water Work, Work Area Isolation, and Fish Handling

The WSDOT conducts in-water work for a variety of projects including bridge, culvert, and streambank protection projects. These projects often require the isolation of work areas within the OHWM to work in the dry and to protect water quality and fish.

Covered Projects. State-wide, this Opinion may cover up to 40 individual projects per year with in-water work. No more than 20 of these can be projects other than replacing fish barrier culverts.

Excluded Projects. This Opinion does not cover the following in-water activities:

1. In-water blasting; and

2. Heavy equipment (e.g. excavators, back hoes, etc.) driving into flowing streams. NMFS may approve the use of small spider excavators operating in flowing streams in cases where the work cannot be conducted from the streambank.

Requirements for Covered Projects. All individual projects with in-water work will:

1. Conduct all work below the OHWM within the WDFW's Allowable Freshwater Work Times (WDFW 2010). For stream reaches where WDFW has not identified a work window (i.e. "Project-specific Work time Required"), WSDOT must get approval from NMFS, via email, on the proposed work window prior to submitting the PNF;

2. Monitor turbidity during in-water work to ensure compliance with State water quality standards and report the results of the monitoring to NMFS via email in the PCF;

3. Replace any LWM removed during construction (LWM may be placed in another location to avoid threats to existing infrastructure);

4. Ensure all equipment operating below the OHWM of waters used by listed fish species use vegetable oil or other biodegradable acceptable hydraulic fluid substitute and be free of any external petroleum products, hydraulic fluid, coolants, and other deleterious materials; and

5. Report any violations of WDFW's Hydraulic Project Approval or Ecology's requirements to the NMFS via email in the PCF.

In addition to these requirements, projects with in-water work area isolation and fish handling will also:

1. Follow the WSDOT Fish Exclusion Protocols and Standards (WSDOT 2009a) or the most recent NMFS-approved guidance;

2. Identify any special considerations for stream isolation and fish relocation in the PNF; and

3. Submit the documentation described in WSDOT Fish Exclusion Protocols and Standards to NMFS via email in the PCF.

Exceptions. The NMFS may approve in-water work outside the specified windows for individual projects in the following circumstances:

1. The work window change will not increase the magnitude of adverse effects to listed species; or

2. The work window change will result in additional short-term adverse effects, but, overall, the project will result in a net long-term benefit to listed species.

Culvert Repair and Replacement

The WSDOT repairs and replace culverts for a variety of reasons, including enhancing fish passage. These culvert projects may involve one or more of the other activities described in this section (e.g. riparian vegetation removal, work area isolation and fish handling, etc.).

Covered Projects. This Opinion does not limit the number of culvert projects per year. The limitations are placed on the other activities described in this section which have adverse effects on listed species and critical habitat.

Excluded Projects. This Opinion does not cover individual projects that extend existing culverts in streams with listed fish species under NMFS jurisdiction where the finished culvert does not meet the WDFW stream simulation or no-slope design criteria (Bates et al. 2003).

Requirements for Covered Projects. All individual projects covered under this Opinion which replace culverts on streams with listed species under NMFS jurisdiction will design the new culvert using the WDFW stream simulation or no-slope design criteria (Bates et al. 2003).

Exceptions. NMFS will not approve any exceptions to the requirement listed above.

Minimization Measures and Requirements that apply to all Individual Projects

1. All projects that disturb soil must comply with the 12 temporary erosion and sediment control (TESC) elements described in Chapter 6 of the Highway Runoff Manual (HRM) (WSDOT 2011a) and must apply best management practices (BMPs) approved by the Washington State Department of Ecology (Ecology). Projects that add or replace 2,000 square feet of impervious surface or disturb 7,000 square feet or more of soil must prepare a standalone TESC Plan. Chapter 6 of the HRM also requires that all projects prepare a project specific spill prevention, control, and countermeasures (SPCC) plan (WSDOT 2011a).

2. All projects will implement the BMPs, as described in the Highway Runoff Manual, which are necessary to ensure that no material, including sediment, pavement slurry, oil or fuel, wet concrete and wash water, debris from bridge demolition, and herbicides, enters aquatic systems.

3. All projects will restore temporarily disturbed areas by protecting existing root systems and replanting with native trees and shrubs. Projects will use native trees and shrubs that are endemic to the project vicinity or region.

4. All concrete will be poured in the dry, or within confined waters not being dewatered to surface waters, and will be allowed to cure a minimum of 7 days before contact with surface water.

5. No paving, chip sealing, or stripe painting will be initiated in rainy weather.

6. Construction will take place from the adjacent stream banks, existing bridges, barges, or temporary work bridges. Some work may be allowed within a dewatered channel or on a dry gravel bar with NMFS approval, but no equipment or vehicle staging will be allowed in these areas.

7. Projects which remove creosote-treated wood will prevent sediments and any contaminated materials from re-entering the aquatic environment and dispose of all contaminated materials at an approved and permitted facility.

8. Projects will direct temporary construction lights away from waters with listed fish species to the greatest extent possible.

9. Projects will shield permanent lighting on bridges or roads adjacent to waters with listed fish species to direct light toward the roadway and away from the water.

Excluded Projects

In addition to the types of projects excluded above, the following activities and types of projects are also excluded for coverage under this Opinion:

1. Projects that cause effects to listed species in a manner not evaluated in this Opinion;

2. Projects with major indirect effects such as those creating new interchanges, highways, and bypasses or new lanes which extend from interchange to interchange;

3. Road realignments greater than 0.5 mile in total length; and

4. New maintenance facilities.

<u>Fast Track</u>

The WSDOT, FHWA, and the NMFS identified a subset of the activities covered under this Opinion which have beneficial effects to listed species and critical habitats. These projects will follow the same procedures described in section 1.3.1 above except that they will not require a project approval email from NMFS in order to proceed. If, after receiving the PNF for a fast track project, the NMFS determines that the project does not meet the Fast Track criteria, NMFS will notify WSDOT and FHWA as soon as possible and not more than five working days from receiving the PNF. The following types of projects are eligible for the Fast Track process:

1. Projects that construct new pollution generating impervious surface (PGIS) that treat or infiltrate 100 percent of stormwater PGIS within the construction limits or an equivalent area of PGIS. Projects which retrofit existing PGIS without adding new PGIS can also use the Fast Track process. All of these projects must still comply with the requirements in sections 1.3.2.1 and 1.3.2.8, and they cannot have any additional activities, not described in these sections, which affect listed species under NMFS' jurisdiction.

2. Projects that replace culverts to allow or enhance passage of listed fish species. All of these projects must still comply with the requirements in sections 1.3.2.2,

1.3.2.6, 1.3.2.7, and 1.3.2.8, and they cannot have any additional activities, not described in these sections, which affect listed species under NMFS' jurisdiction.

3. Projects that remove derelict fishing gear during the repair or replacement of floating bridge anchor cables. These projects must comply with the requirements in section 1.3.2.8, and they cannot have any additional activities, not described in these sections, which affect listed species under NMFS' jurisdiction.

4. Projects that remove in-water piles using direct pull or vibratory methods and do not replace them with new piles. These projects must still comply with the requirements in sections 1.3.2.2, 1.3.2.6, and 1.3.2.8, and they cannot have any additional activities, not described in these sections, which affect listed species under NMFS' jurisdiction.

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not
merely the immediate area involved in the action (50 CFR 402.02). The action area consists of all the aquatic areas immediately adjacent to or crossed by state highways, where the environmental effects of individual projects authorized under this Opinion may occur. Individual projects will affect aquatic habitats up to 300 feet downstream due to increases in suspended sediment and up to 600 feet up and downstream due to underwater noise from impact pile driving. All other effects described below will occur within these distances. Twenty-four ESA-listed species and 20 designated critical habitats occur in the action area (Table 1).

The action area is also designated as EFH for Pacific Coast groundfish (PFMC 2006), coastal pelagic species (PFMC 1998), and Pacific Coast salmon (PFMC 1999), or is in an area where environmental effects of the proposed action may 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 on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the United States Fish and Wildlife Service, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species or their critical habitat.

If incidental take is expected, Section 7(b)(4) requires the provision of an incidental take statement (ITS) specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Analytical Approach of the Biological Opinion

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

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). This biological opinion does not rely on the regulatory definition of 'destruction or adverse modification' of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[3]

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

- *Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action*. This section describes the current status of each listed species and its critical habitat relative to the conditions needed for recovery, using guidance for analyzing the status of the listed species' component populations in a "viable salmonid populations" (VSP) paper (McElhany et al. 2000). The VSP approach considers the abundance, productivity, spatial structure, and diversity of each population as part of the overall review of a species' status. We determine the rangewide status of critical habitat by examining the condition of its physical or biological features (also called "primary constituent elements" or PCEs in some designations) - which were identified when the critical habitat was designated.
- *Describe the environmental baseline for the proposed action*. The environmental baseline includes the past and present impacts of Federal, state, or private actions and other human activities *in the action area*.

- *Analyze the effects of the proposed actions*. In this step, NMFS considers how the proposed action would affect the individuals of the species exposed to the project's direct indirect effects. NMFS then evaluates how these effects might alter the species' reproduction, numbers, and distribution or, in the case of salmon

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

and steelhead, their VSP characteristics. NMFS also evaluates the proposed action's effects on critical habitat features.

- *Describe any cumulative effects.* Cumulative effects, as defined in NMFS' implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. *Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.* In this step, NMFS adds the effects of the action to the environmental baseline and the cumulative effects to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species.

- *Reach jeopardy and adverse modification conclusions*. Conclusions regarding jeopardy and the destruction or adverse modification of critical habitat flow from the logic and rationale presented in the Integration and Synthesis section.

2.2 Rangewide Status of the Species and Critical Habitat

Salmon and their habitat throughout Washington are likely affected by climate change. Several studies have revealed that climate change has the potential to affect ecosystems in nearly all tributaries throughout the state (Battin et al. 2007; ISAB 2007). While the intensity of effects will vary by region (ISAB 2007), climate change is generally expected to alter aquatic habitat (water yield, peak flows, and stream temperature). As climate change alters the structure and distribution of rainfall, snowpack, and glaciations, each factor will in turn alter riverine hydrographs. Given the increasing certainty that climate change is occurring and is accelerating (Battin et al. 2007), NMFS anticipates salmonid habitats will be affected. Climate and hydrology models project significant reductions in both total snow pack and low-elevation snow pack in the Pacific Northwest over the next 50 years (Mote and Salathe 2009). These changes will shrink the extent of the snowmelt-dominated habitat available to salmon. Such changes may restrict our ability to conserve diverse salmon life histories, especially spring-run Chinook salmon.

In Washington State, most models project warmer air temperatures, increases in winter precipitation, and decreases in summer precipitation. Average temperatures in Washington State are likely to increase 0.1-0.6ºC per decade (Mote and Salathe 2009). Warmer air temperatures will lead to more precipitation falling as rain rather than snow. As the snow pack diminishes, seasonal hydrology will shift to more frequent and severe early large storms, changing stream flow timing and increasing peak river flows, which may limit salmon survival (Mantua et al. 2009). The largest driver of climate-induced decline in salmon populations is projected to be the impact of increased winter peak flows, which scour the streambed and destroy salmon eggs (Battin et al. 2007).

Higher water temperatures and lower spawning flows, together with increased magnitude of winter peak flows are all likely to increase salmon mortality. Higher ambient air temperatures will likely cause water temperatures to rise (ISAB 2007). Salmon and steelhead require cold water for spawning and incubation. As climate change progresses and stream temperatures warm, thermal refugia will be essential to persistence of many salmonid populations. Thermal refugia are important for providing salmon and steelhead with patches of suitable habitat while allowing them to undertake migrations through or to make foraging forays into areas with greater than optimal temperatures. To avoid waters above summer maximum temperatures, juvenile rearing may be increasingly found only in the confluence of colder tributaries or other areas of cold water refugia (Mantua et al. 2009).

Climate change is expected to make recovery targets for these salmon populations more difficult to achieve. Habitat action can address the adverse impacts of climate change on salmon. Examples include restoring connections to historical floodplains and freshwater and estuarine habitats to provide fish refugia and areas to store excess floodwaters, protecting and restoring riparian vegetation to ameliorate stream temperature increases, and purchasing or applying easements to lands that provide important cold water or refuge habitat (Battin et al. 2007; ISAB 2007).

2.2.1 Status of the Species

Puget Sound Chinook Salmon

Generally, PS Chinook salmon adults spawn in freshwater rivers and large streams at elevations above the floodplain. The eggs are deposited in gravel that has well oxygenated water percolating through it (Healey 1991). The eggs over-winter and hatch in the gravel to become juveniles with a yolk-sac. At about the time the yolk sac is absorbed, the juveniles emerge from the gravel and begin to forage on their own. The juveniles forage and move downstream into estuaries where they continue to forage before moving into the North Pacific Ocean where they reside for one to six years (Healey 1991).

Abundance and Productivity. Using peak recorded harvest landings in Puget Sound in 1908, Bledsoe et al. (1989) estimated that the historical run size of the ESU was 670,000. During a recent five-year period, the geometric mean of natural spawners in populations of PS Chinook salmon ranged from 222 to just over 9,489 fish. Most populations had natural spawners numbering in the hundreds (median recent natural escapement is 766), and, of the six populations with greater than 1,000 natural spawners, only two have a low fraction of hatchery fish. Estimates of the historical equilibrium abundance, based on pre-European settlement habitat conditions, range from 1,700 to 51,000 potential PS Chinook salmon spawners per population (Ford et al. 2011).

Long-term trends in abundance and median population growth rates for naturally spawning populations of PS Chinook salmon indicate that approximately half of the populations are declining and the other half are increasing in abundance. Eight of the 22 populations are declining over the short term, and 11 or 12 populations are experiencing long-term declines (Ford et al. 2011). Factors contributing to the downward trends are widespread blockages of streams, degraded freshwater and marine habitat, poor forest practices in upper river tributaries, and urbanization and agriculture in lower tributaries and main stem rivers. Hatchery production and release of PS Chinook salmon are widespread, and more than half of the recent total escapement returned to hatcheries.

All Puget Sound Chinook populations are well below recovery escapement levels (Ford et al. 2011). Most populations are also consistently below recovery spawner-recruit levels identified. Across the ESU, most populations have declined in abundance since the last status review in 2005, and trends since 1995 are mostly flat (Ford et al. 2011).

Spatial Structure and Diversity. The PS Chinook salmon ESU encompasses all runs of Chinook salmon from the Elwha River in the Strait of Juan de Fuca eastward, including rivers and streams flowing into Hood Canal, Puget Sound, and the Strait of Georgia in Washington. Of an estimated 31 original populations, there are 22 extant geographically distinct populations (Ford et al. 2011).

There are two typical life history strategies known as stream type and ocean type (Healey 1991; Myers et al. 1998). Timing of adult returns is dependent on the life history type. Stream type individuals are commonly called spring-run Chinook salmon since adults with this life history migrate into near shore waters and return to natal streams in spring to early summer. The ocean type life history is commonly called the fall-run PS Chinook salmon since most of the adults move to their natal streams in late summer and early fall. Fall-run PS Chinook salmon spawn in late September through October (Healey 1991). Most PS Chinook salmon are ocean type.

The artificial propagation of fall-run PS Chinook salmon is widespread throughout the ESU. Transfers between watersheds within and outside the ESU have been commonplace throughout the last century. Nearly two billion Chinook salmon have been released into Puget Sound tributaries since the 1950s. The vast majority of these were from local returning fall-run adults. Returns to hatcheries have accounted for 57 percent of the total spawning escapement, although the hatchery contribution to spawner escapement is probably much higher in some populations due to hatchery derived strays on the spawning grounds. The electrophoretic similarity between Green and Duwamish River fall-run PS Chinook salmon and several other fall-run stocks in Puget Sound suggests that there may have been a significant and lasting effect from Green River hatchery transplants (Ford et al. 2011).

Puget Sound Steelhead

Steelhead are the anadromous form of *O. mykiss*. PS steelhead typically spend two to three years in freshwater before migrating downstream into marine waters. Once the juveniles emigrate, they move rapidly through Puget Sound into the North Pacific Ocean where they reside for several years before returning to spawn in their natal streams. Unlike other species of *Oncorhynchus*, *O. mykiss* are capable of repeat spawning. Averaged across all West Coast steelhead populations, eight percent of spawning adults have spawned previously. Coastal populations have a higher incidence of repeat spawning than inland populations (Busby et al. 1996).

Abundance and Productivity. Since 1992 there has been a general downward trend in steelhead populations in this DPS. Busby et al. (1996) reviewed the 21 populations in the Puget Sound DPS and found that 17 had declining trends and four had increasing trends. Marked declines in natural run size are evident in all areas of the DPS. Even sharper declines are observed in southern Puget Sound and in Hood Canal. Throughout the DPS, natural steelhead production has shown a weak response to reduced harvest since the mid-1990s. Median population growth rates were estimated for several populations in the DPS, using the 4-year running sums method (Holmes 2001; Holmes and Fagan 2002). They estimated that the growth rate was less than 1 for most populations in the DPS, meaning the populations are declining.

No abundance estimates exist for most of the summer-run populations; all appear to be small, most averaging less than 200 spawners annually. Summer-run populations are concentrated in northern Puget Sound and Hood Canal; only the Elwha River and Canyon Creek support summer-run steelhead in the rest of the DPS. Steelhead are most abundant in northern Puget Sound, with winter-run steelhead in the Skagit and Snohomish rivers supporting the two largest populations (approximately 3,000 and 5,000 respectively). From 2005-2009, geometric means of natural spawners indicate relatively low abundance (4 of 15 populations with fewer than 500 spawners annually) and declining trends (6 of 16 populations) in natural escapement of winter-run steelhead throughout Puget Sound, particularly in southern Puget Sound and on the Olympic Peninsula (Ford et al. 2011). Widespread declines in abundance and productivity in most natural populations have been caused by the following factors:

Spatial Structure and Diversity. PS steelhead are found in all accessible large tributaries to Puget Sound and the eastern Strait of Juan de Fuca (WDFG 1932). Nehlsen et al. (1991) identified nine PS steelhead stocks at some degree of risk or concern.

The WDF et al. (1993) identified 53 stocks within the DPS, of which 31 were considered to be of native origin and predominantly natural production. Of the 31 stocks, they rated 11 as healthy, three as depressed, one as critical, and 16 as unknown.

There are two types of steelhead, winter steelhead and summer steelhead. Winter steelhead become sexually mature during their ocean phase and spawn soon after arriving at their spawning grounds. Adult summer steelhead enter their natal streams and spend several months holding and maturing in freshwater before spawning. The PS steelhead DPS is composed primarily of winter-run populations.

(1) Steelhead habitat has been dramatically affected by a number of large dams in the Puget Sound Basin that eliminated access to habitat or degraded habitat by changing river hydrology, temperature profiles, downstream gravel recruitment, and movement of large woody debris.

(2) In the lower reaches of rivers and their tributaries, urban development has converted natural areas (e.g. forests, wetlands, and riparian habitat) into impervious surfaces (buildings, roads, parking lots, etc.). This has changed the hydrology of urban streams causing increases in flood frequency, peak flow, and stormwater pollutants. The hydrologic changes have resulted in gravel scour, bank erosion, sediment deposition during storm events, and reduced summer flows (Moscrip and Montgomery 1997; Booth et al. 2002; May et al. 2003).

(3) Agricultural development has reduced river braiding, sinuosity, and side channels through the construction of dikes and the hardening of banks with riprap. Constriction of rivers, especially during high flow events, increases gravel scour and the dislocation of rearing juveniles. Much of the habitat that existed before European immigration has been lost due to these land use changes (Beechie et al. 2001; Collins and Montgomery 2002; Pess et al. 2002).

(4) In the mid-1990s, WDFW banned commercial harvest of wild steelhead. Previous harvest management practices contributed to the decline of PS steelhead (Busby et al. 1996). Predation by marine mammals (principally seals and sea lions) and birds may be of concern in some local areas experiencing dwindling steelhead run sizes (Kerwin 2001).

(5) Ocean and climate conditions can have profound impacts on steelhead populations. Changing weather patterns affect their natal streams. As snow pack decreases, in-stream flow is expected to decline during summer and early fall (Battin et al. 2007).

(6) The extensive propagation of the Chambers Creek winter steelhead and the Skamania Hatchery summer steelhead stocks have contributed to the observed decline in abundance of native PS steelhead populations (Hard et al. 2007). Approximately 95 percent of the hatchery production in the PS DPS originates from these two stocks. The Chambers Creek stock has undergone extensive breeding to provide an earlier and more uniform

spawn timing. This has resulted in a large degree of reproductive divergence between hatchery and wild winter-run fish. The Skamania Hatchery stock is derived from summer steelhead in the Washougal and Klickitat rivers and is genetically distinct from the Puget Sound populations of steelhead. For these reasons, Hard et al. (2007) concluded that all hatchery summer- and winter-run steelhead populations in Puget Sound derived from the Chambers Creek and Skamania Hatchery stocks should be excluded from the DPS. NMFS included two hatchery populations that were derived from native steelhead, the Green River winter-run and the Hamma Hamma winter-run, as part of the DPS (72 FR 26722).

Hood Canal Summer-run Chum Salmon

Summer-run chum salmon are defined as those stocks that spawn from August through October. This ESU consists of two populations of naturally spawned and certain hatchery stocks of summer-run chum salmon in Hood Canal and the eastern Strait of Juan de Fuca. The eastern Strait of Juan de Fuca population is composed of the following stocks: Jimmycomelately, Salmon, and Snow creeks and the Dungeness River. HCSR chum have also been reintroduced into Chimacum Creek where they had been extirpated. The Hood Canal population has seven extant stocks of summer chum: Lilliwaup Creek and the Little Quilcene, Big Quilcene, Hamma Hamma, Duckabush, Dosewallips, and Union rivers. In addition to these seven stocks, HCSR chum have been re-introduced into two additional streams in the Hood Canal population where they had been recently extirpated, Big Beef Creek and the Tahuya River. The following streams are those which had low HCSR chum spawner escapement in 2006 but are not considered viable stocks: Eagle and Stavis creeks and the Dewatto and Skokomish rivers (WDFW and PNPTC 2007).

Chum salmon exhibit obligatory anadromy. There are no recorded landlocked or naturalized freshwater populations. Chum salmon spend a greater fraction of their life history in marine waters than other Pacific salmonids. Chum salmon usually spawn in coastal areas and juveniles emigrate to seawater almost immediately after emerging from the gravel (Salo 1991). The nearshore and intertidal areas within the geographic region of the ESU are especially important to emigrant juveniles (Simenstad and Wissmar 1985; Hirschi et al. 2003).

The time that juvenile HCSR chum salmon spend in estuaries is the most critical phase of their life history and has a major impact on the size of the returning adult run. Because freshwater is measurably diluted by seawater, Hood Canal (and all of Puget Sound) is technically considered estuarine. Within the greater Hood Canal estuary, there are many river mouth estuaries (subestuaries). Hood Canal summer chum fry emerge from their redds at night and move immediately downstream and likely enter their natal subestuary the same night (Simenstad 2000). HCSR chum fry are approximately 38 millimeters at emergence. Simenstad (2000) reported that the residence time within the natal subestuary is less than one week. Once HCSR chum fry leave their natal subestuary, they migrate northward at a rate of seven to 14 kilometers per day (Tynan 1997).

Simenstad (2000) described two phases for juvenile HCSR chum. “Epibenthic” fry are less than 50 mm in length. At this stage, chum fry are restricted to very shallow water (less than two meters in depth). While terrestrial insects are a prominent portion of the epibenthic fry diet in subestuaries, these fry feed primarily on epibenthic invertebrates in the nearshore. Their diet in the nearshore is surprisingly specific with only two or three copepods dominating. Epibenthic fry migrate in close proximity to native eelgrass (*Zostera marina*) habitat where high densities of epibenthic invertebrates can be found. The fry will utilize non-natal subestuaries for foraging and refuge from predators as they migrate north. Shallow nearshore habitat is vital for summer chum fry migrating between subestuaries (Simenstad 2000). Epibenthic fry typically avoid areas of higher wave energy, even where there is abundant prey (Simenstad 2000).

Once summer chum fry reach 50 mm in length, they begin transitioning to the “neritic” phase (Simenstad 2000). Initially, they move into open water habitats at night and return to the shallow nearshore during the day. Once the fry reach 60 mm in length, they can avoid predators and freely migrate in open water and are capable of crossing Hood Canal. At this size, the fry are also able to feed on the larger prey found in open water (Simenstad 2000). Neritic fry feed primarily on plankton such as copepods, amphipods, and larvaceans. The average residence time for summer chum in Hood Canal is 24 days (Simenstad 2000). It is critical that summer chum make the “epibenthic-neritic” transition prior migrating out of the Canal. If the fry encounter limited prey resources during the epibenthic phase and do not reach the size necessary to feed and avoid predators in open-water, they will likely suffer high mortality in the marine environment.

HCSR chum mature primarily at three to four years of age. They enter the Hood Canal area from early August through the end of September. HCSR chum enter natal streams from the third week in August through the first week in October. HCSR chum may mill in front of their natal stream for up to ten to twelve days before entering freshwater (Brewer et al. 2005).

Good et al. (2005) reviewed threats to the ESU and concluded that harvest threats have substantially decreased while supplementation has begun to rebuild the spatial structure and abundance of the ESU. Habitat threats remain the major risk to the ESU, particularly the widespread loss of estuary and lower floodplain habitats. The following excerpt from the Washington Department of Fish and Wildlife (WDFW) and the Point no Point Treaty Council (PNPTC) (2007) provides the most up to date information for the ESU:

“The improved summer chum salmon returns and escapements to Hood Canal and Strait of Juan de Fuca streams, enhanced by strong returns to various supplementation programs, and combined with the high percentage of natural origin recruits in recent years suggest a substantial reduction of the extinction risk for this Evolutionarily Significant Unit (ESU). For example, the 4-year average total escapement has increased from 2,367 summer chum (1988- 1991) to 45,606 summer chum (2003-2006). From 2001 to 2006, supplementation-origin fish accounted for about 46 percent, 40 percent, 26 percent, 17 percent, 30 percent, and 20 percent of summer chum escapement which also means that natural-origin spawners comprised about 54 percent, 60 percent, 74 percent, 83 percent, 70 percent, and 80 percent during these same years. Due to successful reintroduction programs, spawners now return to three streams (i.e., Chimacum Creek, Big Beef Creek and Tahuya River) where they had been recently extirpated. In addition, extinction risk has decreased for each of the eight extant stocks in the ESU; i.e., from 1985-1988, there were four, two, and two stocks at high, moderate, and low risk of extinction compared to zero high risk, two moderate risk, and six low risk stocks during 2001-2004 (Adicks et al. 2005).

While all of the above events are very positive results for the summer chum salmon recovery effort, they do not yet constitute full recovery. The co-managers have developed interim recovery goals for summer chum salmon (PNPTT and WDFW 2003; HCCC 2005), that require strong production performance of natural origin recruits over three generations (12 years), and the recent years of improved escapement and recruitment are not sufficient to meet the recovery goals. In addition, the NMFS Puget Sound Technical Recovery Team (PSTRT) has defined and recommended viability criteria for the ESU and its two independent component populations (i.e., Hood Canal and Strait of Juan de Fuca). The ESU and population viability criteria are expressed in terms of risk of extinction over a 100-year time frame and the aim of the criteria is to describe viability characteristics that are necessary to ensure a high probability of ESU persistence (Sands et al. 2007). The PSTRT has reviewed the co-managers' interim goals and concluded that they were compatible with, and could be viewed as intermediate steps to achieving, the long-term viability criteria. The PSTRT analyses also strongly support the use of the local stocks identified by the comanagers for recovering the ESU (NMFS 2007a).

Many of the management changes that have taken place in the Hood Canal summer chum salmon recovery planning area within the last few years have proven to be beneficial. Harvest and hatchery management measures implemented by the co-managers have been consistent with the SCSCI and effective. A key premise of the SCSCI is that, in addition to harvest and hatchery management actions, 'commensurate, timely improvements in the condition of habitat critical for summer chum salmon survival are necessary to recover listed populations to healthy levels.' Some habitat protection and restoration measures identified in the HCCC summer chum recovery plan (HCCC 2005) have been implemented and more are planned and will be needed to support long-term, self-sustaining summer chum salmon populations."

A detailed assessment of the threats and opportunities for recovery actions is in the draft Hood Canal summer-run chum recovery plan (Brewer et al. 2005). Potential recovery
activities include new shoreline management rules issued by the Washington Department of Ecology, and several habitat improvement projects have been funded by the Washington State Salmon Recovery Funding Board.

The abundance, spatial structure, and diversity of HCSR chum salmon have improved since listing, but the ESU has had low productivity for the last five years. The ESU has not consistently met the recovery criteria and remains at moderate risk of extinction (Ford et al. 2011).

Lower Columbia River Chinook Salmon

Lower Columbia River Chinook salmon are from the Willamette-Lower Columbia recovery domain, one of the two recovery domains for steelhead and salmon species and critical habitats for the Columbia Basin below (Table 4). Recovery domains are the geographically-based areas NMFS is using to prepare multi-species recovery plans. For each recovery domain, a technical review team (TRT) appointed by NMFS has developed, or is developing, criteria necessary to identify independent populations within each species, recommended viability criteria for those species, and descriptions of factors that limit species recovery.

Table 2. Recovery planning domains identified by NMFS and their ESA-listed salmon and steelhead species.

Recovery Domain	Species
Willamette-Lower Columbia	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
Interior Columbia	UCR spring-run Chinook salmon SR spring/summer Chinook salmon SR fall-run Chinook salmon LO sockeye salmon SR sockeye salmon UCR steelhead MCR steelhead SRB steelhead

The following is a summary of the limiting factors and threats for the two recovery domains (IC-TRT 2006; Ford et al. 2011; UCSRB 2007; NMFS 2009; ODFW and NMFS 2011; LCFRB 2010):

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

- Degraded freshwater habitat (floodplain connectivity and function, channel structure and complexity, riparian areas, stream substrate, stream flow, and water quality) from the cumulative impacts of agriculture, forestry, and development;
- Reduced access to spawning and rearing habitat from tributary hydropower projects;
- Hatchery-related effects;
- Harvest-related effects;
- Reduced access to off-channel rearing habitat in the Lower Columbia River;
- Reduced productivity from sediment and nutrient-related changes in the estuary;
- Juvenile fish strandings that result from ship wakes;
- Contaminants affecting fish health and reproduction;
- Degraded stream flow as a result of hydropower and water supply operations;
- Current or potential predation from hatchery-origin salmonids;
- Fish passage barriers that limit access to spawning and rearing habitats;
- Avian and marine mammal predation in the lower mainstem Columbia River and estuary;
- Predation, competition, and disease from non-native species and out-of-ESU races of salmon and steelhead; and
- Genetic diversity effects from out-of-population hatchery releases.

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

The Lower Columbia Chinook salmon species includes all naturally-spawned populations of Chinook salmon in the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River; the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River; and progeny of seventeen artificial propagation programs. LCR Chinook populations exhibit three different life history types base on return timing and other features: fall-run (a.k.a. “tules”), late-fall-run (a.k.a. “brights”), and spring-run.

Of the 32 historical populations in the ESU, 28 are extirpated or at “very high” risk. Based on the recovery plan analyses, all of the tule populations are “very high” risk except one that is considered at “high” risk. Tule harvest management modeling suggests three of the populations (Coweeman, Lewis, and Washougal) are at lower risk. However, even these more optimistic evaluations suggest the remaining 18 populations are at substantial risk because of very low natural origin spawner abundance (less than 100 per population), high hatchery fraction, habitat degradation and harvest impacts. Overall, the new information does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Columbia River Chum Salmon

This species includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, and progeny of three artificial propagation programs. The WLC-TRT identified 17 historical populations of CR chum salmon (Myers et al. 2006). Unlike other species in the WLC recovery domain, CR chum salmon spawn in the mainstem Columbia River.

The vast majority (14 out of 17) chum salmon populations remain "extirpated or nearly so." The Grays River and Lower Gorge populations showed a sharp increase in 2002, but have since declined back to low abundance levels. Chinook and coho salmon populations in the Lower Columbia and Willamette showed similar increases in the early 2000s followed by declines to typical recent levels, suggesting the increase in chum salmon may be related to ocean conditions. Recent data on the Washougal/mainstem Columbia population are not available, but they likely follow a pattern similar to the Grays and Lower Gorge populations.
Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Lower Columbia River Coho Salmon

This species includes all naturally-spawned populations of coho salmon in the Columbia River and its tributaries in Washington and Oregon, from the mouth of the Columbia up to and including the Big White Salmon and Hood rivers; in the Willamette River to Willamette Falls, Oregon; and progeny of 25 artificial propagation programs. The WLC-TRT identified 24 historical populations of LCR coho salmon (Myers et al. 2006). Of the 27 historical populations in the ESU, 24 are at "very high" risk. The remaining three populations (Sandy, Clackamas, and Scappoose rivers) are at "moderate" or "high" risk (Ford et al. 2011). As was noted in the 2005 status review, smolt traps indicate some natural production in Washington populations, though given the high fraction of hatchery origin spawners suspected to occur in these populations it is not clear that any are self-sustaining (Ford et al. 2011). Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Lower Columbia River Steelhead

This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between and including the Cowlitz and Wind rivers, Washington; in the Willamette and Hood rivers, Oregon; and progeny of ten artificial propagation programs; but excluding all steelhead from the upper Willamette River basin above Willamette Falls, Oregon, and from the Little and Big White Salmon rivers, Washington.

Summer steelhead return to freshwater long before spawning. Winter steelhead, in contrast, return from the ocean much closer to maturity and spawn within a few weeks. Summer steelhead spawning areas in the Lower Columbia River are found above waterfalls and other features that create seasonal barriers to migration. Where no temporal barriers exist, the winter-run life history dominates. All of the populations increased in abundance during the early 2000s. Most populations have since declined back to levels within one standard deviation of the long- term mean. Exceptions are the Washougal summer run and North Fork Toutle winter run, which are still higher than the long-term average, and the Sandy, which is lower. In general, the populations do not show any sustained dramatic changes in abundance or fraction of hatchery origin spawners since the 2005 status review (Ford et al. 2010).

Upper Willamette River Chinook Salmon

This species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River; in the Willamette River and its tributaries above Willamette Falls, Oregon; and progeny of seven artificial propagation programs. The WLC-TRT identified seven historical populations of UWR Chinook salmon. Only the Clackamas population is "viable" (McElhany et al. 2007). Data since the last status review in 2005 has confirmed the high fraction of hatchery origin fish in all of the populations of this species. The new data have also highlighted the substantial risks of pre-spawning mortality. Although recovery plans target key limiting factors, there have been no significant on-the-ground-actions since the last status review to resolve the lack of access to historical habitat above dams nor have there been substantial actions removing hatchery fish from the spawning grounds. Overall, the new information does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Upper Willamette River Steelhead

This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River. The WLC-TRT identified five historical populations of UWR steelhead, all with winter run timing (Myers et al. 2006). UWR steelhead are currently inhabiting many tributaries that drain the west side of the upper Willamette River basin. Analysis of historical observations, hatchery records, and genetic analysis strongly suggested many of these spawning aggregations are the result of recent introductions and do not represent a historical population. Nevertheless, the WLC-TRT recognized these tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. Summer steelhead have become established in the McKenzie River where historically no steelhead existed. Since the last status review in 2005, UWR steelhead initially increased in abundance but subsequently declined, and current abundance is at the levels observed in the mid-1990s. The DPS appears to be at lower risk than the UWR Chinook salmon ESU, but continues to have overall low abundance. The elimination of winter run hatchery release in the basin reduced hatchery threats, but non-native summer steelhead hatchery releases are still a concern. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Upper Columbia River Spring-Run Chinook Salmon

Species in the Interior Columbia (IC) recovery domain include Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, Middle Columbia River (MCR) steelhead, and Snake River Basin (SRB) steelhead. The IC-TRT identified 82 populations of those species based on genetic, geographic (hydrographic), and habitat characteristics. All 82 populations identified use the lower mainstem of the Snake River, the mainstem of the Columbia River, and the Columbia River estuary, or part thereof, for migration, rearing, and smoltification.

The Upper Columbia River Spring-run Chinook salmon species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington (excluding the Okanogan River), the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington, and progeny of six artificial propagation programs. The IC-TRT identified four independent populations of UCR spring-run Chinook salmon in the upriver tributaries of Wenatchee, Entiat, Methow, and Okanogan (extirpated) (IC-TRT 2003; Ford et al. 2011). Increases in natural origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging; however, average productivity levels remain extremely low. Overall, the viability of UCR spring-run Chinook salmon ESU has likely improved somewhat since the last status review, but the ESU is still clearly at "moderate-to-high" risk of extinction (Ford et al. 2011).

Snake River Spring/Summer-Run Chinook Salmon

This species includes all naturally-spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins; and progeny of fifteen artificial propagation programs. The IC-TRT identified 27 extant and four extirpated populations of SR spring/summer-run Chinook salmon (IC-TRT 2003; Ford et al. 2011). Each of these populations faces a "high" risk of extinction (Ford et al. 2011). Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Snake River Fall-Run Chinook Salmon

This species includes all naturally-spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, and progeny of four artificial propagation programs. The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon, and Tucannon rivers. The extant population of Snake River fall-run Chinook salmon is the only remaining population from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (IC-TRT 2003; Ford et al. 2011). The recent increases in natural origin abundance are encouraging. However, hatchery origin spawner proportions have increased dramatically in recent years. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Snake River Sockeye Salmon

This species includes all anadromous and residual sockeye salmon from the Snake River basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake captive propagation program. The IC-TRT identified historical sockeye salmon production in at least five Stanley Basin and Sawtooth Valley lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (*e.g.,* Wallowa and Payette Lakes), although current returns of SR sockeye salmon are extremely low and limited to Redfish Lake (IC-TRT 2007). Although the captive brood program has been successful in providing substantial numbers *O. nerka* for use in supplementation efforts, substantial increases in survival rates across life history stages must occur in order to re-establish sustainable natural production (Hebdon et al. 2004; Keefer et al. 2008). Overall, although the status of the Snake River sockeye salmon ESU appears to be improving, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

The key factor limiting recovery of SR sockeye salmon ESU is survival outside of the Stanley Basin. Portions of the migration corridor in the Salmon River are impeded by water quality and temperature (Idaho Department of Environmental Quality 2011). Increased temperatures may reduce the survival of adult sockeye returning to the Stanley River basin. The natural hydrological regime in the upper mainstem Salmon River basin has been altered by water withdrawals. In most years, sockeye adult returns to Lower Granite suffer catastrophic losses (e.g. greater than 50 percent mortality in one year; Reed et al. 2003) before reaching the Stanley Basin. The cause of these losses is unknown. In the Columbia and Lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown. However, terns and cormorants consume 12 percent of all salmon smolts reaching the estuary, and fish consume an estimated 8 percent of migrating juvenile salmon (Ford et al. 2011).

Middle Columbia River Steelhead

This species includes all naturally-spawned steelhead populations below natural and artificial impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington (excluding steelhead from the Snake River basin), and progeny of seven artificial propagation programs. The IC-TRT identified 17 extant populations in this DPS

(IC-TRT 2003). There have been improvements in the viability ratings for some of the component populations, but the MCR steelhead DPS is not currently meeting the viability criteria (adopted from the IC- TRT) in the MCR steelhead recovery plan (NMFS 2009). In addition, several of the factors cited by Good et al. (2005) remain as concerns or key uncertainties. Natural origin spawning estimates of populations have been highly variable with respect to meeting minimum abundance thresholds. Straying frequencies into at least the Lower John Day River population are high. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, and natural origin returns to the John Day River have decreased. Out-of-basin hatchery stray proportions, although reduced, remain very high in the Deschutes River basin. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Upper Columbia River Steelhead

This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Columbia River basin upstream from the Yakima River, Washington, to the U.S.-Canada border, and progeny of six artificial propagation programs. The IC-TRT identified four independent populations of UCR steelhead, the Wenatchee, Entiat, Methow, and Okanogan rivers (IC-TRT 2003; Ford et al. 2011). All extant populations are considered to be at high risk of extinction (Ford et al. 2011).

The UCR steelhead populations have increased in natural origin abundance in recent years, but productivity levels remain low. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan river populations. 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. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Snake River Basin Steelhead

This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho, and progeny of six artificial propagation programs. The IC-TRT identified 25 historical populations (IC-TRT 2006; Ford et al. 2011). The IC-TRT has not assessed the viability of this species. 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. The relative proportion of hatchery fish in natural spawning areas near major hatchery release sites is highly uncertain. There is little evidence for substantial change in ESU viability relative to the previous BRT and IC-TRT reviews. Overall, therefore, the new information considered does not indicate a change in the biological risk category since the last status review (Ford et al. 2011).

Southern Distinct Population Segment Green Sturgeon

Green sturgeon are long-lived and slow-growing. Adult green sturgeon typically migrate into fresh water beginning in late February and spawn from March to July. Juveniles spend one to three years in freshwater before they enter the ocean. Green sturgeon disperse widely in the ocean between their freshwater life stages. In marine waters, green sturgeon range from Baja California to Canada (NMFS 2008). There are two green sturgeon distinct population segments (DPSs), a northern DPS with spawning populations in the Klamath and Rogue rivers and a southern DPS that spawns in the Sacramento River (NMFS 2008). NMFS listed the SDPS green sturgeon as a threatened species on June 6, 2006 (71 FR 17757). The reduction of spawning habitat to a limited section of the Sacramento River is the principal factor in the decline of the SDPS (NMFS 2006a). Other threats include insufficient flow rates in spawning areas, by-catch of green sturgeon, poaching, entrainment of juveniles by water projects, exotic species, migration barriers, elevated water temperatures in the spawning and rearing habitat, and exposure to contaminants (NMFS 2006a).

The SDPS green sturgeon congregate in coastal waters and estuaries, including non-natal estuaries. Green sturgeon typically enter Washington estuaries during summer (Moser and Lindley 2007), but Lindley (in lit.) found green sturgeon in low numbers in Willapa Bay as early as April and as late as October. Adult and subadult green sturgeon in estuaries feed on crangonid shrimp, burrowing thalassinidean shrimp (primarily the burrowing ghost shrimp (*Neotrypaea californiensis*), amphipods, clams, juvenile Dungeness crab (*Cancer magister*), anchovies, sand lances (*Ammodytes hexapterus*), lingcod (*Ophiodon elongatus*), and other unidentified fish species (Moyle et al. 1995; Moser and Lindley 2007; Dumbauld et al. 2008). Burrowing ghost shrimp comprised approximately 50 percent of the stomach contents of green sturgeon in Willapa Bay (Dumbauld et al. 2008). Kelly et al. (2007) found adults and subadults within San Francisco Bay foraged in water less than 10 m in depth.

Climate change is likely to contribute to conditions affecting the status of the species, including those in estuarine habitat. As described in ISAB (2007), effects of climate change that have influenced the habitat and species in estuarine habitat, include: higher winter freshwater flows and higher sea level elevation may lead to increased sediment deposition and wave damage; lower freshwater flows in late spring and summer may lead to upstream extension of the salt wedge, possibly influencing the distribution of food; and increased temperature of freshwater inflows may extend the range of warm-adapted non-indigenous species that are normally found only in freshwater. In all of these cases, the specific effects on sturgeon abundance, productivity, spatial distribution and diversity are poorly understood.

Eulachon

Eulachon are endemic to the eastern Pacific Ocean and range from northern California to southwest Alaska and into the southeastern Bering Sea. The SDPS of eulachon includes populations spawning in rivers south of the Nass River in British Columbia to the Mad River in California. Eulachon leave saltwater to spawn in their natal streams late winter through early summer and typically spawn in the lower reaches of larger rivers fed by snowmelt. Eulachon spawn earlier in southern portions of their range than in rivers to the north. Spawning begins as early as December and January in the Columbia River system. Larval outmigration occurs 30 to 40 days after spawning; out migrants are dependent on river and tidal currents for movement (Langness in litt.). Studies using otolith aging techniques have concluded that some eulachon spawn at age-2 or age-5, but most are age-2 or age-3 at spawning (Willson et al. 2006). After hatching, larvae are carried downstream and widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly understood.

Available information indicates the southern DPS of eulachon has abruptly declined in abundance throughout its range. The spawning populations in the Columbia and Fraser River have declined to historically low levels. There is very little monitoring data available for Northern California eulachon, but the available information suggests that they experienced an abrupt decline several decades ago. The current sizes of Central and North Coast British Columbia eulachon populations appear inconsistent with the ethnographic literature that describes an extensive grease trading network based upon eulachon catch (Hay et al. 2002).

Eulachon may be at significant risk at population sizes that are a fraction of their historical levels but are still large compared to what would be considered normal for other ESA listed species (Dulvy et al. 2004). Reviews of extinction risk in marine fishes illustrate that forage fish are not immune to risk of extirpation at the population scale (Dulvy et al. 2003; Reynolds et al. 2005; Hutchings 2000; 2001a; 2001b). A number of populations of Atlantic cod and Atlantic herring have either been extirpated or have not shown signs of recovery from depletions (Smedbol and Stevenson 2001). High eulachon minimum viable population sizes are necessary to ensure enough adults breed to produce enough offspring. Eulachon experience high in-river egg and larval mortality and planktonic larval mortality in the ocean. In species with this life history pattern, the genetically effective population size can be several orders of magnitude lower than the census size (Hedgecock 1994; ICES 2004). Many populations in the DPS are below minimum viable population sizes for a highly fecund species.

The impact of climate change on ocean conditions is likely the most serious threat to persistence of eulachon (NMFS 2010). Climate change is leading to rapid changes in both oceanic and freshwater environmental conditions. Eulachon are a cold-water species and are adapted to feed on a northern suite of copepods in the ocean during their transition from larvae to juvenile. Much of their recent recruitment failure may be traced to mortality during this critical period. Climate change may be causing shifts in the suite of copepod species available to eulachon that favor a more southerly species assemblage (Mackas et al. 2001, 2007; Hooff and Peterson 2006). Warming conditions have allowed both Pacific hake (Phillips et al. 2007) and Pacific sardine (*Sardinops sagax*) (Emmett et al. 2005) to expand their distributions to the north, increasing predation on eulachon by Pacific hake and competition for food resources by both species. Other threats to eulachon include bycatch in the shrimp trawl fishery, dams and water diversions, dredging, pollution, and predation.

2.2.2 Status of Puget Sound Chinook Salmon and Hood Canal Summer-run Chum Salmon Critical Habitats

The NMFS designated critical habitat for the PS Chinook salmon and HCSR chum salmon ESUs on September 2, 2005. While the geographic extent of each ESU's critical habitat is different, the primary constituent elements (PCEs) are the same. The following are the PCEs NMFS identified for PS Chinook and HCSR chum salmon critical habitat:

> PCE 1--Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development;
>
> PCE 2--Freshwater rearing sites with (1) water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, (2) water quality and forage that support juvenile development, and (3) natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
>
> PCE 3--Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that support juvenile and adult mobility and survival;
>
> PCE 4--Estuarine areas free of obstruction and excessive predation with (1) water quality, water quantity, and salinity conditions that support juvenile and adult physiological transitions between fresh water and salt water, (2) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and (3) juvenile and adult foraging opportunities, including aquatic invertebrates and prey fish, supporting growth and maturation;
>
> PCE 5--Nearshore marine areas free of obstruction and excessive predation with (1) water quality and quantity conditions and foraging opportunities, including aquatic invertebrates and fishes, supporting growth and maturation, and (2) natural cover including submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels;
>
> PCE 6--Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Critical habitat throughout the Puget Sound basin has been degraded by numerous activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large woody debris, intense urbanization, agriculture, alteration of floodplain and stream morphology, riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, timber harvest, and mining. Changes in habitat quantity, availability, diversity, stream flow, temperature, sediment load, and channel instability are common limiting factors of critical habitat.

2.2.3 Status of Columbia Basin and Washington Coast Critical Habitats

Willamette and Lower Columbia Recovery Domain

The NMFS designated critical habitat in the WLC recovery domain for UWR spring-run Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, and CR chum salmon. Land management activities have severely degraded stream habitat conditions in the Willamette River Basin. Agriculture and high density urban development have impaired aquatic and riparian habitat, water quality and quantity, and watershed processes. Channelization, dredging, and other activities has reduced rearing habitat by 75 percent. In addition, 37 dams block access to more than 435 miles of spawning habitat. The dams also alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of eggs and fry. Agriculture, urbanization, logging, and gravel mining contribute to increased erosion and sediment loads throughout the basin.

The banks of the Willamette River have more than 96 miles of revetments. Approximately half were constructed by the USACE. Generally, the revetments are in the vicinity of roads or on the outside bank of river bends. The revetments cover 65 percent of the meander bends diminishing the complexity and productivity of aquatic habitats (Gregory et al. 2002c; Gregory et al. 2002b). Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory et al. 2002a). Gregory et al. (2002a) described the changes in riparian vegetation in river reaches from riparian forests to agriculture and other uses. This conversion has reduced shading, wood recruitment, channel complexity, and the quality of salmonid habitats.

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 2006b; LCFRB 2010). 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 2006b; LCFRB 2010). Since 1878, the USACE has dredged 100 miles of river channel within the Columbia River, its estuary, and the Willamette River for navigation channels. Originally 20 feet deep, the USACE now maintains the navigation channel of the lower Columbia River at 43 feet deep and 600 feet wide. The lower Columbia River has five ports on the Washington State side, Kalama, Longview, Skamania County, Woodland, and Vancouver. The ports and associated industrial facilities have contaminated the sediments in the lower Columbia River with high levels of arsenic, polycyclic aromatic hydrocarbons (PAHs), and other pollutants.

The most extensive urban development in the lower Columbia River subbasin is the Portland 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 stormwater pollutants (e.g. pesticides and metals).

The Columbia River estuary has lost 62 percent of tidal marsh and 77 percent tidal swamp habitats which are critical to juvenile salmon and steelhead (Sherwood et al. 1990). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food and shelter from predators is plentiful.

Interior Columbia Recovery Domain

The NMFS designated critical habitat in the IC recovery domain for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead. Habitat quality in tributary streams in the IC recovery domain varies from excellent in wilderness and roadless areas to poor in areas with heavy agricultural and urban development (Wissmar et al. 1994; NMFS 2009).

Dams, including the FCRPS in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia River basins, block migration for ESA-listed salmon. For example, construction of Hells Canyon Dam eliminated access to the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Ford et al. 2011), and the Grand Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River. Hydroelectric dams modify natural flow regimes, increase water temperature, increase predation rates on juvenile salmon and steelhead, and prevent and delay migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juvenile salmon and steelhead.

Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have drastically altered hydrological cycles. A series of large dams on the Deschutes River have extirpated salmonid populations by altering flows and blocking access to upstream habitat (IC-TRT 2003). Operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly reduced flows and degraded water quality. Many stream reaches in the IC recovery domain are over-allocated under state water law (i.e. more allocated water rights than the stream flow conditions can support). Water withdrawals increase summer stream temperatures, block fish migration, strand fish, and alter sediment transport (Spence et al. 1996). Reduced tributary stream flow is a major limiting factor for all listed salmon and steelhead species in this area except SR fall-run Chinook salmon and SR sockeye salmon (NMFS 2007a; Ford et al. 2011).

Many stream reaches are listed on the state of Oregon's Clean Water Act section 303(d) list for impaired water temperature. Many areas of 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 and municipal use all contribute to elevated stream temperatures. Contaminants such as insecticides and herbicides from agricultural runoff and heavy metals from mine waste impair water quality in the IC Recovery Domain.

2.2.4. Status of Critical Habitat for Other Species

Southern Distinct Population Segment Green Sturgeon Critical Habitat

On October 9, 2009, NMFS designated critical habitat for the SDPS green sturgeon (73 FR 52084) for three habitat types: freshwater riverine systems, estuarine areas, and nearshore marine waters. These areas include approximately 320 miles of freshwater river habitat, 897 square miles of estuarine habitat, 11,421 square miles of marine habitat, 487 miles of habitat in the Sacramento-San Joaquin Delta, and 135 square miles of habitat within the Yolo and Sutter bypasses (Sacramento River, CA). Habitat evaluations for the upper Sacramento, Feather, and San Joaquin Rivers found dams altered or made inaccessible large amounts of green sturgeon spawning habitat (NMFS 2005). An American Fisheries Society assessment concluded that the green sturgeon's range has declined by 88% (Musick et al. 2000). Logging practices, land use practices, railroad construction, and building and operating dams have all destroyed green sturgeon habitat (Adams et al. 2002). Water temperatures in the current spawning areas are lower than they were historically due to cold water releases from Shasta Dam.

As part of the designation process, NMFS identified habitat features essential to the conservation of the species and provided an assessment of these features within the range of the DPS. The NMFS recognized that the different systems occupied by green sturgeon at specific stages of their life cycle serve distinct purposes and thus may contain different PCEs. Based on the best available scientific information, NMFS identified PCEs for freshwater riverine systems, estuarine areas, and coastal marine waters. NMFS described the following PCEs for the three habitat types:

(1) Freshwater riverine:

(i) Food resources. Abundant prey items for larval, juvenile, subadult, and adult life stages.

(ii) Substrate type or size (i.e., structural features of substrates). Substrates suitable for egg deposition and development (e.g., bedrock sills and shelves, cobble and gravel, or hard clean sand, with interstices or irregular surfaces to ''collect'' eggs and provide protection from predators, and free of excessive silt and debris that could smother eggs during incubation), larval development (e.g., substrates with interstices or voids providing refuge from predators and from high flow conditions), and subadults and adults (e.g., substrates for holding and spawning).

(iii) Water flow. A flow regime (i.e., the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time) necessary for normal behavior, growth, and survival of all life stages.

(iv) Water quality. Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.

(v) Migratory corridor. A migratory pathway necessary for the safe and timely passage of Southern DPS fish within riverine habitats and between riverine and estuarine habitats (e.g., an unobstructed river or dammed river that still allows for safe and timely passage).

(vi) Depth. Deep (less than 5 meters) holding pools for both upstream and downstream holding of adult or subadult fish, with adequate water quality and flow to maintain the physiological needs of the holding adult or subadult fish.

(vii) Sediment quality. Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages.

(2) For estuarine areas:

(i) Food resources. Abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages.

(ii) Water flow. Within bays and estuaries adjacent to the Sacramento River (i.e., the Sacramento-San Joaquin Delta and the Suisun, San Pablo, and San Francisco bays), sufficient flow into the bay and estuary to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds.

(iii) Water quality. Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.

(iv) Migratory corridor. A migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats.

(v) Depth. A diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages.

(vi) Sediment quality. Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages.

(3) For coastal marine areas:

(i) Migratory corridor. A migratory pathway necessary for the safe and timely passage of Southern DPS fish within marine and between estuarine and marine habitats.

(ii) Water quality. Nearshore marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants (e.g., pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon.

(iii) Food resources. Abundant prey items for subadults and adults, which may include benthic invertebrates and fishes.

The NMFS identified several activities that may adversely affect the PCEs. Major categories of these activities are: (1) dams; (2) water diversions; (3) dredging and disposal of dredged material; (4) in-water construction or alterations (including channel modifications/diking, sand and gravel mining, gravel augmentation, road building and maintenance, forestry, grazing, agriculture, urbanization, and other activities); (5) National Pollution Discharge Elimination System permit activities and nonpoint source pollution; (6) power plants; (7) commercial shipping (including concerns related to exotic/invasive species introductions or spread); (8) aquaculture; (9) desalination plants; (10) proposed alternative energy hydrokinetic projects (e.g., tidal energy and wave energy projects); (11) liquefied natural gas projects; (12) bottom trawling; and (13) habitat restoration activities for other species.

Southern Distinct Population Segment Eulachon Critical Habitat

The NMFS designated critical habitat for eulachon on October 20, 2011 (76 FR 65324). This designation includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat. The lateral extent of critical habitat is defined as the width of the stream channel defined by the ordinary high water line, as defined by the U.S. Army Corps of Engineers in 33 CFR 329.11. Based on the best available scientific information, NMFS identified the following three PCEs for SDPS eulachon:

1. Freshwater spawning and incubation sites with water flow, quality, and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles;

2. Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted; and

3. Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival.

The NMFS identified several activities that may adversely affect the PCEs. Major categories of these activities are: (1) dams and water diversions; (2) dredging; (3) in-water construction or alterations; (4) pollution and runoff; (5) tidal, wind, or wave energy projects; (6) port and shipping terminals; and (7) habitat restoration projects.

2.3 Environmental Baseline

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

As described above in the Status of the Species and Critical Habitats sections, factors limiting the recovery of salmon and steelhead vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the action area, road construction, forest management, agriculture, mining, urbanization, and water development, have degraded freshwater streams and rivers, estuarine, and riparian areas. Each of these activities and the general loss and degradation of habitat has contributed to the decline of listed species.

The existing highway system in Washington State contributes to the degraded baseline condition in several ways. As of July 2012, over 1,500 WSDOT-owned culverts were fish passage barriers which block fish access to at least 249 miles of stream habitat. Many highways discharge stormwater to aquatic habitats with little or no treatment to remove pollutants such as suspended solids and metals. Sections of highways which parallel streams degrade stream bank and floodplain conditions by armoring the banks with riprap.

Because the action area for this programmatic consultation includes the combined action areas of individual road preservation, improvement, and maintenance projects whose locations are not yet known, it was not possible to precisely define the current condition of listed species or critical habitats in the action area, the factors responsible for that condition, or the conservation role of those specific areas. Therefore, to complete the jeopardy and destruction or adverse modification analyses in this consultation, NMFS made the following assumptions regarding the environmental baseline in each area that will eventually support an individual project:

1. The purpose of the proposed action is to authorize or carry out activities to preserve, improve, and maintain roadways in Washington State;

2. Each individual project area will be occupied by one or more listed species;

3. The biological requirements of individual fish in those areas are not being fully met because aquatic habitat functions, including functions related to habitat factors limiting the recovery of the species in each area, are impaired; and

2.4 Effects of the Action

"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. During consultation, neither NMFS nor the action agency identified any interrelated or interdependent actions.

2.4.1 Effects on Species

Stormwater

Exposure to stormwater pollutants causes reduced growth, impaired migratory ability, and impaired reproduction in salmonids and other fishes. The extent and severity of these effects varies depending on the extent, timing, and duration of the exposure, ambient water quality conditions, the species and life history stage exposed, pollutant toxicity, and synergistic effects with other contaminants (EPA 1980). The primary pollutants of concern in stormwater from road surfaces are total suspended solids (TSS), total zinc, dissolved zinc, total copper, and dissolved copper. Dissolved metals are particularly difficult to remove from stormwater.

The WSDOT uses the Highway Runoff Dilution and Loading model (HI-RUN) model to predict the post-treatment annual pollutant loading, effluent concentration, and dilution zone dimensions for projects in western Washington (WSDOT 2011b). The HI-RUN model uses a statistical procedure called Monte Carlo simulation. Monte Carlo simulation is a method that estimates possible outcomes from a set of random variables by simulating a process a large number of times and observing the outcomes. Using Monte Carlo simulation, the HI-RUN model calculates multiple model output scenarios by repeatedly sampling values for each input variable from computer-generated probability distributions. In this way, a probability distribution can be derived for the model output that indicates which predicted values have a higher probability of occurrence. The probability of exceeding a specific threshold for detrimental effects also can be determined using this procedure.

Dissolved copper and dissolved zinc are the constituents of greatest concern because they are prevalent in stormwater, they are biologically active at low concentrations, and they have adverse effects on salmonids and other fishes (Sandahl et al. 2007; Sprague 1968). Increased copper and zinc loading presents two pathways for possible adverse effects: direct exposure to water column pollutant concentrations in excess of biological effects thresholds and indirect adverse effects resulting from the accumulation of pollutants in the environment over time, altered food web productivity, and possible dietary exposure.

Baldwin et al. (2003) found that 30 to 60 minute exposures to a dissolved copper concentration of 2.3 μg/L over background level caused olfactory inhibition in coho salmon juveniles. Sandahl et al. (2007) found that a three hour exposure to a dissolved copper concentration of 2.0 μg/L caused olfactory inhibition in coho salmon juveniles.

The toxicity of zinc is widely variable, dependent upon concurrent levels of calcium, magnesium, and sodium in the water column (De Schamphelaere and Janssen 2004). A review of zinc toxicity studies reveals effects including reduced growth, avoidance, reproduction impairment, increased respiration, decreased swimming ability, increased jaw and bronchial abnormalities, hyperactivity, hyperglycemia, and reduced survival in freshwater fish (Eisler 1993). Juveniles are more sensitive to elevated zinc concentrations than adults (EPA 1987). Sprague (1968) documented avoidance in juvenile rainbow trout exposed to dissolved zinc concentrations of 5.6 μg/L over background levels.

The program will add up to 20 acres of new PGIS[4] per year to watersheds throughout the State of Washington. The NMFS used the HI-RUN model to estimate the state-wide total increase in pollutants loading. To be conservative, NMFS assumed no infiltration and basic water quality treatment. In reality, most projects covered under this Opinion will achieve some level of infiltration. Many projects will also used enhanced water quality BMPs which target dissolved metals. NMFS chose this conservative approach, in part, to account for any exemptions NMFS grants to the treatment levels described in the proposed action.

After water quality treatment proscribed in the HRM, the program will add approximately 643 pounds of total suspended solids, 0.56 pound of total copper, 0.34 pound dissolved copper, 2.6 pounds of zinc, and 1.8 pounds of dissolved zinc per year. However, the individual projects will average 0.25 acre of new impervious surface. Therefore, each individual project will, on average, add approximately eight pounds of total suspended solids, 0.007 pound of total copper, 0.004 pound dissolved copper, 0.033 pound of zinc, and 0.023 pound of dissolved zinc.

During storm events, the stormwater BMPs will discharge treated stormwater. The dilution zones (the distance downstream from an outfall that it takes to for pollutants to dilute to below the biological effects thresholds) for dissolved zinc and dissolved copper will typically be 10 feet or less for the individual projects in this program. Listed salmonids, green sturgeon, and eulachon that pass within 10 feet of the outfall during storm events are likely to experience sublethal effects, such as reduced growth and impaired migratory ability.

Riparian Vegetation Removal

The temporary removal of riparian vegetation affects listed salmonids by reducing streambank stability leading to erosion and sedimentation, increasing water temperatures,

[4] Projects which infiltrate all stormwater and therefore do not discharge pollutants to listed species habitats do not count against the 20-acre per year limit.

reducing leaf litter and organic input for aquatic insect production, and reducing LWM recruitment (Spence et al. 1996). Elevated water temperatures may adversely affect salmonid physiology, growth, and development, alter life history patterns, induce disease, and may exacerbate competitive predator-prey interactions (Spence et al. 1996). Loss of invertebrate production reduces the prey base for listed salmonids (Spence et al. 1996). Individual projects covered under this Opinion will average approximately 0.5 acre of riparian vegetation impacts. Revegetation of riparian areas disturbed by construction activities will maintain or improve habitat conditions for salmonids by increasing plant densities in degraded areas or changing plant species at the site to those that are more beneficial to aquatic species. Typically, it takes two to five years to restore riparian function to disturbed areas.

These small areas of riparian impacts are not likely to measurably affect the overall riparian condition of any watershed in Washington State. Statewide, the total riparian impacts of all individual projects approved in any single calendar year will not exceed five acres.

Impact Pile Driving

High levels of underwater sound can injure or kill fish and cause alterations in behavior (Turnpenny et al. 1994; Turnpenny and Nedwell 1994; Popper 2003; Hastings and Popper 2005). Death from barotrauma can be instantaneous or delayed up to several days after exposure. Even in the absence of mortality, elevated noise levels can cause sublethal injuries. Fish suffering damage to hearing organs may suffer equilibrium problems, and may have a reduced ability to detect predators and prey (Turnpenny et al. 1994; Hastings et al. 1996). Hastings (2007) determined that a Sound Exposure Level (SEL) as low as 183 dB (re: 1 μPa^2-sec) [5] was sufficient to injure the non-auditory tissues of juvenile spot (*Leiostomus xanthurus*) and pinfish (*Lagodon rhomboides*) with an estimated mass of 0.5 grams.

Adverse effects on survival and fitness can occur even in the absence of overt injury. Exposure to elevated noise levels can cause a temporary shift in hearing sensitivity (referred to as a temporary threshold shift), decreasing sensory capability for periods lasting from hours to days (Turnpenny et al. 1994; Hastings et al. 1996). Popper et al. (2005) found temporary threshold shifts in hearing sensitivity after exposure to cumulative SELs as low as 184 dB. Temporary threshold shifts reduce the survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success.

Cumulative SEL is a measure of the risk of injury from exposure to multiple pile strikes. The Equal Energy Hypothesis, described by NMFS (2007b), is used as a basis for calculating cumulative SEL. The number of pile strikes is estimated per continuous work period. This approach assumes that there will be a break of at least 12 hours between work periods. NMFS uses the practical spreading model to calculate transmission loss. The NMFS, USFWS, FHWA, and WSDOT agreed to interim criteria to minimize

[5] Throughout this document, the reference value for dB SEL is 1 μPa^2-sec.

potential impacts to fishes (FHWG 2008). The interim criteria include peak sound pressure level (SPL) and SEL injury threshold limits of:

- Peak SPL: levels at or above 206 dB from a single hammer strike likely results in the onset of physical injury; and
- SEL: cumulative levels at or above 187 dB for fish sizes of 2 grams or greater, or 183 dB for fish smaller than 2 grams.

The WSDOT will construct up to seven individual projects per year with in-water, impact pile driving throughout the State. Each project will have up to 40 steel piles up to 30 inches in diameter. One of the seven projects can impact drive sheet piles for a coffer dam if other installation methods are not feasible. The WSDOT will use a vibratory hammer to drive the piles. However, in order to ensure that the pile will be able to support the weight of construction equipment or to overcome difficult substrates, WSDOT will finish driving each pile with an impact hammer. The WSDOT will use a confined or unconfined bubble curtain for all impact pile driving (except for sheet piles) or conduct impact pile driving during times when listed fish species are not present.

In analyzing the sound levels for impact pile driving, NMFS uses underwater sound data and the number of strikes per pile from previous projects with the same or similarly sized piles (Illingworth and Rodkin 2007; WSDOT unpublished data). In order to estimate the impacts of an individual project which used the maximum allowable number and size of piles covered under this Opinion, NMFS analyzed the peak SPL and cumulative SEL injury thresholds for driving 40 30-inch steel piles. Based on information provided by WSDOT on past projects, NMFS assumed the following:

- WSDOT can drive between four and eight piles per day;

- After using a vibratory hammer, each pile will take 500 impact strikes; and

- The confined or unconfined bubble curtain will result in a 10dB reduction.

Given the assumptions above, underwater sound from the driving of 40 30-inch piles would exceed the injury thresholds at 10 feet for Peak SPL (206 dB), 282 feet for cumulative SEL for fish greater than or equal to two grams (187 dB), and 328 feet for cumulative SEL for fish less than two grams (187 dB). These zones would occur for between five and 10 days of pile driving. Assuming a work area of 150 linear feet, an individual project could expose approximately 800 linear feet per stream to injurious levels of underwater sound. This scenario is a reasonable worst-case for an individual project covered under this Opinion. The implementation of seven in-water pile driving projects of this magnitude would expose 5,642 linear feet of streambank to injurious levels of underwater sound per year in Washington State. The vast majority of covered projects will have smaller injury zones because of fewer and smaller diameter steel piles.

The NMFS cannot estimate the number of individuals that will experience adverse effects from underwater sound. Impact pile driving will occur episodically throughout the in-water work windows. NMFS cannot predict the number of individual fish that will be exposed. Furthermore, not all exposed individuals will experience adverse effects. NMFS expects that some individuals of listed fish species will experience sublethal effects, such as temporary threshold shifts, from underwater noise for each of the seven projects per year. Physical injury from barotrauma, while possible, is unlikely due to in-water work windows which avoid exposure to the most sensitive life history stages and the relatively small size of piles.

Suspended Sediment

Projects conducted under this proposed action will likely result in suspended sediment above background levels as a result of runoff from areas with disturbed riparian vegetation, placement of riprap, and pile driving. WSDOT will employ BMPs described in the HRM to minimize the production of suspended sediment. Sediment delivery from the proposed action will largely be temporary and localized in nature. Sediment delivery from disturbed riparian areas will occur only until new vegetation grows. Sediment production from pile driving will continue for only a short period after driving is completed, and will occur only in a small area surrounding the pile being driven. Likewise, placement of riprap and other bank hardening materials will produce localized, temporary sediment confined to approximately the duration and location of placement.

Sediment Effects on Listed Salmonids. Salmonids typically avoid areas of higher suspended sediment which can mean that they displace themselves from their preferred habitats in order to seek areas with less suspended sediment. Fish unable to avoid suspended sediment can experience adverse effects. The severity of effect of suspended sediment increases as a function of the sediment concentration and exposure time (Newcombe and Jensen 1996; Bash et al. 2001). Suspended sediments can cause sublethal effects such as elevated blood sugars and cough rates (Servizi and Martens 1991), physiological stress, and reduced growth rates. Elevated turbidity levels can reduce the ability of salmonids to detect prey, cause gill damage (Sigler et al. 1984; Lloyd et al. 1987; Bash et al. 2001), and cause juvenile steelhead to leave rearing areas (Sigler et al. 1984). Additionally, short-term pulses of suspended sediment influence territorial, gill-flaring, and feeding behavior of salmon under laboratory conditions (Berg and Northcote 1985). Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991). However, research indicates that chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Lloyd et al. 1987; Servizi and Martens 1991).

Monitoring turbidity, a measurement of water clarity, is a surrogate for monitoring the concentration of suspended sediment in a water sample. A nephelometric turbidity unit (NTU) is a measurement of turbidity. At a minimum, WSDOT must comply with Washington State water quality standards for turbidity (WAC 173-201A-200). State water quality standards allow for mixing zones of 300 feet or less for turbidity from the downstream extent of a project. The WSDOT will construct up to 40 projects per year with in-water work. Assuming a maximum in-water work area of 150 linear feet[6], the program will result in a maximum of 3.4 miles of streams exposed to elevated suspended sediment per year in the State of Washington. The 3.4-mile estimate is conservative. Many projects covered under this Opinion will take place in stream where the State water quality standards allow for a mixing zone of only 100 feet.

The NMFS cannot estimate the number of individuals that will experience adverse effects from suspended sediment. Pulses of elevated suspended sediment will occur episodically during the in-water work for individual projects. NMFS cannot predict the number or duration of each pulse nor the number of individual fish that will be exposed to each pulse. Furthermore, not all exposed individuals will experience adverse effects. NMFS will use the physical extent of elevated suspended sediment to quantify the effects of elevated suspended sediment on listed salmonids. NMFS expects that some individuals of listed fish species will experience sublethal effects described above from elevated suspended sediment for each of the 40 projects per year. However, because of the small scale of the projects, their distribution, and the temporary nature of sediment delivery, NMFS expects sediment impacts from any one project to be small, and impacts from the program as a whole are unlikely to disproportionately impact fish from any one population.

Sediment Effects on Green Sturgeon and Eulachon. Green sturgeon spend a majority of their sub-adult and adult life history stages in turbid environments and feed on benthic species such as ghost shrimp. Because of their age, location, and life history, these individuals are relatively distant from, and insensitive to, the effects of elevated suspended sediment described above, and those effects are unrelated to the principal factor for the decline of this species, the reduction of its spawning area in the Sacramento River. Adult and subadult green sturgeon are far less sensitive to elevated suspended sediment than salmonids. They spend most of their lives in turbid nearshore and estuarine environments and feed infaunal benthic prey such as burrowing shrimp. It is extremely unlikely the small, short-term increases in suspended sediment from the proposed action would adversely affect green sturgeon. Therefore, NMFS considers the effects of elevated suspended sediment from this program on SDPS green sturgeon to be insignificant.

Similar to green sturgeon, adult eulachon spend a majority of their sub-adult and adult life history stages in turbid environments and are unlikely to experience adverse effects from elevated suspended sediment. While elevated suspended sediment could impact eggs and larvae, the in-water work windows will ensure that eulachon eggs and larvae will not be exposed to elevated suspended sediment. Therefore, NMFS considers the effects of elevated suspended sediment from this program on SDPS eulachon to be both insignificant (for adults) and discountable (for eggs and larvae).

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[6] Based on past WSDOT projects

Fish Handling

Handling stresses fish, increasing plasma levels of cortisol and glucose (Hemre and Krogdahl 1996; Frisch and Anderson 2000). Electrofishing can kill fish or cause physical injuries including internal hemorrhaging, spinal misalignment, or fractured vertebrae. Although potentially harmful to fish, electrofishing is intended to locate fish in the isolated work area for removal to avoid more certain injury. Ninety-five percent of fish captured and handled survive with no long-term effects, and up to five percent are expected to be injured or killed, including delayed mortality because of injury (NMFS 2003a).

The program will implement up to 40 projects per year that dewater streams and handle fish. Based on review of past projects, NMFS expects that each project with in-water work area isolation will result in the capture of approximately l00 individuals of ESA-listed fish species considered in this Opinion. This estimate is conservative because it assumes a higher level of fish presence than will likely occur in during the work windows, or at times outside of work windows when NMFS determines that fish presence is low. Therefore, it includes projects which receive exemptions to the work window requirements as described in the proposed action. Up to five percent of fish handled are likely to be injured or killed and the remainder are likely to survive with no long-term effects (NMFS 2003a). Therefore, the program will injure or kill up to 200 fish per year during fish handling operations. Because the adult life stages of listed species will have a greater ability to avoid work areas and will be easier to herd out of in-water work areas without handling, the vast majority of the 200 will be juvenile salmonids.

Beneficial Effects

The primary beneficial effect of the program is the removal of fish passage barriers. From 1991 to 2011, WSDOT completed 258 fish barrier removal projects opening up over 850 miles of upstream habitat. In 2012, WSDOT had an additional 13 fish barrier removal projects under construction (WSDOT 2012b). NMFS expects WSDOT will continue to remove barrier culverts at a similar rate in the future. The program will result in an average of 12 fish barrier removal projects per year which will restore access to an average of 40 miles of stream habitat. Other beneficial effects include the reduction of stormwater pollutants in some watersheds through stormwater treatment and improved streambank conditions from replacing standard riprap bank protection with ISPG designs.

2.4.2 Effects on Critical Habitat

Salmon and Steelhead Critical Habitats

Freshwater Spawning Sites. The NMFS identified the three components of this PCE; water quantity, water quality, and substrate that support spawning, incubation, and larval development. The program will not affect water quantity. New impervious surfaces have the potential to alter flow regimes by increasing peak flows in the winter and reducing base flows in the summer. However, the small areas of new PGIS added by individual projects covered under this Opinion are unlikely to have any measurable effect on flows, and the program specifically excludes any individual project that would alter the flows of any waterbody.

Individual projects will have temporary adverse effects to water quality at spawning sites due to increased suspended sediment during in-water work. However, the in-water work windows will avoid spawning and incubation times for listed fish species, and water quality will return to pre-project conditions prior to the start of listed species spawning. Even after water qaulity treatment, stormwater discharges from new PGIS will increase the loadings of stormwater pollutants to streams in Washington State. However, the increases will be small and localized, and will not have a measurable effect on water quality of critical habitat at the watershed scale.

Increased suspended sediment could increase the percentage of fines in spawning gravels. However, given the small scale of the individual projects in the program and the in-water work windows which will avoid spawning and incubation times for listed fish species, the substrate will return to pre-project conditions prior to the start of listed species spawning.

Freshwater Rearing Sites. The components of this PCE are water quantity and quality, floodplain connectivity, forage, and natural cover. The effects to water quantity and water quality will be the same as described in the preceding section. The program will maintain floodplain connectivity conditions by repairing existing shoreline and bridge armoring and will improve floodplain connectivity conditions by replacing older bridges with newer ones that span more of the active channel and floodplain. Individual projects will cause localized reductions in forage and natural cover for listed salmon and steelhead impact by impacting riparian vegetation. These impacts will be offset in the long-term by on- and off-site restoration. Overall, these small areas of riparian impacts are not likely to measurably affect the forage and natural cover conditions of any individual watershed. Individual projects that replace conventional riprap revetments with the streambank techniques in Appendix A will improve the natural cover component of this PCE by incorporating LWM.

Freshwater Migration Corridors. Individual projects this program will temporarily impair this PCE by isolating in-water work areas. Overall, the program significantly improve this PCE throughout the State by replacing existing fish passage barrier culverts with fish passable culverts.

Estuarine Areas. The components of this PCE are water quantity, quality, and salinity, forage, and natural cover. The program will not affect salinity, and the impacts to water quantity and quality, forage, and natural cover will be the same as those described in the section on freshwater rearing.

Nearshore Marine Areas. The effects to water quality from suspended sediment will be the same as described section on freshwater spawning. The program will not measurably affect forage opportunities for listed salmon and steelhead in nearshore marine areas.

Offshore Marine Areas. The program will not affect offshore marine water quality or forage opportunities for listed salmon and steelhead.

Southern Distinct Population Segment Green Sturgeon Critical Habitat

Freshwater Riverine. Green sturgeon do not use non-tidally influenced freshwater areas of Washington State, and the program will not affect this PCE.

Estuarine Areas. In Washington, NMFS designated Grays Harbor, Willapa Bay, and the lower Columbia River estuary as critical habitat for SDPS green sturgeon. The components of this PCE are food resources, water flow and quality, migratory corridors, depth, and sediment quality. The program will not affect the food resources, water flow, migratory corridors, depth, or sediment quality components of SDPS green sturgeon critical habitat. The program will not affect water quality in estuarine areas in a way that will affect the normal behavior, growth, or survival of green sturgeon.

Coastal Marine Areas. The program will not affect the passage or forage components of this PCE. The water quality component is defined as "waters with adequate dissolved oxygen levels and acceptably low levels of contaminants." The program will not measurably affect these water quality parameters in coastal marine areas.

Southern Distinct Population Segment Eulachon Critical Habitat

Freshwater Spawning and Incubation Sites. The effects to this PCE are the same as those described for listed salmon and steelhead in the section on freshwater rearing..

Freshwater and Estuarine Migration Corridors. The effects to this PCE are the same as those described for listed salmon and steelhead on freshwater rearing and estuarine areas.

Nearshore and Offshore Marine Foraging Habitat. The program will not affect this PCE.

2.5 Cumulative Effects

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

Washington's population grew by over one million people between 1990 and 2000 (Washington State Office of Financial Management 2007). The Washington State Office of Financial Management projects the population will increase another 41 percent by the year 2030, primarily in the counties along Puget Sound and adjacent to metro areas. This increase is expected to result in some activities that are likely to adversely affect listed fish and their critical habitat within the action area, such as development, recreational activities, and road construction and maintenance.

The most common activities reasonably certain to occur in the action area are agricultural activities, operation of non-Federal hydropower facilities, urban and suburban development, recreational activities, logging, road construction and maintenance, and mining. These activities are often not Federal actions and would result in adverse effects to listed fish and their habitat. Some of the activities, such as logging and development, are subject to regulation under state programs, and the effects to fish and stream habitats are reduced to varying degrees under these programs compared to past effects reflected in the environmental baseline. These activities will result in negative effects to abundance, productivity, and spatial structure of fish at the population scale and result in some degradation of the condition of critical habitat PCEs.

Throughout Washington, watershed councils, Native American tribes, local municipalities, conservation groups, and others will continue to carry out restoration projects in support of listed fish recovery. Many of these actions will be covered by other programmatic consultations, or by future individual consultations, in which cases their effects will not be cumulative effects. Some of the private or state-funded actions for which funding commitments and necessary approvals already exist will not undergo consultation, and will result in beneficial cumulative effects. These beneficial effects will be similar to those described in the Effects to Listed Species section of this opinion. These effects will result in small improvements to abundance, productivity, and spatial structure of listed fish at the population scale, and result in some improvement to the condition of critical habitat PCEs.

2.6 Integration and Synthesis

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

The environmental baseline includes the effects of years of activities that have adversely affected listed fish and their critical habitat, such as urban and suburban development, agricultural practices, logging, and road construction and maintenance. The existing highway infrastructure includes culverts that do not permit fish passage, structures that hamper floodplain function, and impermeable surfaces that contribute stormwater pollutants to affected waters.

As described above in the cumulative effects section, population growth in Washington will result in future private and state actions in addition to ongoing activities described in the environmental baseline that will continue. These activities could result in adverse effects to listed fish and their habitat in addition to those described in the environmental baseline. Ongoing and future restoration activities throughout the State will result in benefits to listed fish. Those activities that result in negative effects will impact abundance, productivity, and spatial structure of fish at the population scale and result in degradation of the condition of critical habitat PCEs.

The effects of the proposed action on listed fish are both adverse and beneficial. While projects are expected to have short-term adverse effects on individual fish, the proposed action also includes activities such as culvert and bridge replacement that will address conditions currently impairing productivity over the long-term. It is unlikely given the small scale and temporary duration of the effects of individual projects that the aggregated biological effects of all the individual projects undertaken in this program will have a measurable effect on listed fish population abundance or productivity. The individual projects will have minimal, short-term, and spatially isolated effects that will not appreciably impact population spatial structure or diversity or environmental baseline. Because the program is not expected to impact any of the viability parameters for any affected species, it will therefore not reduce appreciably the likelihood of survival and recovery of any species in the wild.

Critical habitat within the action area supports migration, spawning, and rearing. Implementation of this program will cause short-term degradation of critical habitat. All of these effects will be minor and transient, and the physical and biological features of critical habitat will quickly recover from these minor disturbances. Some projects carried out under this program will cause longer-term effects on critical habitat. However, the minimization measures of the program will significantly reduce the severity of these effects. Based on the available information, only a few projects are likely to be authorized in this program in any given watershed. When considered at the watershed scale, the aggregate effects of all individual projects in this program will not appreciably impair the ability of critical habitat to provide for the conservation of listed species.

In addition to the environmental baseline, effects of this program, and cumulative effects, our conclusions for all species addressed by this Opinion are also based on following considerations:

1. the NMFS will review all individual projects to ensure the effects fall within the range of effects of this Opinion;

2. the minimization measures will ensure that any short-term effects to habitat will be brief, minor, and scheduled to occur at times least likely to affect listed species;

3. many projects, such as culvert replacements that remove passage barriers, will have beneficial long-term effects; and

4. the individual and combined effects of all individual projects will not impair properly functioning habitats, appreciably reduce the functioning of impaired habitats, or retard the progress of impaired habitats toward proper functioning condition.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of the species listed in Table 1 or destroy or adversely modify the designated critical habitats listed in Table 1.

2.8. Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a permit or exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. 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.

2.8.1 Amount or Extent of Take

Effects of the action will coincide with the presence of the species listed in Table 1, with the exception of listed rockfish and marine mammals, such that the incidental take is reasonably certain to occur. Take from fish handling is reported as the number of fish. Take caused by stormwater discharges, riparian vegetation removal, impact pile driving, and elevated suspended sediment cannot be accurately quantified as a number of fish because NMFS cannot predict, using the best available science, the number of individuals of listed fish species that will be exposed to these stressors. Furthermore, even if NMFS could estimate that number, the manner in which each exposed individual responds to that exposure cannot be predicted. In contrast, the number of fish affected by capture and handling can be estimated as provide below.

In circumstances where NMFS cannot estimate the amount of individual fish that would be injured or killed by the effects of the proposed action, NMFS assesses the extent of take as an amount of modified habitat and exempts take based only on that extent. This extent is readily observable and therefore suffices to trigger reinitiation of consultation, if exceeded and necessary (see H.R. Rep. No 97-567, 97th Cong., 2d Sess. 27 (1982).

For this program, implemented with the requirements described in the proposed action, NMFS exempts take for the following:

1. Stormwater discharges from 20 acres of new PGIS per year;

2. Removal of or impacts to 20 acres of riparian vegetation per year;

3. Exposure of 5,642 linear feet of stream to in-water noise above the thresholds describe in section 2.4.1.3 per year;

4. Exposure of 3.4 miles of streams to elevated suspended sediment per year; and

5. The handling of 4,000 individual listed fish per year of which 200 will be injured or killed.

2.8.2 Effect of the Take

The effect of take on listed species is that no jeopardy will occur among any of the species evaluated in this biological opinion.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" (RPMs) are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in section 7(o)(2) to apply.

The FHWA and the USACE shall minimize take of species listed in Table 1. These reasonable and prudent measures are necessary and appropriate to minimize the take of these species. The FHWA and the USACE shall:

1. minimize incidental take from stormwater discharges;

2. minimize incidental take from riparian vegetation removal;

3. minimize incidental take from impact pile driving;

4. minimize incidental take from elevated suspended sediment; and

5. minimize incidental take from fish handling;

2.8.4 Terms and Conditions

1. To implement RPM 1, FHWA and the USACE shall:

   a) For western Washington, implement the programmatic approach to monitoring detailed in "Programmatic Monitoring Approach for Highway Stormwater Runoff in Support of Endangered Species Act (ESA) Section 7 Consultations" (WSDOT 2009c);

   b) For western Washington, re-evaluate the effects of stormwater dischargers to listed species and critical habitats and, if necessary, reinitiate consultation if the programmatic monitoring results suggest the HI-RUN analyses performed for this program underestimated the effluent pollutant concentrations or the size of the dilution zones.

   c) For all individual projects, report to NMFS the total pre- and post-project PGIS in acres and the net increase in PGIS;

   d) For all individual projects in western Washington with new PGIS, report to NMFS the net change in loadings, in pounds per year, of total and dissolved copper, total and dissolved zinc, and TSS and the dilution zones for dissolved copper and dissolved zinc;

2. To implement RPM 2, FHWA and the USACE shall:

   a) Restore all temporarily disturbed riparian areas with native riparian trees and/or shrubs;

   b) Ensure there is no net loss of riparian function through on- or off-site restoration; and

   c) For all individual projects, report to NMFS the total temporary and permanent impacts to riparian vegetation and the total area of on- or off-site restoration.

3. To implement RPM 3, FHWA shall:

   a) Use a vibratory hammer to drive piles to the maximum extent practicable;

   b) Use a confined or unconfined bubble curtain when listed species may be present during impact pile driving (except for sheet piles and when driving in waters that are less than 3 feet deep);

   c) Implement the monitoring and reporting requirements described in section 1.3; and

d) For all individual projects, report to NMFS the total linear feet of stream exposed to injurious levels of underwater sound.

4. To implement RPM 4, FHWA shall:

a) Conduct all work below the OHWM within the WDFW's Allowable Freshwater Work Times unless NMFS has approved an alternate in-water work window as described in the proposed action (WDFW 2010);

b) Monitor turbidity during in-water work and report the results of the monitoring to NMFS; and

c) Report any violations of WDFW's Hydraulic Project Approval or Ecology's requirements to NMFS via email.

5. To implement RPM 5, FHWA shall:

a) Follow the WSDOT Fish Exclusion Protocols and Standards (WSDOT 2009a) or most the recent NMFS-approved guidance; and

b) Report the number and species of all listed fish handled during in-water work.

2.9. Conservation Recommendations

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

In order to develop information to reduce impacts from transportation projects on listed species, NMFS recommends that WSDOT and FHWA continue to research new technologies to minimize underwater noise from pile driving and the levels of pollutants in stormwater discharges.

2.10 Reinitiation of Consultation

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

modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 "Not Likely to Adversely Affect" Determinations

2.11.1 Southern Resident Killer Whale and Southern Resident Killer Whale Critical Habitat

The proposed action will not have any direct effects on Southern Resident killer whales (SRKWs). Underwater noise from in-water pile driving is the most likely mechanism of direct effects to SRKWs from transportation projects. These types of projects are not covered in this Opinion (see Section 1.3.2.9, Excluded Projects). Projects which adversely affect SRKWs by any other mechanism are also excluded from this Opinion.

The project may indirectly affect the quantity of prey available to Southern Residents. Any salmonid take up to the aforementioned maximum extent and amount would result in an insignificant reduction in adult equivalent prey resources for Southern Resident killer whales that may intercept these species within their range. Therefore, NMFS concurs with FHWA's determination that the proposed action may affect, but is not likely to adversely affect Southern Resident killer whales.

2.11.2 Eastern Distinct Population Segment of Steller Sea Lion

As with SRKWs, underwater noise from in-water pile driving is the most likely mechanism of direct effects to Steller sea lion from transportation projects. Again these projects are not covered under this Opinion. NMFS does not expect impacts to accrue from the activities considered in this Opinion. Based on these minimization measures, NMFS finds that the effects of the proposed action are expected to be insignificant and/or discountable, and thus are not likely to adversely affect Steller sea lions.

2.11.3 Yelloweye Rockfish, Canary Rockfish, and Bocaccio

Rockfish fertilize their eggs internally and the young are extruded as larvae. Rockfish larvae are pelagic, often found near the surface of open waters, under floating algae, detached seagrass, and kelp. Juvenile bocaccio and canary rockfish settle onto shallow nearshore water in rocky or cobble substrate that support kelp and other macroalgae at 3 to 6 months of age, and move to progressively deeper waters as they grow (Love et al. 2002). Juvenile yelloweye rockfish do not typically occupy shallow waters (Love et al. 1991) and are very unlikely to be within the action area. Adult yelloweye rockfish, canary rockfish, and bocaccio typically occupy waters deeper than 120 feet (Love et al. 2002).

The project will occur adjacent to waters that consist of sand and mud substrates of Commencement Bay and that are devoid of kelp. The action area are less than 120 feet deep. As such, adults of ESA-listed rockfish are not expected to occur within this area and will not be affected by project activities. Juvenile canary rockfish, yelloweye rockfish, and bocaccio are unlikely to occupy the action area because of the characteristics of their substrates and lack of kelp.

Larval yelloweye rockfish, canary rockfish or bocaccio could occur within the project and action area, though they are readily dispersed by currents after they are born, making the concentration or probability of presence of larvae in any one location extremely small (NMFS 2003b). The size of the project and action area where effects could occur to larval ESA-listed rockfish, combined with the short duration of project activities, make it extremely unlikely and therefore discountable that a larvae will be present and thus exposed to project activities. Because all potential adverse effects are discountable, NMFS concurs with the determination of may affect, not likely to adversely affect for yelloweye rockfish, canary rockfish, and bocaccio.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Adverse effects include the direct or indirect physical, chemical, or biological alterations 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 EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the Federal action agency and descriptions of EFH contained in the fishery management plan developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific Coast salmon (PFMC 1999).

3.1 Essential Fish Habitat Affected by the Project

The proposed action will affect EFH designated for coastal pelagic species, Pacific Coast groundfish, and Pacific Coast salmon, including estuaries designated as habitats areas of particular concern (HAPCs).

3.2 Adverse Effects on Essential Fish Habitat

As described fully in the preceding sections, the following effects may result from the proposed action:

1. Stormwater discharges from 20 acres of new PGIS per year;

2. Removal or impacts to five acres of riparian vegetation per year;

3. Exposure of 5,642 linear feet of stream to in-water noise above the thresholds describe in section 2.4.1.3 per year; and

4. Exposure of 3.4 miles of streams to elevated suspended sediment per year.

3.3 Essential Fish Habitat Conservation Recommendations

The NMFS expects that full implementation of these EFH conservation recommendations would
protect, by avoiding or minimizing the adverse effects described in section 3.2 above, approximately 52 acres of designated EFH for Pacific coast salmon per year. These conservation
recommendations are a subset of the ESA terms and conditions. NMFS recommends that FHWA:

1. For western Washington, implement the programmatic approach to monitoring detailed in "Programmatic Monitoring Approach for Highway Stormwater Runoff in Support of Endangered Species Act (ESA) Section 7 Consultations" (WSDOT 2009c);

2. For western Washington, re-evaluate the effects of stormwater dischargers to listed species and critical habitats and, if necessary, reinitiate consultation if the programmatic monitoring results suggest the HI-RUN analyses performed for this program underestimated the effluent pollutant concentrations or the size of the dilution zones;

3. For all individual projects with new PGIS, report to NMFS the total pre- and post-project PGIS in acres and the net increase in PGIS;

4. For all individual projects with new PGIS in western Washington, report to NMFS the net change in loadings, in pounds per year, of total and dissolved copper, total and dissolved zinc, and TSS and the dilution zones for dissolved copper and dissolved zinc;

5. Restore all temporarily disturbed riparian areas with native riparian vegetation;

6. Ensure there is no net loss of riparian function through on- or off-site restoration;

7. For all individual projects, report to NMFS the total temporary and permanent impacts to riparian vegetation and the total area of on- or off-site restoration;

8. Use a vibratory hammer to drive piles to the maximum extent practicable;

9. Use a confined or unconfined bubble curtain when listed species may be present during impact pile driving (except for sheet piles and when driving in waters that are less than 3 feet deep);

10. Implement the monitoring and reporting requirements for pile driving described in section 1.3.2.4.3;

11. For all individual projects, report to NMFS the total linear feet of stream exposed to injurious levels of underwater sound;

12. Conduct all work below the OHWM within the WDFW's Allowable Freshwater Work Times (WDFW 2010);

13. Monitor turbidity during in-water work and report the results of the monitoring to NMFS; and

14. Report any violations of WDFW's Hydraulic Project Approval or Ecology's requirements to NMFS via email.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Federal action agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH conservation recommendation from NMFS. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH conservation recommendations, unless NMFS and the Federal action agency have agreed to use alternative time frames for the Federal action 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 NMFS' conservation recommendations, the Federal action 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(l)(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 response and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The (Federal action agency) must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations, 50 CFR
600.920(k)(1).

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 Biological Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. These users include three agencies of the Federal government (NMFS, FHWA, and USACE), the WSDOT, the residents of the State of Washington, and the general public.

Individual copies were provided to the above-listed entities. This consultation will be posted on the NMFS Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

4.3.1 Information Product Category

Natural Resource Plan.

4.3.2 Standards

This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01, *et seq.,* and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

4.3.3 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.

4.3.4 Referencing

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

4.3.5 Review Process

This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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APPENDIX

1. INTEGRATED STREAMBANK PROTECTION GUIDELINE (ISPG) TECHNIQUES

1.1 Introduction

WSDOT uses the Integrated Streambank Protection Guidelines (ISPG) extensively in its bank stabilization efforts. The ISPG discusses the mechanisms and causes of stream bank failure, identifies channel, hydraulic, and habitat risk factors for streambank protection projects, and describes descriptions and conceptual designs for a number of standardized techniques to use in streambank protection. WSDOT currently uses the following three categories of techniques:

1. Smaller and simpler Large Woody Material (LWM) designs (9 techniques);

2. Large and complex LWM designs (6 techniques); and

3. Floodplain Roughness Features (2 techniques).

1.2 Smaller and Simpler Large Woody Material (LWM) Designs

The WSDOT uses simple LWM designs for bank stabilization on small steams (less than 30 feet wide). Simple LWM designs rely on the weight of the logs, boulders, and overburden for stability. While they may have vertical elements such as driven posts, they do not rely on the them for anchoring.

1.2.1 Simple Ballasted Logs

This design consists of a log or series of logs cabled to large boulders. The WSDOT uses simple ballasted logs to protect banks by arranging them at the toe of the bank, perpendicular to flow. Because of their anchoring system, ballasted logs only work in river systems that bring in aggregate and bedload which buries the anchor boulders over time.

1.2.2 Roughness Trees

Roughness trees decrease water velocity by adding roughness to the channel. Roughness trees are LWM installations in the channel and along banks which increase resistance to current. They trap sediment and allow riparian vegetation to establish.

1.2.3 Anchor Points

Anchor points, composed of boulders and logs, mimic natural hard structures such as trees or rock outcroppings. Anchor points prevent or limit erosion near isolated streambank erosion sites. The WSDOT uses anchor points as a stand-alone treatment and in combination with other techniques.

1.2.4 Roughened Log Toes

The WSOT constructs roughened log toes by placing logs, large woody material, rocks, and gravel fill parallel to the streambank between the channel bottom and the lower vegetation limit. Log toes provide a foundation for upper-bank treatments such as reinforced soil (section 1.4.3). They may extend under a reconstructed bank to provide protection at the toe of the streambank where erosion is strongest.

1.2.5 Log crib walls

Log crib walls are a type of retaining wall consisting of an elongated box made out of logs and backfilled with soil and rock. Long, parallel logs referred to as "stretchers" are parallel with the channel centerline, while shorter logs called "headers" are perpendicular to the channel. The stretchers and headers are arranged alternately to create a crib wall. After construction, WSDOT plants trees and other riparian vegetation in the gaps between the logs.

1.2.6 Groins

Groins are large roughness elements of rock and LWM constructed individually or in a series. They project into the channel from the bank and extend above the high-flow elevation in order provide continuous bank roughness. Groins redirect flow away from a streambank and reduce velocities near banks. Sediment accumulates behind groins to further protect banks. Groins have a higher profile than barbs (section 1.2.7), and they deepen the thalweg and narrow the stream.

1.2.7 Barbs

Barbs are similar to groins but are lower in profile. They angle upstream to control erosion and direct flow away from the bank. Flow spills over barbs toward the center of the channel. Barbs reduce near-bank water velocity, increase channel roughness, dissipate energy, reduce channel-bed shear stress, and interrupt sediment transport.

1.2.8 Buried Groins

The WSDOT constructs buried groins (rock and LWM) in the ground beneath the eroding bank to stop bank erosion . When the stream erodes around the buried groins, they function like normal groins to redirect flow and reduce velocities.

1.2.9 Wood Studded Revetments

Wood studded revetments are rock revetments studded with root wads to provide roughness, diffuse energy, and deflect flows.

1.3 Large and complex LWM designs

The WSDOT uses the following large and complex LWM designs to protect the banks of larger streams (greater than 30 feet wide).

1.3.1 Engineered Log Jams

Engineered log jams (ELJ) mimic large naturally occurring log jams and redirect flow for streambank stability. They consist of 10 or more logs that extend both below and above bankfull water surface. The WSDOT uses three types of ELJs, meander jams, flow deflection jams, and apex bar jams.

1.3.1.1 Meander Jams

The WSDOT constructs meander jams on the outside bank and the downstream half of meander bends in large, low gradient channels. Meander jams recruit additional wood and deflect and diffuse flows.

1.3.1.2 Flow Deflection Jams

Flow deflection jams are smaller than meander jams. Flow deflection jams consist of a series of logs with attached root wads and often include large volumes of material collected on the jam.

1.3.1.3 Apex Bar Jams

Apex bar jams are crescent or fan shaped jams at the head of islands or gravel bars. Apex bar jams split and turn flows. Bars downstream these jams tend to grow and become persistent. Apex bar jams recruit large volumes of additional wood.

1.3.2 High Crib Walls

High crib walls consist of pilings and a linear log matrix. They provide contiguous protection to the bank with a great deal of roughness and complexity. High crib walls are narrow in profile and minimize occlusion of the channel. They are especially useful in narrow channels that cannot accommodate wider structures.

1.3.3 Dolotimber

Dolotimbers are ballasted, prefabricated “logs.” While not described specifically in ISPG, they represent a further development in ELJ technology. The WSDOT can construct jams using dolotimbers without pilings and in areas such where traditional ELJs are not feasible.

1.3.4 Drop structures

Drop structures consist of rock and wood. The WSDOT uses them to facilitate fish passage and to counter vertical instability, such as channel incision.

1.4 Floodplain Roughness Features

1.4.1 Floodplain Flow Spreaders

Floodplain flow spreaders are most often constructed using woody plantings, rock aprons, or fascines. WSDOT uses them to prevent preferential flow pathway formation on re-vegetated banks or floodplains adjacent to vulnerable bridges.

1.4.2 Woody Plantings and Herbaceous Cover

Woody plantings and herbaceous cover enhance floodplain roughness and restore disturbed stream banks and riparian areas.

1.4.3 Soil Reinforcement and Coir Logs

Soil reinforcement and coir logs restore upper stream banks and riparian areas.