UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
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Seattle, WA 98115

Refer to NMFS No:
2010/03196

January 19, 2011

John McAvoy, P.E.
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R.F. Krochalis
Regional Administrator
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Re: Endangered Species Act Section 7 Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation Recommendations for the Columbia River Crossing (Federal #: HPP S001(250), Lower Columbia–Clatskanie Rivers (4th field HUC 17080003), Lower Columbia River (4th field HUC 17080006), and Lower Willamette River (4th field HUC 17090012), Oregon and Washington

Dear Messrs. Krochalis and McAvoy:

The enclosed document contains a biological Opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act (ESA) on the effects of the Federal Highway Administration (FHWA) and the Federal Transit Authority (FTA) partially funding the proposed Columbia River Crossing (CRC). The proposed CRC includes the replacement of the Interstate 5 freeway bridges across the lower Columbia River between Portland, Oregon and Vancouver, Washington. As co-leads, funding to design and engineer this project originates from the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), under sections 1101, 1701, 1702, and 5309 (23 U.S.C.) (New Starts Program).

In this Opinion, NMFS concluded that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River (UWR) Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), LCR coho salmon (*O. kisutch*), SR sockeye salmon (*O. nerka*), LCR steelhead (*O. mykiss*), UWR steelhead, Middle Columbia River (MCR) steelhead, UCR steelhead, Snake River Basin (SRB) steelhead, southern green sturgeon (*Acipenser medirostris*), eulachon (*Thaleichthys pacificus*), or eastern Steller sea lion (*Eumetopias jubatus*), or result in the destruction or adverse modification of critical habitats designated for any of the above listed species, except LCR coho salmon, for which critical habitat is not proposed or designated, eulachon, for which critical habitat is proposed but not yet designated, and eastern Steller sea lion, which does not have critical habitat designated in the action area.

In addition, NMFS concurred with the FHWA and FTA's determination that the proposed action is not likely to adversely affect the southern resident killer whale (*Orcinus orca*). The southern resident killer whale does not have critical habitat designated in the action area.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the Opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the FHWA and FTA must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species considered in this Opinion, except for eastern Steller sea lion.

The NMFS did not include take of eastern Steller sea lions in this exemption because the FHWA and FTA are not authorized to take sea lions under section 101(a)(5) of the Marine Mammal Protection Act. If the FHWA and FTA obtain that authorization, they may request an amendment that will add eastern Steller sea lions to this exemption.

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

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

If you have questions regarding this consultation, please contact Devin Simmons, Fishery Biologist in the Willamette Basin Habitat Branch of the Oregon State Habitat Office, at 503.231.2313.

Sincerely,

for Michael Tehan

William W. Stelle, Jr.
Regional Administrator

cc: Jim Brick, ODFW
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Endangered Species Act
Section 7 Biological Opinion

and

Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Conservation Recommendations

for the

Columbia River Crossing (Federal #: HPP S001(250),
Lower Columbia–Clatskanie Rivers (4th field HUC 17080003),
Lower Columbia River (4th field HUC 17080006), and
Lower Willamette River (4th field HUC 17090012),
Oregon and Washington

Lead Action Agencies: Federal Highway Administration
Federal Transit Authority

Consultation Conducted By: National Marine Fisheries Service
Northwest Region

Date Issued: January 19, 2011

Issued by: for William W. Stelle, Jr.
Regional Administrator

NMFS No.: **2010/03196**

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LIST OF ABBREVIATIONS

BA	Biological Assessment
BMP	Best Management Practice
CFR	Code of Federal Regulations
CHART	Critical Habitat Analytical Review Team
CIA	Contributing Impervious Area
CRC	Columbia River Crossing
dB	Decibel
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FR	Federal Register
FTA	Federal Transit Authority
HUC	Hydraulic Unit Code
I-5	Interstate Freeway 5
LCR	Lower Columbia River
MCR	Mid Columbia River
MP	Mile Post
MSA	Magnuson Stevens Act
NMFS	National Marine Fisheries Service
ODOT	Oregon Department of Transportation
OHW	Ordinary High Water
PCE	Primary Constituent Element
Re: 1µPa	Reference 1 MicroPascal
RM	River Mile
RMS	Root Mean Squared
ROW	Right of Way
SEL	Sound Exposure Level
SR	Snake River, or State Route
SRB	Snake River Basin
TRT	Technical Review Team
UCR	Upper Columbia River
U.S.C.	United States Code
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WLC	Willamette/Lower Columbia
WDOT	Washington State Department of Transportation

INTRODUCTION

This document contains a biological Opinion (Opinion) that was prepared by the National Marine Fisheries Service (NMFS) 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.[1] It also contains essential fish habitat (EFH) conservation recommendations prepared by NMFS 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 section 515 of the Treasury and General Government Appropriations Act of 2001 (Data Quality Act) (44 U.S.C. 3504 (d)(1) and 3516), and underwent pre-dissemination review. The administrative record for this consultation is on file at the Oregon State Habitat Office in Portland, Oregon

Background and Consultation History

The Federal Highway Administration (FHWA) and Federal Transit Authority (FTA) propose to use their authority under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), under sections 1101, 1701, 1702, and 5309 (New Starts Program) to complete preliminary engineering and an environmental impact statement (EIS) for the Interstate 5 (I-5) Columbia River Crossing (CRC). The CRC project planning team (CRC Team) consists of staff from the FHWA and FTA and their agents, the Washington Department of Transportation (WDOT) and the Oregon Department of Transportation (ODOT). This Opinion is necessary to complete the EIS.

On August 23-24, 2005, the NMFS began coordination with the CRC Team at an interagency workshop to coordinate development of an EIS.

On February 28, 2006, NMFS agreed to participate in the CRC Interstate Collaborative Environmental (InterCEP) Process Group, a NEPA compliance streamlining effort, by signing the January 25, 2006 InterCEP Agreement (CRCP 2006).

On November 9, 2006, NMFS submitted official technical guidance for use within the draft EIS.

On August 6, 2008, NMFS submitted official comments on the CRC Draft EIS.

On October 20, 2009, NMFS facilitated a CRC Team and Fish Passage Advisory Group (FPAC) coordination meeting to gain the best available fish abundance, presence, and timing data available for the 13 species of Pacific salmon and steelhead species affected by the action.

[1] With respect to designated critical habitat, the following analysis relied only on the statutory provisions of the ESA, and not on the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02.

On June 25, 2010, after an extended period of informal consultation, the FHWA and FTA requested formal consultation under section 7 of the ESA and EFH consultation under the MSA. They concluded that the proposed action is not likely to adversely affect southern resident killer whale (*Orcinus orca*), and is likely to adversely affect the following 16 ESA-listed species and their designated critical habitats (critical habitat has not been designated or proposed for LCR coho salmon or eulachon), and would adversely affect EFH designated for Chinook and coho salmon:

- Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tschawtscha*),
- Upper Willamette River (UWR) Chinook salmon,
- Upper Columbia River (UCR) spring-run Chinook salmon,
- Snake River (SR) spring/summer run Chinook salmon,
- SR fall-run Chinook salmon,
- Columbia River (CR) chum salmon (*O. keta*),
- LCR coho salmon,
- SR sockeye salmon (*Oncorhynchus nerka*),
- LCR steelhead (*O. mykiss*),
- UWR steelhead,
- MCR steelhead,
- UCR steelhead,
- Snake River Basin (SRB) steelhead
- southern green sturgeon (*Acipenser medirostris*)
- eulachon (*Thaleichthys pacificus*), and
- eastern Steller sea lion (*Eumetopias jubatus*).

On August 11, 2010, NMFS notified the FHWA and FTA that the BA was complete and that NMFS will complete a biological opinion by November 7, 2010.

On September 22, 2010, the CRC Team provides NMFS with the final data summaries of ESA-listed salmon, steelhead, and eulachon of presence, abundance, timing, and calculated hydroacoustic related take estimates for use in formal consultation. This represents a culmination of coordination with NMFS and the FPAC.

On September 23, 2010, the FHWA and FTA submit a draft final stormwater design package for use in the Opinion.

On September 28, 2010, the FHWA and FTA replied to a letter from the NMFS Office of Protected Resources, dated August 12, 2010, regarding the CRC Team's request for a Letter of Authorization for incidental take under the Marine Mammal Protection Act.

On October 4, 2010, the FHWA and FTA submit final details qualifying the September 23, 2010 transmittal. Final engineering will continue as final design of the action occurs.

On October 13, 2010, the FHWA and FTA notified NMFS that service changes to the new North Portland Harbor bridges is likely after the conclusion of consultation. This would add a direct local connection between Hayden Island and North Marine Drive. However, this addition would not change the degree or amount of effects addressed in this Opinion due to using already planned for bridge structure. In addition, the project may be phased due to funding, which could prolong the construction.

On October 19, 2010, the FHWA and FTA provided an additional response to the NMFS Office of Protected Resources. This response included a new analysis of the effects of the proposed CRC on eastern Steller sea lions, and an addendum to BA Appendix K with final calculations of the impacts of underwater noise to fish.

On October 21, 2010, the FHWA and FTA submit final elements of the proposed action, including a test pile program to be completed before CRC construction begins.

On November 17, 2010, the FHWA and FTA submitted a final application for incidental take under the Marine Mammal Protection Act that revised the analysis of effects of the CRC on eastern Steller sea lions.

On December 8, 2010, NMFS, FHWA and FTA concur that the test pile program has separate utility and function from the CRC, and would be consulted on separately (see NMFS 2010).

Description of the Proposed Action

The FHWA and FTA will complete a multimodal transportation improvement project within a 5-mile corridor of I-5 to improve safety; reduce traffic congestion; increase mobility of motorists, freight, bicyclists, and pedestrians from Vancouver, Washington to Portland, Oregon; and to extend the light-rail train (Tri-MET's Yellow Line MAX) from Delta Park, in Portland, Oregon, to Clark College in Vancouver, Washington (Figure 1). Construction will begin in September 2012, and end in December 2020.

The proposed action will include replacement of the current pair of I-5 bridges spanning the lower Columbia River. It will also add three new bridges that cross the North Portland Harbor, and widen the existing I-5 crossing over the harbor as well. Construction of the lower Columbia River bridges would occur from 2013 – 2017, and Harbor bridge construction would occur from 2013-2016. FHW and FTA plan to complete construction below ordinary high water (OHW) for both bridges by April 2017. The in-channel portion of the work will occur within a tidally influenced area that terminates approximately 40 river miles upstream of the project area at Bonneville Dam.

Figure 1. Alignments of the proposed Columbia River Crossing highway improvements, bridges, and light rail features.

Columbia River Bridge

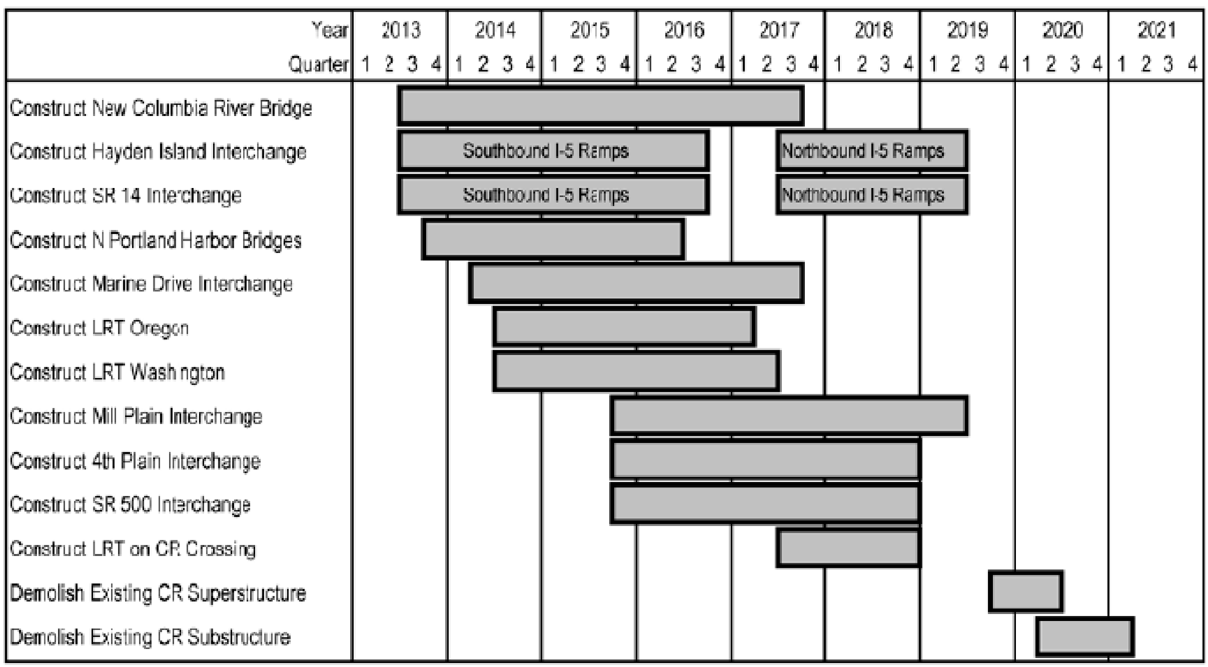
The northbound and southbound replacement structures located at Columbia river mile (RM) 106 will be constructed downstream of the current crossing on a curved alignment to preserve the existing points of landward alignment for ingress and egress of the crossing. These bridges will have a 15 foot gap between them, spanning the lower Columbia River from Vancouver, Washington, to Hayden Island, Portland, Oregon (Table 1):

Table 1. Approximate width, length and clearance of the proposed Columbia River Crossing bridge over the mainstem of the lower Columbia River.

Bridge	**I-5 Northbound**	**I-5 Southbound (with light rail)**
Width over water (ft)	Varies: 91-130	Varies: 91-130
Length over water (ft)	2,700	2,650
Bridge Clearance (ft)	Varies: 95	Varies: 95

The bridges' substructure will be supported by eight matched pier sets, 16 piers total, each supported by a complex of up to nine 10 foot diameter columns and a pier cap. These pier sets are numbered 1-8 with the sequence beginning landward on Hayden Island and ending landward in the City of Vancouver. Only sets 2-7 will be built below OHW (*i.e.*, 17.6 feet National Geodetic Vertical Datum) (Corps 2004), and use 88 columns. The FHWA and FTA will construct these columns using a sequential drilled-shaft technique (Table 2).

Table 2. Estimated timeline for construction of the proposed Columbia River Crossing bridge over the mainstem of the lower Columbia River.



CR = Columbia River; LRT = Light Rail Transit; N = North; SR = State Route

Each shaft will be constructed by first advancing a 10 foot diameter steel casing either by use of a vibratory hammer or by using hydraulic rams to oscillate or rotate it through river bottom sediments into the Troutdale Formation, a geologic layer of consolidated aggregate. Advancement would continue several feet into this formation, which may be up to approximately

272 feet below OHW. The casing is then drilled (hollowed) and the tailings removed for disposal, a re-bar cage is dropped into place, and the shaft is filled with concrete. The casing will be removed for re-use. Once all of the columns within a complex are finished then they are joined by poured (in-place) concrete and steel fittings to form a pile-cap. This kind of work is typically contained by a form that is floated into place by barges. The cap and its columns bear the load placed upon the pier that it supports entirely.

To construct the bridge piers, temporary round hollow-steel pile will be installed to create temporary work platforms, work bridges, falsework, and vessel tethers that will support equipment and people necessary to construct the piers and the superstructure of the bridge itself (Table 3). Equipment likely to be supported includes but is not limited to cranes, generators, and hydraulic rams. Load-bearing piles will be installed by first advancing them to a point of refusal using a vibratory hammer, and then using an impact hammer to proof, or test, each pile for a specified vertical load bearing capacity. Non-load bearing piles will be advanced to refusal only.

Table 3. Estimated number of cofferdams and piles necessary to complete the temporary in-water structure for the proposed Columbia River Crossing bridge over the mainstem of the lower Columbia River.

	Count
Cofferdams	2
Pipe Piles	
Load Bearing 18-24 inches	600
Load Bearing 36-48 inches	240
Non-Load Bearing 18-24 inches	384
Total	**1,224**
Support Structures	18
Barges	Up to 12 at a single time

Impact driving will be non-continuous, and within discrete blocks across 31-weeks of in-water work from September 15 through April 15 of each year (Table 4). Pile driving will occur every year for 6-years. The impact driving strike rate is 40-strikes per minute. Daily pile installation includes up to 6-piles, three 18-24 inch piles and three 36-48 inch piles. Impact driving may occur across a 12-hour period each day, but will not include more than 1-hour of actual pile driving activity. Vibratory driving without impact driving will occur year-round, as needed. The total number of days of impact pile driving in the Columbia River will be between 138 and 142 days.

Table 4. Example of sequence of pile driving and removal for the Columbia River Crossing bridges.

Figure 3-6. Sequencing of Pile Driving and Removal for Construction in the Columbia River

Task Name	Start	Finish	Duration
Bridge Construction Scenario 2/5/13	**9/16/13**	**4/5/17**	**928 days**
Pier 2	**10/16/13**	**1/22/16**	**593 days**
Install Work Bridge Piles (Vibratory & Impact Pile Driving)	10/16/13	11/14/13	22 days
Install Cofferdam (Vibratory Installation)	12/31/13	3/11/14	51 days
Remove Work Bridge & Piles (Vibratory Removal)	9/16/14	10/13/14	20 days
Remove Cofferdam (Vibratory Removal)	2/27/15	3/19/15	15 days
Erect Tower Crane (Vibratory & Impact Pile Driving)	2/27/15	3/19/15	15 days
Remove Tower Crane (Vibratory Removal)	1/11/16	1/22/16	10 days
Barge Moorings (Vibratory Installation & Removal)	10/16/13	1/22/16	593 days
Pier 3	**9/16/13**	**9/29/15**	**532 days**
Install Work Bridge Piles (Vibratory & Impact Pile Driving)	9/16/13	10/15/13	22 days
Remove Work Platform & Piles (Vibratory Removal)	3/24/14	9/26/14	135 days
Erect Tower Crane (Vibratory & Impact Pile Driving)	9/29/14	10/17/14	15 days
Remove Tower Crane (Vibratory Removal)	9/16/15	9/29/15	10 days
Barge Moorings (Vibratory Installation & Removal)	9/16/13	9/29/15	532 days
Pier 4	**11/15/13**	**10/20/15**	**503 days**
Install Work Bridge Piles (Vibratory & Impact Pile Driving)	11/15/13	12/17/13	23 days
Remove Work Platform & Piles (Vibratory Removal)	10/9/14	11/19/14	30 days
Erect Tower Crane (Vibratory & Impact Pile Driving)	3/20/15	4/9/15	15 days
Remove Tower Crane (Vibratory Removal)	10/7/15	10/20/15	10 days
Barge Moorings (Vibratory Installation & Removal)	11/15/13	10/20/15	503 days
Pier 5	**10/29/14**	**10/19/16**	**516 days**
Install Work Bridge Piles (Vibratory & Impact Pile Driving)	10/29/14	11/28/14	23 days
Remove Work Platform & Piles (Vibratory Removal)	9/16/15	10/27/15	30 days
Erect Tower Crane (Vibratory & Impact Pile Driving)	3/21/16	4/8/16	15 days
Remove Tower Crane (Vibratory Removal)	10/6/16	10/19/16	10 days
Barge Moorings (Vibratory Installation & Removal)	10/29/14	10/19/16	516 days
Pier 6	**12/1/14**	**4/5/17**	**613 days**
Install Work Bridge Piles (Vibratory & Impact Pile Driving)	12/1/14	12/31/14	23 days
Remove Work Platform & Piles (Vibratory Removal)	1/5/16	2/15/16	30 days
Erect Tower Crane (Vibratory & Impact Pile Driving)	4/11/16	9/23/16	120 days
Remove Tower Crane (Vibratory Removal)	3/23/17	4/5/17	10 days
Barge Moorings (Vibratory Installation & Removal)	12/1/14	4/5/17	613 days
Pier 7	**9/29/14**	**1/23/17**	**606 days**
Install Work Bridge Piles (Vibratory & Impact Pile Driving)	9/29/14	10/28/14	22 days
Install Cofferdam (Vibratory Installation)	12/11/14	2/20/15	52 days
Remove Work Bridge & Piles (Vibratory Removal)	9/16/15	10/13/15	20 days
Remove Cofferdam (Vibratory Removal)	2/29/16	3/18/16	15 days
Erect Tower Crane (Vibratory & Impact Pile Driving)	2/29/16	3/18/16	15 days
Remove Tower Crane (Vibratory Removal)	1/10/17	1/23/17	10 days
Barge Moorings (Vibratory Installation & Removal)	9/29/14	1/23/17	606 days

Conceptual Schedule Only

Note: This is a proposed schedule, so activity dates are likely to change.

FHWA and FTA expect that temporary pile will be advanced 70-140 feet below the channel bottom. Additionally, cofferdams are likely to be installed around the sites of pier sets 2 and 7. These shallow areas may preclude the use of barges, so that temporary work bridges and cofferdams will be constructed to allow equipment and construction worker access.

Above water structures will be fabricated at an off-site location, barged into alignment, and lifted by crane into place for attachment. Off-site locations used for overall construction staging and pre-fabrication of bridge segments are likely to occur at the following locations:

- The Port of Vancouver near Terminal 3 (52 acres)
- The Red Lion at the Quay Hotel (2.6 acres), acquired through right-of-way (ROW).
- The vacant Thunderbird Hotel (5.6 acres), acquired through ROW.

Demolition of the current bridges will occur over approximately 1.5 years, from September 2018 through March 2020. Demolition will commence once the following project components are complete: (1) Construction of the north and southbound replacement bridges; (2) redevelopment of the SR 14 interchange; (3) redevelopment of the Hayden Island interchange; and (4) routing of north and southbound traffic onto the new bridges. Demolition of the superstructure will begin with removal of the counterweights. The contractor will lock the lift-span into place and the counterweights cut into pieces and transferred off-site via truck or barge. Next, the contractor will cut the lift towers into manageable pieces and load them onto barges. Prior to removal of the trusses, the deck will be removed by cutting it into manageable pieces; these pieces will be transported by barge or truck or by using a breaker, in which case debris will be caught on a barge or other containment system below the work area. After contractors demolish the deck, they will lift the trusses onto barges and transfer them to off-site locations for final demolition. Finally, the contractors will use a diamond wire saw to cut the piers into manageable sections before transporting them offsite to complete demolition.

In addition, nine sets of the 11 existing Columbia River bridge piers are below the OHW level and are supported on a total of approximately 1,800 driven timber piles that are assumed to be treated with a creosote wood preservative- direct evidence is not evident nor readily accessible. The FHWA and FTA would remove only those vacant piles that pose a navigation hazard within the navigation channels and protrude above the surface channel bed. These would be removed via vibratory extraction, direct pull, clamshell dredge, or use of an underwater saw to cut below channel bottom. The number of piles is unknown as original spec sheets are not demonstrable of this element. If treated, the removal of piles or containment is of concern due to the presence of polycyclic aromatic hydrocarbons and heavy metals, which are toxic to aquatic life including fish.

North Portland Harbor Bridge

The current I-5 bridge that crosses the North Portland Harbor, a channel of the lower Columbia River, will be widened with the addition of a south-bound automobile ramp. Widening of the existing structure will require the addition of eight, 10-foot diameter drilled shaft columns. Unlike the Columbia River bridges, these columns will connect directly to the superstructure, avoiding the need for a pile-cap. The addition of three new bridge alignments will carry local traffic from Hayden Island to Marine Drive, the I-5 northbound collector distributor ramp, the I-5 southbound collector distributor, and the light rail train and bike/pedestrian path (Figure 2). These alignments diverge from the I-5 alignment on Hayden Island. The first requires five drilled shafts, the second requires five drilled shafts, and the third requires 12 drilled shafts. Construction of the North Portland Harbor bridge will follow the same sequence of pile driving and removal as the Columbia River bridge (Table 4) and require the use of barges and temporary piles (Tables 5 and 6).

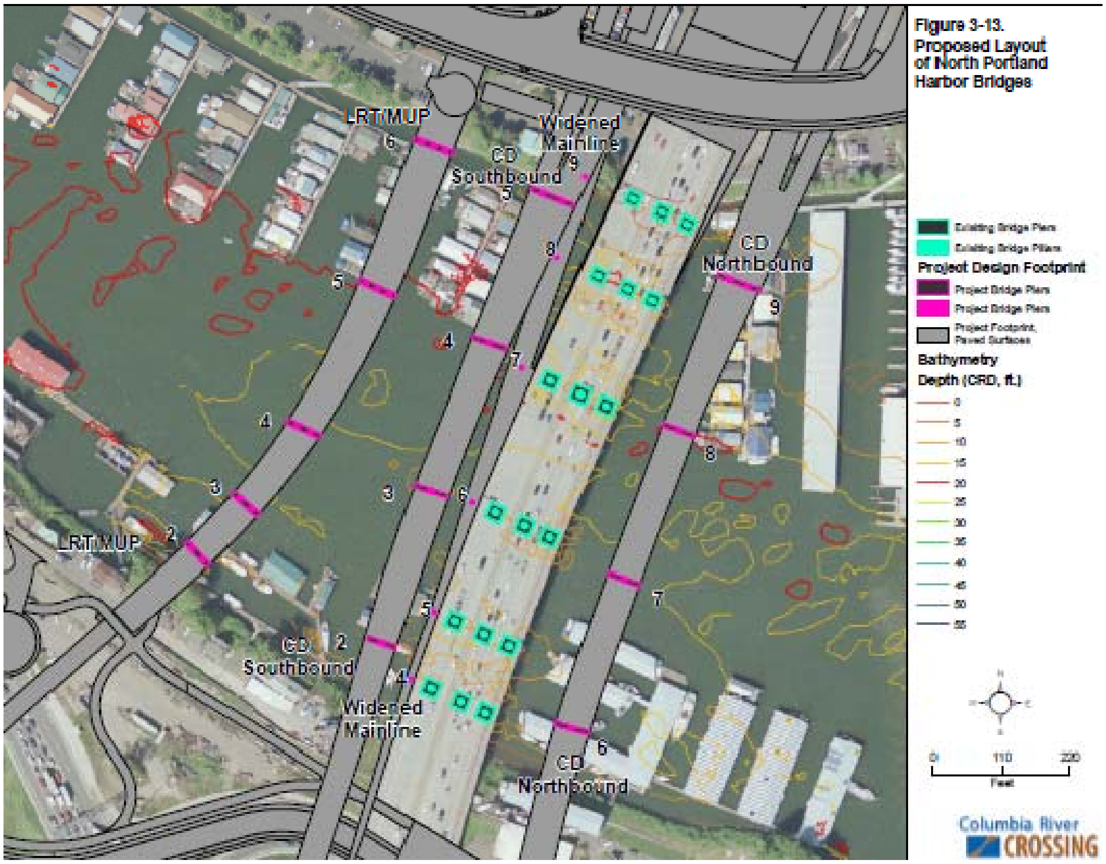


Figure 2. Substructure locations for the proposed Columbia River Crossing bridges over the North Portland Harbor.

Table 5. Estimated number of piles necessary to complete the temporary in-water structure for the proposed Columbia River Crossing bridges over the North Portland Harbor.

	Count
Pipe Piles	
Load Bearing 18-24 inch	600
Load Bearing 36-48 inch	240
Non-Load Bearing 18-24 inch	384
Total	**1,224**
Support Structures	18
Barges	Up to 12 at a single time

Table 6. Approximate length and width of the proposed Columbia River Crossing bridges over the North Portland Harbor.

Bridge	LRT and Bike/Ped Path	I-5 Southbound Collector-Distributor	Widened Mainline	I-5 Northbound Collector-Distributor
Width Over Water	Varies 50-65 ft	Varies 50-82 ft	Varies 162-200 ft	Varies 57-82 ft
Length Over Water	Approx. 875 ft	Approx. 945 ft	Approx. 990 ft	Approx. 1,020 ft

Unlike at the Columbia River mainstem location, cofferdams will not be used in North Portland Harbor, and only those parts of the remnant structure that are in the way of the new structure will be removed. The material is generally at or below grade, and will be removed via a clamshell dredge will be used to minimize material loss into the channel.

Roadways

Improvements will modify the I-5 thoroughfare for the length of the project from Oregon milepost (MP) 305.9 to Washington MP 3.1, approximately 5-miles. Of that, approximately 2.5 miles constitute the landward or non-bridge portions of I-5 itself. Depending on the road segment, modifications will include some combination of lane widening, lane additions, repaving, pavement overlays, shoulder expansion, road-prism elevation increase, and replacement.

Three interchanges in Portland and four in Vancouver will be improved. These include from south to north the Marine Drive, Victory Boulevard, Hayden Island, Washington State Route (SR) 14, Mill Plain Blvd., Fourth Plain Blvd, and the Washington SR 500 interchanges.

In addition to interchange improvements, highway safety and mobility will be improved with a series of auxiliary (add/drop) lanes that will be sequentially added and then dropped at strategic locations through the corridor. The add/drop lanes will allow vehicles to travel between given points without merging into mainline interstate traffic, and will allow vehicles exiting or entering to minimize conflicts with through traffic. From the south end of the project area, I-5 northbound will add one auxiliary lane starting where the Victory Boulevard on-ramp enters I-5. Another auxiliary lane will be added where the Marine Drive on-ramp enters I-5. An optional third auxiliary lane will be added where Hayden Island traffic enters I-5 over the river. One of these lanes will be dropped at the SR 14 off-ramp, and a second will be dropped at the Mill Plain off-ramp. North of the Mill Plain off-ramp, the number of auxiliary lanes will vary between one and three.

Lanes will be added or dropped as the various on-ramps and off-ramps enter or exit I-5 at each subsequent interchange. Southbound I-5 and the associated interchanges and ramps will have a similar series of add/drop lanes. The interchanges and lane improvements will extend roadway improvements to local roadways within the jurisdiction of the cities of Portland and Vancouver.

Transit

Currently light rail train operated by TriMET originates and terminates in Oregon without service to Vancouver. The action would extend TriMet owned light rail train service from Portland to Vancouver northwest through Washington and Broadway Street to and onto W 17th Street northeast until its terminus at Clark College. Three park-and-ride facilities will be constructed in Vancouver: The SR 14 Park and Ride (I-5 and SR 14), Mill District (Washington, East 16th, main, and East 15th Street block), and Clark College (Figure 3). To support this extra capacity expansion of the TriMet Ruby Junction Maintenance Facility in Gresham Oregon will occur. Approximately 5.4 acres of pavement will be added to the site. Bus routes and capacity will changed as well, and will be incorporated into the park-and-ride and light rail train path improvements. As discussed previously, the addition of light rail train will result in the construction of a new bridge across North Portland Harbor, to be incorporated into the CRC bridges, and the addition of a landward ingress/egress path on Hayden Island and within Vancouver.

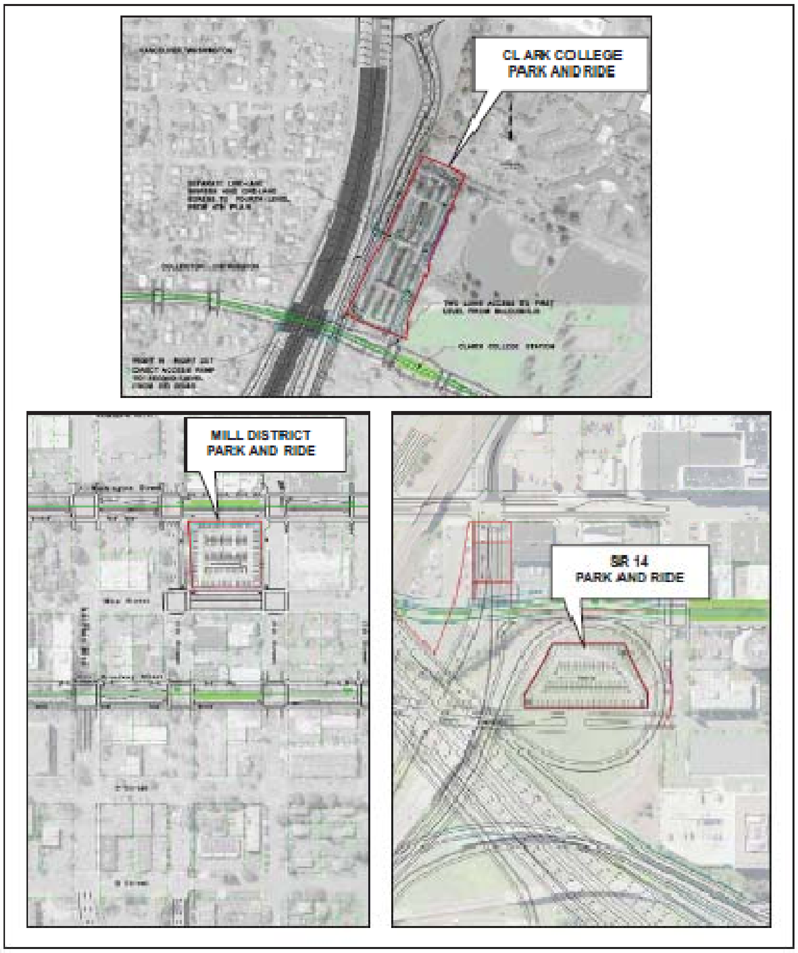


Figure 3. Light rail train Park and Ride facilities for the proposed Columbia River Crossing.

Off-site Construction and Staging

The FHWA and FTA have proposed to use non-CRC corridor locations for use for material and equipment staging, pre-fabrication of bridge elements, and for final demolition of current bridge element. The FHWA and FTA have identified and included sites likely for this use in the action area. They are as follows:

- **Port of Vancouver Staging Area**. This 52-acre site is located along SR 501 near the Port of Vancouver's Terminal 3 North facility. This site is without river frontage, so materials would be transported over land to the construction site. Activities will consist of material storage, material fabrication, equipment storage and repair, and temporary buildings.
- **Alcoa/Evergreen**. This 94.5-acre site would be a major casting/staging yard and is located on the north shore of the lower Columbia River at approximately River Mile

(RM) 102. It is undergoing environmental remediation prior to the anticipated 2013 start date.

- **Red Lion Staging Area.** This is a 2.6-acre site on the north shore of the lower Columbia River, immediately downstream of the existing bridge alignment. Acquisitions would occur through ROW, possibly through purchase. It requires partial demolition of the Red Lion at the Quay Motel. This site would be a staging site for materials and equipment and for fabrication of smaller bridge and roadway components. Temporary buildings, such as trailers or other mobile units would also be included.
- **Thunderbird Staging Area.** This is a 5.6-acre site on Hayden Island on the south shore of the lower Columbia River, immediately downstream of the existing bridge alignment. A large portion of the parcel will be acquired as new ROW for the new bridge alignment. The site is relatively large and it is adjacent to the river and the construction zone. The same types of activities could occur on this site as on the Red Lion Hotel site.
- **Sundial Casting Area.** This 56-acre site lies on the south shore of the lower Columbia River near RM 120.2. This currently serves as an industrial rock product processing facility.

Stormwater Management

The action will include management and treatment for a contributing impervious area (CIA) of approximately 296 acres. The FHWA and FTA have delineated the CIA to be equal to the boundaries of the Columbia River Crossing corridor, which includes I-5 ROW and any work done to local roadways in Portland and Vancouver. The CIA include any terrestrial roadway or bridges, bridge decks that function as the I-5 thoroughfare, ingress and egress ramps, local access, and mass transit/automobile mergers. Stormwater management through treatment will reduce pollutant loads and alter pollutant speciation of stormwater before discharge into ESA-fish bearing watersheds. The CIA consists of from south to north the Columbia Slough basin, the Columbia River basin, and the Burnt Bridge Creek basin (Figures 4 – 6). The FHWA and FTA plan to capture and treat all stormwater runoff from the CIA up to the design storm, although a stormwater management plan for 6.8 acres of CIA is still incomplete (Table 7).

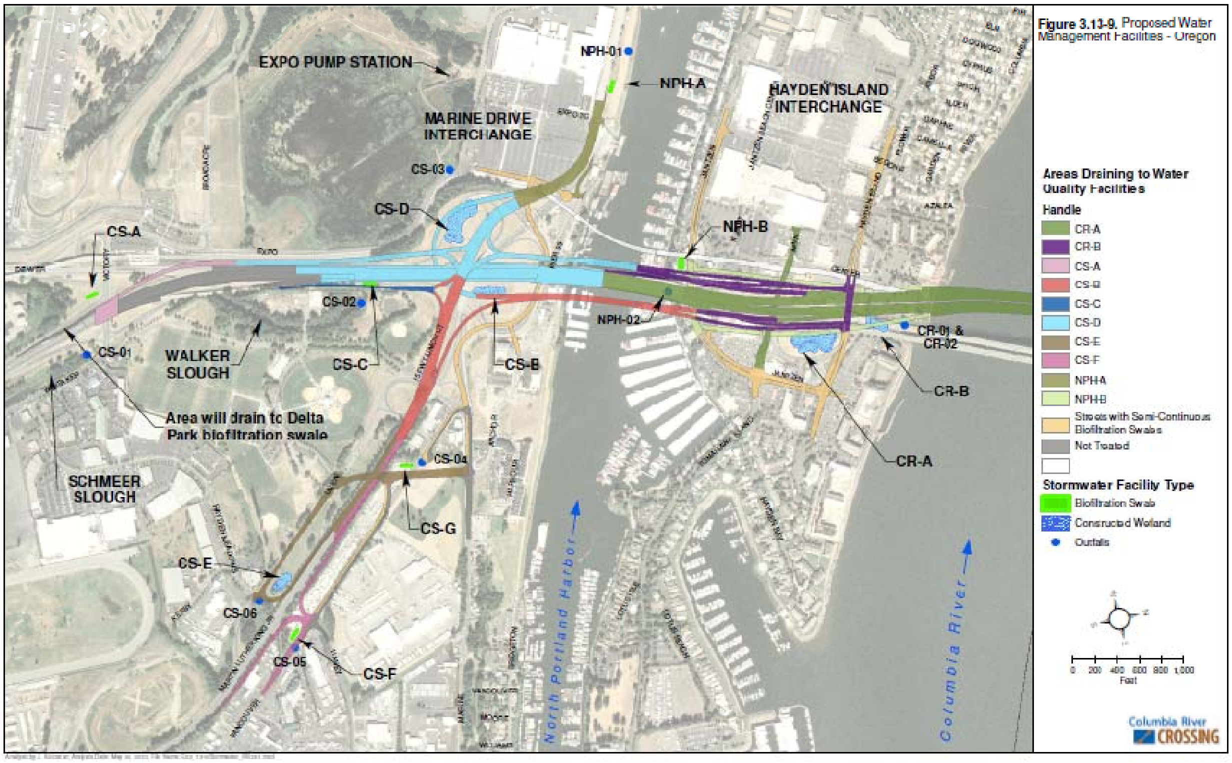


Figure 4. Overview of the contributing impervious area and stormwater treatment basins (southern segment) for the proposed Columbia River Crossing project.

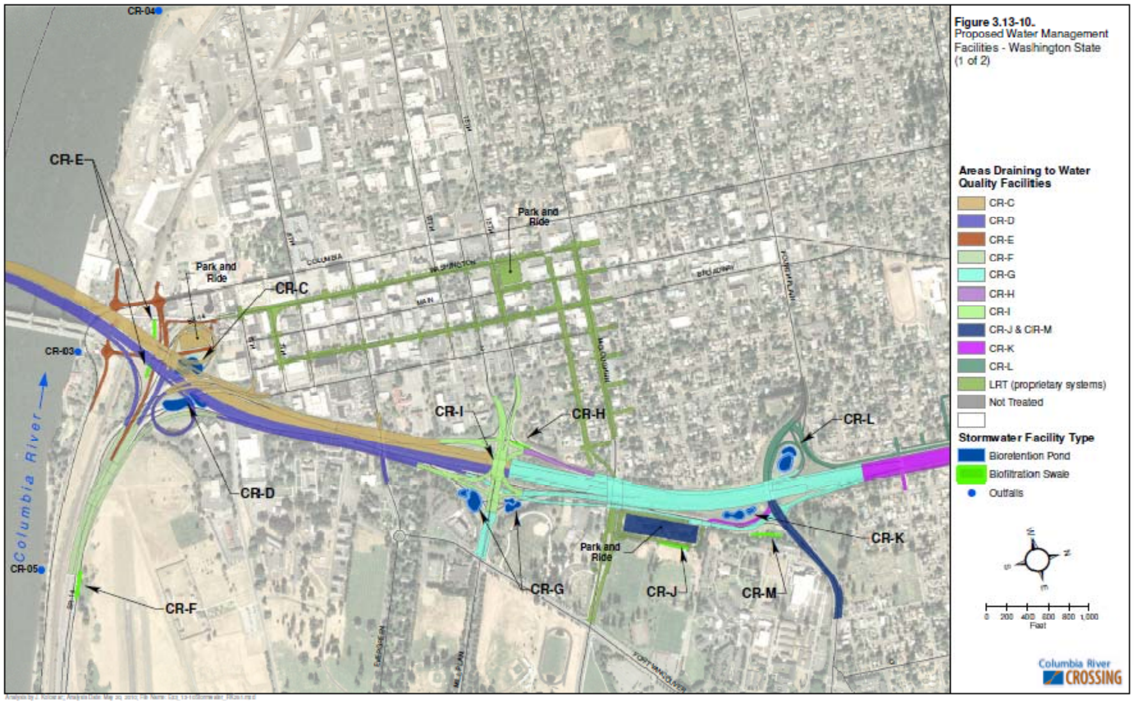


Figure 5. Overview of the contributing impervious area and stormwater treatment basins (middle segment) for the proposed Columbia River Crossing project.

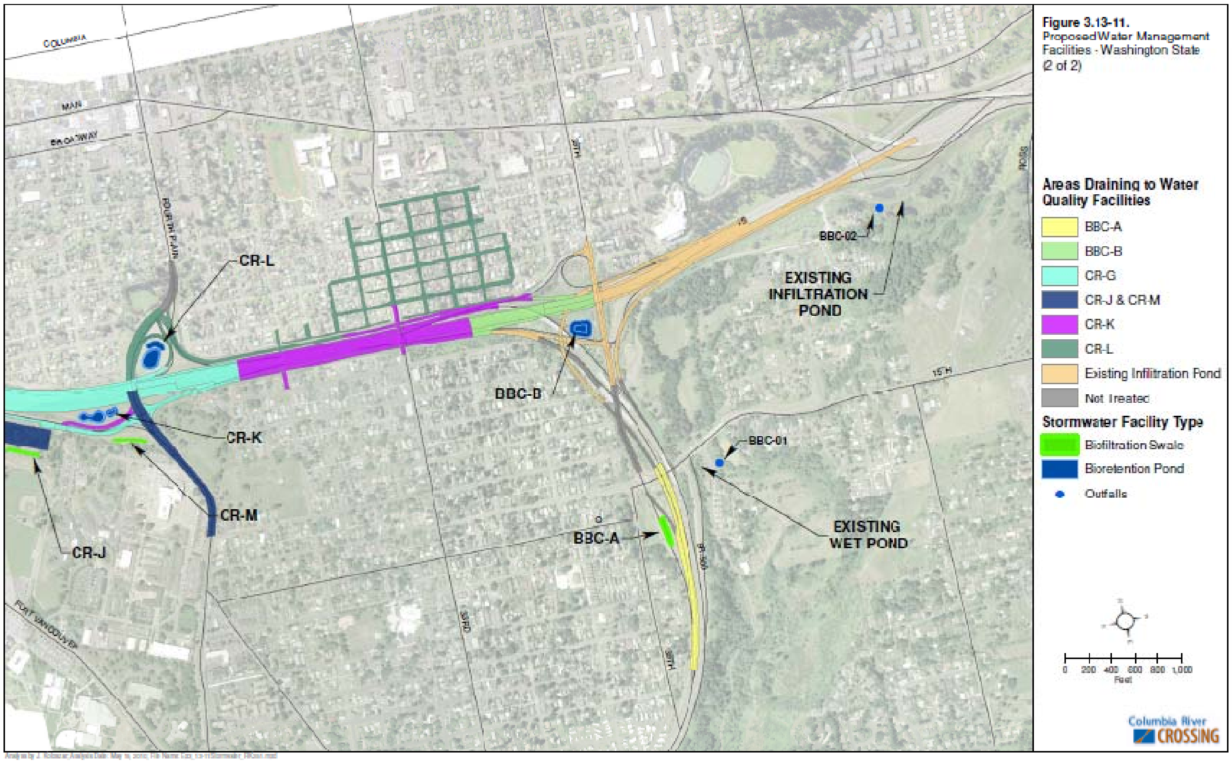


Figure 6. Overview of the contributing impervious area and stormwater treatment basins (northern segment) for the proposed Columbia River Crossing.

Table 7. Summary of the contributing impervious area management for the Columbia River Crossing at time of consultation.

Watershed	Total CIA (acres)	Treated CIA (acres)	Untreated CIA (acres)
Burnt Bridge Creek	21.9	21.9	0
Columbia River	217.9	216.9	1.0
Columbia Slough	55.7	49.9	5.8
Total	295.5	288.7	6.8

Final engineering and design of the roadways, bridge decks, and stormwater treatment facilities is not complete. For the consultation, the FHWA and FTA have submitted design and engineering at varying stages of completeness for stormwater management, up to 30%. Design elements while mostly fixed are approximate and subject to change. The following demonstrates the design approach and methods of treatment within the following management parameters:

1. Treatment capacity design will meet standards and specifications found in WDOT's Highway Runoff Manual (WDOT 2010a), and thus exceed 50% of the 2-year, 24-hour storm.
2. The CIA in the Burnt Bridge Creek watershed is the only area that requires stormwater quantity treatment because it is the only non-mainstem or non-tidal waterbody that will receive stormwater discharge from the project area. This treatment will ensure that the stormwater runoff does not alter change stream hydrology by limiting the rate of stormwater discharge to 50% of the 2-year event.
3. Stormwater quality treatment will consist of one or more of the following methods:
    a. Bioretention ponds are infiltration ponds that use an engineered (amended) soil mix to remove pollutants as runoff infiltrates through this zone to the underlying soils. The primary mechanisms for pollutant reduction are filtration, sorption, biological uptake, and microbial activity. While this best management practice (BMP) is best suited to sites with Hydrologic Group A and B soils, it may be used for Group C and D Hydrologic Group soils with the addition of an underdrain system to collect infiltration runoff and direct it to a stormwater conveyance system. An infiltration rate of 1 inch per hour was assumed when estimating the size of these facilities. If the soils cannot sustain this rate and there is insufficient space to increase the pond size to accommodate a lower value, underdrains will be installed.
    b. Constructed treatment wetlands are shallow, permanent, vegetated ponds that function like natural wetlands. They remove pollutants through sedimentation, sorption, biological uptake, and microbial activity.
    c. Soil-amended biofiltration swales are trapezoidal channels with mild slopes and shallow depths of flow. The channels are dry between storm events and are typically vegetated. They treat runoff by filtration and sorption as runoff flows through the grass surface and amended soils. Amended soils, especially compost-amended, constitute an excellent filtration medium. Compost-amended soils have a high cation exchange capacity that will bind and trap dissolved metals. Similar to bioretention ponds, an underdrain system is recommended for sites with Group C and D Hydrologic Group soils.
    d. Soil-amended filter strips treat sheet runoff from an adjacent roadway surface. Similar to grass swales, filter strips treat runoff by filtration and sorption as runoff flows through the vegetated surface and amended soils. In a confined urban setting such as the project corridor, opportunities to use this BMP are limited.
    e. Bioslopes, like filter strips, treat sheet runoff from an adjacent roadway surface. They comprise a vegetated filter strip, infiltration trench, and underdrain, and reduce pollutants through sorption and filtration. The percolating runoff flows through a special mixture of materials, including dolomite and gypsum, which

promotes the adsorption of pollutants. Bioslopes are also known as media filter drains and ecology embankments.

Other water quality BMPs, including dispersal, drywells and proprietary systems, such as cartridge filters, may be used when limiting factors prevent the use of these BMPs are prevented by lack of suitable space, soils non-conducive to infiltration, polluted soils, and protection of historic building foundations. Pre-treatment facilities including baffle type oil-water separators and coalescing plate oil-water are likely also. Their use is common in high average daily trip areas to protect the treatment facilities and to prevent overwhelming of the treatment technology. Accidents and spills are expected to occur on interstate freeways.

All treatment facilities will be designed and engineered to use the preceding techniques singly, or in combination, to achieve treatment. Engineering criteria including facility dimensions, depth, area, slopes, and materials (abiotic and biotic); and design parameters from the WDOT Runoff Manual (WDOT 2010a) will be used and met when designing these facilities.

Additional Impact Avoidance and Minimization Measures

The applicant proposes to implement the following BMPs as impact avoidance and minimization measures. These BMPs were included in the BA and are a nondiscretionary part of the proposed action. The FHWA and FTA will ensure that their contractors will:

1. Prepare and carry out an Erosion and Sediment Control Plan for any part of the project that requires a ground disturbing activity, such as land clearing, vegetation removal, grading, ditching, filling, embankment compaction, or excavation, including any erosion that may result from weather, the nature of the construction materials used, or the stage or work.
2. Prepare and carry out a Spill Prevention Control and Countermeasures and an Erosion and Spill Control Plan for any potentially hazardous material that will be stored or used at the project site to prevent or contain accidental spills in the work/repair area to insure no contaminants escape containment to surface waters.
3. Limit entrapment and disturbance to benthic habitats through use of wire-saw demolition of existing bridge piers instead of cofferdams.
4. Reduce underwater sound from underwater structure installation through use of the drilled shaft method to install the permanent in-water bridge structure, use of the ‘vibe and proof’ pile installation technique to install temporary piles, and complete all monitoring as described in the underwater sound monitoring plan.
5. Use directional techniques for all construction lighting to reduce nighttime illumination of the lower Columbia River.

Interrelated and Interdependent Actions

Effects of the action under consultation are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action (50 CFR 402.01). Interrelated actions are those that are part of a larger action and depend on the larger action for their justification, and interdependent actions are those that have no independent utility apart from the action under consideration.

The BA identified the following actions and interrelated and interdependent with CRC: (1) CRC maintenance; (2) compensatory mitigation to comply with section 404 of the Clean Water Act; (3) utility relocation during construction; (4) construction and operation of additional staging areas; (5) acquisition and relocation of existing floating homes in North Portland Harbor; (6) design and operation of a pump station in an unnamed channel of the Columbia Slough; and (7) transit-oriented development on Hayden Island.

The present level of planning for these actions is not sufficient to support a complete analysis of effects that are reasonably certain to occur on ESA-listed species or their designated critical habitats. Nonetheless, after due consideration, NMFS concluded that the effects of CRC maintenance, compensatory mitigation, and utility relocation are likely to be within the range of actions that have already completed formal consultation (*e.g.*, NMFS 2008a, 2008b). Additional staging areas are within the range of effects considered in this consultation. Acquisition and relocation of existing floating homes, the Columbia Slough pump station, and development on Hayden Island are actions that will have independent utility and, depending on their eventual disposition, are likely to be the object of a future consultation.

Action Area

Action area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this consultation, the action area will include: (1) The area where underwater noise caused by pile driving will exceed background; (2) the lower Columbia River where dissolved and suspended pollutants caused by stormwater runoff from CRC is redistributed to the Pacific Ocean; and (3) the eastern Pacific Ocean where southern resident killer whales overlap with Chinook salmon from the Columbia basin.

Background noise levels for the project site are not available.[2] However, due to the curvature of the river and islands present, underwater sound from impact pile driving is expected to reach land well before attenuating to assumed background sound levels of 120 dB (re: 1μPa) root mean square. Thus, the action area is not expected to extend beyond Sauvie Island, about 5.5 miles downstream of the project site, and Lady Island, about 12.5 miles upstream. This distance encompasses the lower Columbia River from approximately RM 101 to 119. As no pile driving activities will occur within North Portland Harbor, there will be no aquatic effects from underwater pile driving noise in this area.

Sixteen ESA-listed species and 12 designated critical habitats occur in the action area and were considered in this opinion (Table 8). Southern resident killer whales do not occur in this action area but were nonetheless considered in this Opinion because Chinook salmon is the preferred

[2] One measurement of 136 dB peak has been reported for the lower Columbia River at RM 45 where the river is tidally influenced (Carlson *et al.* 2001, cited in the BA). A crude approximation of the root mean square (RMS) values is approximately 121 dB RMS (subtracting 15 dB, Jim Laughlin 2009, personal communication).

prey of southern resident killer whales and a reduction in Chinook salmon could reduce the available quantity of that prey within the range of the killer whale. For reasons explained in Appendix A of this Opinion, NMFS concluded that the proposed action is not likely to adversely affect southern resident killer whales.

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.

Table 8. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: T means listed as threatened under the ESA; E means listed as endangered.

Species	Listing Status	Critical Habitat	Protective Regulations
Marine and Anadromous Fish			
Chinook salmon (*Oncorhynchus tshawytscha*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Chum salmon (*O. keta*)			
Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon (*O. kisutch*)			
Lower Columbia River	T 6/28/05; 70 FR 37160	Not applicable	6/28/05; 70 FR 37160
Sockeye salmon (*O. nerka*)			
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	2/01/06; 71 FR 5178
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Green sturgeon (*Acipenser medirostris*)			
Southern	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	6/02/10; 75 FR 30714
Eulachon (*Thaleichthys pacificus*)			
Eulachon	T 3/18/10; 75 FR 13012	01-05-2011; 76 FR 515	Not applicable
Marine Mammals			
Steller sea lion (*Eumetopias jubatus*)			
Eastern	T 5/5/1997; 63 FR 24345	8/ 27/93; 58 FR 45269	11/26/90; 55 FR 49204
Killer whale (*Orcinus orca*)			
Southern Resident	E 11/18/05; 70 FR 69903	11/29/06; 71 FR 69054	ESA section 9 applies

ENDANGERED SPECIES ACT BIOLOGICAL OPINION

Section 7(a)(2) of the ESA requires Federal FHWA and FTA to consult with NMFS 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. The Opinion that follows records the results of the interagency consultation for this proposed action. The ITS provided after the Opinion specifies the impact of taking of threatened or endangered species that will be incidental to the proposed action; reasonable and prudent measures that NMFS considers necessary and appropriate to minimize such impact, and nondiscretionary terms and conditions (including, but not limited to, reporting requirements) that must be complied with by the FHWA and FTA to carry out the reasonable and prudent measures.

To complete the jeopardy analysis presented in this Opinion, NMFS reviewed the status of each listed species[3] considered in this consultation, the environmental baseline in the action area, the effects of the action, and cumulative effects (50 CFR 402.14(g)). From this analysis, NMFS determined whether effects of the action were likely, in view of existing risks, to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

For the critical habitat adverse modification analysis, NMFS considered the status of the entire designated area of the critical habitat considered in this consultation, the environmental baseline in the action area, the likely effects of the action on the function and conservation role of the affected critical habitat, and cumulative effects. NMFS used this assessment to determine whether, with implementation of the proposed action, critical habitat would remain functional, or retain the current ability for the primary constituent elements (PCE) to become functionally established, to serve the intended conservation role for the species.[4]

If the action under consultation is likely to jeopardize the continued existence of an ESA-listed species, or destroy or adversely modify critical habitat, NMFS must identify any reasonable and prudent alternatives for the action that avoid jeopardy or destruction or adverse modification of critical habitat and meet other regulatory requirements (50 CFR 402.02).

Status of the Species and Critical Habitat

The summaries that follow describe the status of ESA-listed species, their designated critical habitats, southern green sturgeon and eastern Steller sea lions that occur within the geographic area of the action area affected by the FHWA and FTA. These summaries are a synthesis of information presented across a large body of scientific publications and reports, and are the basis for the analyses we present in the Effects of the Action section of this Opinion. More detailed

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[3] An "evolutionarily significant unit" (ESU) of Pacific salmon (Waples 1991) and a "distinct population segment" (DPS) (Policy Regarding the Recognition of District Vertebrate Population; 61 FR 4721, Feb 7, 1996) are both "species" as defined in section 3 of the ESA.

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

information on the status and trends of these listed resources, and their biology and ecology, occur in the listing regulations and critical habitat designations published in the Federal Register (Table 8) and in many publications available from the NMFS Northwest Region, Protected Resources Division, Portland, Oregon.

The status of species and critical habitat sections below are organized into two recovery domains (Table 9) to better integrate recovery-planning information that NMFS is developing on the conservation status of the species and critical habitats considered in this consultation. Recovery domains are the geographically based areas that NMFS is using to prepare multi-species recovery plans.

Although southern green sturgeon, eulachon and eastern Steller sea lion are not part of this recovery domain structure, they are presented here for convenience as part of the Willamette/Lower Columbia Recovery Domain. Southern green sturgeon are under the jurisdiction of NMFS' Southwest Region, which has not yet convened a recovery team for this species. Nor has a recovery team yet been convened for eulachon, a species under the jurisdiction of NMFS' Northwest Region. The Steller sea lion recovery plan is under the jurisdiction of NMFS' Protected Resources Division, Silver Springs, Maryland (NMFS 2008c).

Table 9. Recovery planning domains identified by NMFS and the ESA-listed species considered in this consultation.

Recovery Domain	Species
Willamette-Lower Columbia	LCR Chinook salmon
	UWR Chinook salmon
	CR chum salmon
	LCR coho salmon
	LCR steelhead
	UWR steelhead
	Southern green sturgeon
	Eulachon
	Eastern Steller sea lion
Interior Columbia	UCR spring-run Chinook salmon
	SR spring/summer Chinook salmon
	SR fall-run Chinook salmon
	SR sockeye salmon
	UCR steelhead
	MCR steelhead
	SRB steelhead

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, recommend viability criteria for that species, and analyze factors that limit species survival. The definition of a population used by each TRT to analyze Pacific salmon and steelhead is set forth in the viable salmonid population (VSP) document prepared by NMFS for use in conservation assessments of Pacific salmon and steelhead (McElhany *et al.* 2000). The boundaries of each population are defined using a combination of genetic information, geography, life-history traits, morphological traits, and population dynamics that indicate the extent of reproductive isolation among spawning groups. To-date, the TRT have divided the 13 species of Pacific salmon and steelhead considered in this Opinion into 189 populations. The overall viability of a species is a function of the VSP attributes of its constituent populations. Those attributes are abundance, population growth rate, population spatial structure, and diversity. Until a viability analysis of a species is completed, the VSP guidelines recommend that all populations should be managed to retain the potential to achieve viable status to ensure a rapid start along the road to recovery, and that no significant parts of the species are lost before the full recovery plan is implemented (McElhany *et al.* 2000).

The status of critical habitat was based primarily on a watershed-level analysis of conservation value that focused on the presence of listed ESA-listed species and physical features (*i.e.*, the PCEs) that are essential to their conservation. This analysis for the 2005 designations of Pacific salmon and steelhead species was completed by Critical Habitat Analytical Review Teams (CHARTs) that focused on large geographical areas corresponding approximately to recovery domains (NOAA Fisheries 2005). Each watershed was ranked using a conservation value attributed to the quantity of stream habitat with PCEs, the present condition of those PCEs, the likelihood of achieving PCE potential (either naturally or through active restoration), support for rare or important genetic or life history characteristics, support for abundant populations, and support for spawning and rearing populations. In some cases, our understanding of these interim conservation values has been further refined by the work of TRTs and other recovery planning efforts that have better explained the habitat attributes, ecological interactions, and population characteristics important to each species.

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

Status of the Species

Natural variations in freshwater and marine environments have substantial effects to the abundance of salmon, steelhead, southern green sturgeon, eulachon, and eastern Steller sea lion populations. Of the various natural phenomena that affect most populations of Pacific salmon and steelhead, changes in ocean productivity are generally considered the most important. Pacific salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation probably contributes to significant natural mortality, although the levels of predation are largely unknown. In general, Pacific salmon and steelhead are eaten by pelagic fishes, birds, and marine mammals.

Over the past few decades, the sizes and distributions of the Pacific salmon and steelhead populations considered in this Opinion, like the other salmon and steelhead species that NMFS has listed, generally have declined because of natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Enlarged populations of terns, seals, sea lions, and other aquatic predators in the Pacific Northwest were identified as factors that may be limiting the productivity of some Pacific salmon and steelhead populations (Bottom *et al.* 2005, Fresh *et al.* 2005). It is also likely that climate change will play an increasingly important role in determining the abundance of Pacific salmon and steelhead by exacerbating long-term problems related to temperature, stream flow, habitat access, predation, and marine productivity (CIG 2004, Scheuerell and Williams 2005, Zabel *et al.* 2006, ISAB 2007).

Willamette and Lower Columbia (WLC) Recovery Domain. Species in the WLC recovery domain include LCR Chinook, UWR Chinook, CR chum, LCR coho, LCR steelhead, and UWR steelhead, southern green sturgeon, and eulachon. Although the WLC-TRT has not yet addressed southern green sturgeon or eulachon, it has identified 107 demographically-independent populations of Pacific salmon and steelhead (Table 10). 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 lower Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

McElhany *et al.* (2007) found that, for populations in Oregon, the combined extinction risk is very high for LCR Chinook, UWR Chinook salmon, CR chum salmon, LCR coho salmon, and moderate for LCR steelhead and UWR steelhead, although the status of those species with populations in Washington is still under assessment.

Table 10. Demographically-independent populations in the WLC recovery domain.

Species	Populations	Combined Extinction Risk
LCR Chinook salmon	32	Very High
UWR Chinook salmon	7	Very High
CR chum salmon	17	Very High
LCR coho salmon	24	Very High
LCR steelhead	23	Moderate
UWR steelhead	4	Moderate

LCR Chinook salmon. This species includes all naturally-spawned populations of Chinook salmon in the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River; the Willamette River to Willamette Falls, Oregon, exclusive of spring-run

Chinook salmon in the Clackamas River; and progeny of seventeen artificial propagation programs. The WLC-TRT identified 22 historical populations of LCR Chinook salmon – seven in the coastal subregion, six in the Columbia Gorge, and nine in the western Cascades. Twelve of those populations occur within the action area (Table 11) and only Sandy River late fall Chinook is considered viable (McElhany *et al.* 2007).

The major factors limiting recovery of LCR Chinook salmon include altered channel morphology, loss of habitat diversity, excessive sediment, high water temperature, reduced access to spawning/rearing habitat, and harvest impacts (NMFS 2006).

Table 11. LCR Chinook salmon populations.

Stratum		Spawning Population (Watershed)
Ecological Subregion	Run Timing	
Coast Range	Fall	Young Bay
		Grays River
		Big Creek
		Elochman River
		Clatskanie River
		Mill Creek
		Scappoose River
Columbia Gorge	Spring	Upper Cowlitz River
		Cispus River
		Tilton River
		Big White Salmon River
		Hood River
	Early Fall (tule)	Upper Gorge Tributaries
		Big White Salmon River
	Fall	Upper Cowlitz River
		Lower Cowlitz River
		Coweeman River
		Toutle River
		Lower Gorge Tributaries
		Hood River
Western Cascade Range	Spring	Toutle River
		Kalama River
		Lewis River
		Sandy River
	Early Fall (tule)	Lewis River
		Salmon Creek
		Sandy River
	Fall	Kalama River
		Clackamas River
		Washougal River
	Late Fall (bright)	Lewis River
		Sandy River

UWR Chinook salmon. The species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon, and progeny of seven artificial propagation programs. All seven historical populations of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 12); only the Clackamas population is characterized as viable (McElhany *et al.* 2007).

The major factors limiting recovery of UWR Chinook salmon identified by NMFS include lost/degraded floodplain connectivity and lowland stream habitat, degraded water quality, high water temperature, reduced streamflow, and reduced access to spawning/rearing habitat (NMFS 2006).

Table 12. UWR Chinook salmon populations. Overall viability risk: extinct or very high means greater than 60% chance of extinction within 100 years; relatively high means 60 to 25% risk of extinction in 100 years; moderate means 25 to 5% risk of extinction in 100 years, low or negligible means 5 to 1% risk of extinction in 100 years; very low means less than 1% chance of extinction in 100 years, and NA means not available. A low or negligible risk of extinction is considered viable.

Stratum		Spawning Population (Watershed)	Overall Viability Risk
Ecological Subregion	Run Timing		
Western Cascade Range	Spring	Clackamas	Low
		Molalla	Relatively High
		North Santiam	Very high
		South Santiam	Very high
		Calapooia	Very high
		McKenzie	Moderate
		Middle Fork Willamette	Very high

CR 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 and aggregated these into four strata (Myers *et al.* 2006). Unlike other species in the WLC recovery domain, CR chum salmon spawning aggregations were identified in the mainstem Columbia River. These aggregations generally were included in the population associated with the nearest river basin. Three strata and eight historical populations of CR chum salmon occur within the action area (Table 13); of these, none are viable (McElhany *et al.* 2007).

The major factors limiting recovery of CR chum salmon include altered channel morphology, loss of habitat diversity, excessive sediment, reduced streamflow, harassment of spawners, and harvest impacts (NMFS 2006).

Table 13. CR chum salmon populations.

Stratum		Spawning Population (Watershed)
Ecological Subregion	Run Timing	
Coast Range	Fall	Young's Bay
		Grays River
		Big Creek
		Elochman River
		Clatskanie River
		Mill Creek
		Scappoose Creek
Columbia Gorge	Summer	Cowlitz River
	Fall	Cowlitz River
		Lower Gorge Tributaries
		Upper Gorge Tributaries
Western Cascade Range	Fall	Kalama River
		Salmon Creek
		Lewis River
		Clackamas River
		Washougal River
		Sandy River

LCR 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 and divided these into two strata based on major run timing: early and late (Myers *et al.* 2006). Three strata and nine historical populations of LCR coho salmon occur within the action area (Table 14). Of these nine populations, Clackamas River is the only population characterized as viable (McElhany *et al.* 2007).

In general, late coho salmon spawn in smaller rivers or the lower reaches of larger rivers from mid-November to January, coincident with the onset of rain-induced freshets in the fall or early winter. Spawning typically takes place within a few days to a few weeks of freshwater entry. Late-run fish also tend to undertake oceanic migrations to the north of the Columbia River, extending as far as northern British Columbia and southeast Alaska. As a result, late coho salmon are known as Type N coho. Alternatively, early coho salmon spawn in the upper reaches of larger rivers in the lower Columbia River and in most rivers inland of the Cascade Crest. During their oceanic migration, early coho salmon tend to migrate to the south of the Columbia River and are known as Type S coho salmon. They may migrate as far south as the waters off northern California. While the ecological significance of run timing in coho salmon is fairly well understood, it is not clear how important ocean migratory pattern is to overall diversity and the relative historical abundance of Type N and Type S life histories largely is unknown.

The major factors limiting recovery of LCR coho salmon include degraded floodplain connectivity and channel structure and complexity, loss of riparian areas and large wood recruitment, degraded stream substrate, loss of stream flow, reduced water quality, and impaired passage (NMFS 2007).

Table 14. LCR coho salmon spawning populations.

Stratum		Spawning Population (Watershed)
Ecological Subregion	Run Type	
Coast Range	N	Young's Bay
		Grays River
		Big Creek
		Elochman Creek
		Clatskanie River
		Mill, Germany, Abernathy Creeks
		Scappoose River
Columbia Gorge	N	Lower Gorge Tributaries
	S	Upper Gorge Tributaries
		Big White Salmon River
		Hood River
Western Cascade Range	N	Lower Cowlitz River
		Coweeman River
		Salmon Creek
	N and S	Cispus River
		Upper Cowlitz River
		Tilton River
		North Fork Toutle River
		South Fork Toutle River
		Kalama River
		North Fork Lewis River
		East Fork Lewis River
		Clackamas River
		Washougal River
		Sandy River

LCR steelhead. The 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. The WLC-TRT identified 23 historical populations of LCR steelhead (Myers *et al*. 2006). Within these populations, the winter-run timing is more common in the west Cascade subregion, while farther east summer steelhead are found almost exclusively.

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. Six strata and 23 historical populations of LCR steelhead occur within the action area (Table 15).

The major factors limiting recovery of LCR steelhead include altered channel morphology, lost/degraded floodplain connectivity and lowland stream habitat, excessive sediment, high water temperature, reduced streamflow, and reduced access to spawning/rearing habitat (NMFS 2006).

Table 15. LCR steelhead populations spawning.

Stratum		Population (Watershed)
Ecological Subregion	Run Timing	
Columbia Gorge	Summer	Wind River
		Hood River
	Winter	Lower Gorge Tributaries
		Upper Gorge Tributaries
		Hood River
West Cascade Range	Summer	Kalama River
		North Fork Lewis River
		East Fork Lewis River
		Washougal River
	Winter	Cispus River
		Tilton river
		Upper Cowlitz River
		Lower Cowlitz River
		North Fork Toutle River
		South Fork Toutle River
		Coweeman River
		Kalama River
		North Fork Lewis River
		East Fork Lewis River
		Clackamas River
		Salmon Creek
		Sandy River
		Washougal River

UWR 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). Only winter steelhead historically existed in this area because flow conditions over Willamette Falls allowed only late winter steelhead to ascend the falls, until a fish ladder was constructed in the early 1900s and summer steelhead were introduced. Summer steelhead have become established in the McKenzie River where historically no steelhead existed, although these fish were not considered in the identification of historical populations. UWR steelhead are currently found in many tributaries that drain the west side of the upper Willamette River basin. Analysis of historical observations, hatchery records, and genetic analysis strongly suggested that many of these spawning aggregations are the result of recent introductions and do not represent a historical population. Nevertheless, the WLC-TRT recognized that these tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance.

One stratum and five historical populations of UWR steelhead occur within the action area (Table 16), although the west-side tributaries population was included only because it is important to the species as a whole, and not because it is independent. Of these five populations, none are viable (McElhany *et al.* 2007).

The major factors limiting recovery of UWR steelhead include lost/degraded floodplain connectivity and lowland stream habitat, degraded water quality, high water temperature, reduced streamflow, and reduced access to spawning/rearing habitat (NMFS 2006).

Table 16. UWR steelhead populations. Overall viability risk: extinct or very high means greater than 60% chance of extinction within 100 years; relatively high means 60 to 25% risk of extinction in 100 years; moderate means 25 to 5% risk of extinction in 100 years, low or negligible means 5 to 1% risk of extinction in 100 years; very low means less than 1% chance of extinction in 100 years, and NA means not available. A low or negligible risk of extinction is considered viable.

Stratum		Population Spawning (Watershed)	Overall Viability Risk
Ecological Subregion	Run Type		
West Cascade Range	Winter	Molalla	Moderate
		North Santiam	Moderate
		South Santiam	Moderate
		Calapooia	Moderate
		West-side Tributaries	Moderate

Southern green sturgeon. Southern green sturgeon includes all naturally-spawned populations of green sturgeon that occur south of the Eel River in Humboldt County, California. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea. Although it is commonly observed in bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, the distribution and timing of estuarine use are poorly understood.

The principal factor for the decline of southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. Other factors include degradation of freshwater and estuarine habitat quality, water diversions, and fishing. The viability of this species is still under assessment. Southern green sturgeon occur in three recovery domains: Puget Sound (although this area was excluded from proposed critical habitat), the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts.

Eulachon. The ESA-listed population of eulachon includes all naturally spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Core populations for this species include the Fraser River, Columbia River and (historically) the Klamath River. The most significant factor responsible for the decline of eulachon is change in ocean conditions due to climate change (EBRT 2010). Other factors include many adverse effects related to dams and water diversions, artificial fish passage barriers, increased water temperatures, insufficient streamflow, altered sediment balances, water pollution, over-harvest, and predation.

The viability of this species is under assessment although abrupt and continuing declines in abundance throughout its range and the added vulnerability that a small population size presents for this type of highly fecund, broadcast spawning species are of particular concern. Eulachon occur in four recovery domains: Puget Sound, the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts. Within the Columbia River, major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis and Sandy rivers. In the early 1990's, there was an abrupt decline in the abundance of Eulachon returning to the Columbia River with no evidence of returning to their former population levels since then (Drake *et al.* 2008).

Of the four components of species viability criteria, abundance of the southern Eulachon has declined in the Columbia River to historic low levels, productivity is of concern due to climate change, diversity is limited to a single age class, and spatial structure is declining as runs sizes dwindle throughout their range (Drake *et al.* 2008). Based on these factors, the Biological Review Team (BRT) determined that the southern Eulachon was at moderate risk of extinction (Drake *et al.* 2008).

Eastern Steller sea lion. The eastern Steller sea lion ranges from southeast Alaska to southern California with a minimum abundance of 44,404 animals (NMFS 2009a), and has increased at 3% per year for the past 30 years (NMFS 2008c). The greatest increases have occurred in southeast Alaska and British Columbia (together accounting for 82% of pup production), but performance has remained poor in California at the southern extent of their range. In Southeast Alaska, British Columbia and Oregon, the number of Steller sea lions has more than doubled since the 1970s. There are no substantial threats to the species, and the population continues to increase at approximately 3% per year. The final Steller sea lion recovery plan identifies the need to initiate a status review for the eastern Steller sea lion and consider removing it from the Federal List of Endangered Wildlife and Plants (NMFS 2008c). The eastern Steller sea lions breeds on rookeries located in southeast Alaska, British Columbia, Oregon, and California; there are no rookeries located in Washington. Haulouts are located throughout the eastern population's range (NMFS 2008c).

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

Interior Columbia (IC) Recovery Domain. Species in the IC recovery domain include UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, MCR steelhead, and SRB steelhead. The IC-TRT identified 82 demographically-independent populations of those species based on genetic, geographic (hydrographic), and habitat characteristics (Table 17). In some cases, the IC-TRT further aggregated populations into major groupings based on dispersal distance and rate, and drainage structure, primarily the location and distribution of large tributaries (IC-TRT 2003). All 82 populations identified use the lower mainstem of the Snake River, the mainstem of the Columbia River, and the Columbia River estuary, or part thereof, for migration, rearing, and smoltification.

Table 17. Demographically-independent populations of ESA-listed Pacific salmon and steelhead in the IC recovery domain.

Species	Populations
UCR spring-run Chinook salmon	3
SR spring/summer Chinook salmon	31
SR fall-run Chinook salmon	1
SR sockeye salmon	1
UCR steelhead	4
MCR steelhead	17
SRB steelhead	25

The IC-TRT also recommended viability criteria that follow the VSP framework (McElhany *et al.* 2006) and described biological or physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period (IC-TRT 2007, see also NRC 1995). As of this writing, the IC-TRT has applied the viability criteria to 68 populations, although it has only completed a draft assessment for 55 populations (IC-TRT 2006). Of those assessments, the only population that the TRT found to be viable was the North Fork John Day population of MCR steelhead. The strength of this population is due to a combination of high abundance and productivity, and good spatial structure and diversity, although the genetic effects of the large number of out-of-species strays and of natural spawners that are hatchery strays are still significant long-term concerns.

UCR spring-run Chinook salmon. This species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam 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), but no major groups due to the relatively small geographic area affected (IC-TRT 2003, McClure *et al.* 2005). The IC-TRT considered that this species is at high risk of extinction because all extant populations are at high risk (IC-TRT 2006).

The major factors limiting recovery of UWR spring-run Chinook salmon include altered channel morphology and flood plain, riparian degradation and loss of in-river large wood, reduced streamflow, impaired passage, hydropower system mortality, and harvest impacts (NMFS 2006).

SR 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 sub-basins; and progeny of fifteen artificial propagation programs. The IC-TRT identified 31 historical populations of SR spring/summer run Chinook salmon, and aggregated these into major population groups (Table 18) (IC-TRT 2003, McClure *et al.* 2005). This species includes those fish that spawn in the Snake River drainage and its major tributaries, including the Grande Ronde River and the Salmon River, and that complete their adult, upstream migration past Bonneville Dam between March and July. Each of these populations are part of the Grande Ronde and Imnaha River major group, and all face a high risk of extinction (IC-TRT 2006).

The major factors limiting recovery of SR spring/summer run Chinook salmon include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, and hydropower system mortality (NMFS 2006).

Table 18. SR spring/summer run Chinook salmon populations.

<table>
<tr><th>Major Group</th><th>Spawning Populations (Watershed)</th><th>Major Group</th><th>Spawning Populations (Watershed)</th></tr>
<tr><td rowspan="2">Lower Snake River</td><td>Tucannon River</td><td rowspan="7">Middle Fork Salmon River (continued)</td><td>Camas Creek</td></tr>
<tr><td>Asotin River</td><td>Loon Creek</td></tr>
<tr><td rowspan="7">Grande Ronde and Imnaha rivers</td><td>Wenaha River</td><td>Pistol Creek</td></tr>
<tr><td>Wallowa-Lostine River</td><td>Sulphur Creek</td></tr>
<tr><td>Minam River</td><td>Bear Valley Creek</td></tr>
<tr><td>Catherine Creek</td><td>March Creek</td></tr>
<tr><td>Upper Grande Ronde</td><td>U. Middle Fork main</td></tr>
<tr><td>Imnaha River mainstem</td><td rowspan="8">Upper Mainstem Salmon</td><td>N. Fork Salmon River</td></tr>
<tr><td>Big Sheep Creek</td><td>Lemhi River</td></tr>
<tr><td colspan="2">Looking-glass Creek</td><td>Pahsimeroi River</td></tr>
<tr><td>Little Salmon</td><td>Little Salmon River</td><td>Upper Salmon l. main</td></tr>
<tr><td rowspan="3">South Fork Salmon River</td><td>South Fork Main Stem</td><td>East Fork Salmon River</td></tr>
<tr><td>Secesh River</td><td>Yankee Fork</td></tr>
<tr><td>East Fork South Fork</td><td>Valley Creek</td></tr>
<tr><td colspan="2">Chamberlin Creek</td><td>Upper Salmon main</td></tr>
<tr><td rowspan="2">Middle Fork Salmon River</td><td>Big Creek</td><td colspan="2" rowspan="2">Panther Creek</td></tr>
<tr><td>L. Middle Fork main</td></tr>
</table>

SR 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 (IC-TRT 2003, McClure *et al.* 2005). Unlike the other listed Chinook species in this recovery domain, most SR fall-run Chinook have a subyearling, ocean-type life history in which juveniles out-migrate the next summer, rather than rearing in freshwater for 13 to 14 months before outmigration. The IC-TRT has not completed a viability assessment of this species.

The major factors limiting recovery of SR fall-run Chinook salmon include reduced spawning/rearing habitat, degraded water quality, hydropower system mortality, and harvest impacts (NMFS 2006).

SR 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 production in at least five Stanley Basin 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 are extremely low and limited to Redfish Lake (IC-TRT 2007).

The major factors limiting recovery of SR sockeye salmon include altered channel morphology and flood plain, reduced streamflow, impaired passage, and hydropower system mortality (NMFS 2006).

MCR 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 20 historical populations of MCR steelhead in five major groups (Table 19) (IC-TRT 2003, McClure *et al.* 2005).

The major factors limiting recovery of MCR steelhead include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, impaired passage, and hydropower system mortality (NMFS 2006).

Table 19. MCR steelhead populations.

Major Group	Population (Watershed)
Cascade Eastern Slope Tributaries	Klickitat River
	Fifteenmile Creek
	Deschutes River Eastside Tributaries
	Deschutes River Westside Tributaries
	White Salmon (access blocked above Condit Dam)
	Deschutes (extirpated above Pelton Dam)
	Crooked River (extirpated)
John Day River	Lower Mainstem John Day River
	North Fork John Day River
	Middle Fork John Day River
	South Fork John Day River
	Upper Mainstem John Day River
	Willow Creek (extirpated)
Rock Creek	Rock Creek
Walla Walla and Umatilla rivers	Umatilla River
	Walla Walla River
	Touchet River
Yakima River	Satus Creek
	Toppenish Creek
	Naches River
	Upper Yakima

UCB 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. Four independent populations of UCR steelhead were identified by the IC-TRT in the same upriver tributaries as for the previous species (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan) and, similarly, no major population groupings were identified due to the relatively small geographic area involved (IC-TRT 2003, McClure *et al.* 2005). The IC-TRT has not completed a viability assessment of this species, although all extant populations are considered to be at high risk of extinction (IC-TRT 2006).

The major factors limiting recovery of UCR steelhead include altered channel morphology and flood plain, riparian degradation and loss of in-river large wood, excessive sediment, degraded water quality, reduced streamflow, hydropower system mortality, harvest impacts, and hatchery impacts (NMFS 2006).

SRB 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. These fish are genetically differentiated from other interior Columbia steelhead populations and spawn at higher altitudes (up to 6,500 feet) after longer migrations (more than 900 miles). The IC-TRT identified 25 historical populations in five major groups (Table 20) (IC-TRT 2003, McClure *et al.* 2005). The IC-TRT has not completed a viability assessment of this species.
The major factors limiting recovery of SRB steelhead include altered channel morphology and flood plain, excessive sediment, degraded water quality, reduced streamflow, hydropower system mortality, harvest impacts, and hatchery impacts (NMFS 2006).

Table 20. SRB steelhead populations.

	Spawning Populations (Watershed)
Lower Snake River	Tucannon River
	Asotin River
Clearwater River	Lower Clearwater River
	S. Fork Clearwater
	Lolo Creek
	Selway Creek
	Lochsa River
	N. Fork Clearwater (extirpated)
Grande Ronde River	Lower Grande Ronde
	Joseph Creek
	Wallowa River
	Upper Grande Ronde
Salmon River	Little/Lower Salmon
	South Fork Salmon
	Secesh River
	Chamberlain Creek
	L. Middle Fork Salmon
	U. Middle Fork Salmon
	Panther Creek
	North Fork Salmon
	Lemhi River
	Pahsimeroi River
	East Fork Salmon
	Upper Main Salmon
Imnaha	Imnaha River
Hells Canyon	Hells Canyon Tributaries

Status of the Critical Habitats

NMFS designated critical habitat for all species considered in this Opinion, except LCR coho salmon, for which critical habitat is not proposed or designated, and eulachon, for which critical habitat is proposed but not yet designated; eastern Steller sea lion does not have critical habitat designated in the action area (Table 8). To assist in the designation of critical habitat for ESA-listed species of Pacific salmon and steelhead in 2005, NMFS convened Critical Habitat Analytical Review Teams, or CHARTs, organized by major geographic areas that roughly correspond to salmon recovery planning domain (NOAA Fisheries 2005). Each CHART consisted of Federal biologists and habitat specialists from NMFS, the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the U.S. Bureau of Land Management, with demonstrated expertise regarding Pacific salmon and steelhead habitat and related protective efforts within that domain.

Each CHART assessed biological information pertaining to areas under consideration for designation as critical habitat to identify the areas occupied by listed Pacific salmon and steelhead, determine whether those areas contained PCEs essential for the conservation of those species, and whether unoccupied areas existed within the historical range of the listed Pacific salmon and steelhead that may also be essential for conservation. The CHART then scored each habitat area based on the quantity and quality of the physical and biological features; rated each habitat area as having a “high,” “medium,” or “low” conservation value; and identified management actions that could affect habitat for Pacific salmon and steelhead.

The ESA gives the Secretary of Commerce discretion to exclude areas from designation if he determines that the benefits of exclusion outweigh the benefits of designation. Considering economic factors and information from CHARTs, NMFS partially or completely excluded the following types of areas from the 2005 critical habitat designations:

1. Military areas. All military areas were excluded because of the current national priority on military readiness, and in recognition of conservation activities covered by military integrated natural resource management plans.

2. Tribal lands. Native American lands were excluded because of the unique trust relationship between tribes and the federal government, the federal emphasis on respect for tribal sovereignty and self governance, and the importance of tribal participation in numerous activities aimed at conserving salmon.

3. Areas With Habitat Conservation Plans. Some lands covered by habitat conservation plans were excluded because NMFS had evidence that exclusion would benefit our relationship with the landowner, the protections secured through these plans outweigh the protections that are likely through critical habitat designation, and exclusion of these lands may provide an incentive for other landowners to seek similar voluntary conservation plans.

4. Areas With Economic Impacts. Areas where the conservation benefit to the species would be relatively low compared to the economic impacts.

In designating these critical habitats, NMFS organized information at scale of the watershed or 5th field HUC because it corresponds to the spatial distribution and site fidelity scales of Pacific salmon and steelhead populations (WDF *et al.* 1992, McElhany *et al.* 2000). For earlier critical habitat designations for Snake River, similar information was not available at the watershed scale, so NMFS used the scale of the sub-basin or 4th field HUC to organize critical habitat information. For southern green sturgeon, the CHART identified and designated critical habitat as specific areas within freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas
(within 110-meter depth).

NMFS reviews the status of designated critical habitat affected by the proposed action by examining the condition and trends of PCEs throughout the designated area. These PCEs vary slightly for some species, due to biological and administrative reasons, but all consist of site types and site attributes associated with life history events (Tables 21 – 23).

Table 21. Primary constituent elements of critical habitats designated for ESA-listed salmon and steelhead species considered in the Opinion (except SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, and SR sockeye salmon), and corresponding species life history events.

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

Table 22. Primary constituent elements of critical habitats designated for SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and corresponding species life history events.

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

Table 23. Primary constituent elements of critical habitat proposed for southern green sturgeon and corresponding species life history events.

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

Climate change is likely to have negative implications for the conservation value of designated critical habitats in the Pacific Northwest (CIG 2004, Scheuerell and Williams 2005, Zabel *et al.* 2006, ISAB 2007). Average annual Northwest air temperatures have increased by approximately 1^{o}C since 1900, or about 50% more than the global average warming over the same period (ISAB 2007). The latest climate models project a warming of 0.1 to 0.6^{o}C per decade over the next century. According to the ISAB, these effects may have the following physical impacts within the next 40 or so years:

- Warmer air temperatures will result in a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.
- With a shift to more rain and less snow, the snowpack will diminish in those areas that typically accumulate and store water until the spring freshet.
- With a smaller snowpack, these watersheds will see their runoff diminished and exhausted earlier in the season, resulting in lower stream flows in the June through September period.
- River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.

- Water temperatures will continue to rise, especially during the summer months when lower stream flows and warmer air temperatures will contribute to the warming regional waters.

These changes will not be spatially homogeneous across the entire Pacific Northwest. Sites with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring would be less affected. Low-lying areas that historically have received scant precipitation are likely to be more affected. The ISAB (2007) also identified the likely effects of projected climate changes on Columbia River salmon and their habitat. These effects may include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition among species. Similar effects are likely to occur to some extent throughout the Pacific Northwest.

W LC Recovery Domain. Critical habitat was designated in the WLC recovery domain for UWR spring-run Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, and CR chum salmon. In addition to the Willamette and Columbia River mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappoose River in the Oregon Coast sub-basin; Hood River in the Gorge; and the Sandy, Clackamas, Molalla, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades sub-basin.

The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75%. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Agriculture, urbanization, and gravel mining on the valley floor logging in the Cascade and Coast Ranges contribute to increased erosion and sediment loads throughout the basin.

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

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

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

Gregory *et al.* (2002c) described the changes in riparian vegetation in river reaches from the mouth to Newberg, from Newberg to Albany, and from Albany to Eugene. They noted that the riparian forests were formerly a mosaic of brush, marsh, and ash tree openings maintained by annual flood inundation. Below the City of Newberg, the most noticeable change was that conifers were almost eliminated. Above Newberg, the formerly hardwood-dominated riparian forests along with mixed forest made up less than half of the riparian vegetation by 1990, while agriculture dominated. This conversion represents a loss of recruitment potential for large wood, which functions as a component of channel complexity, much as the morphology of the streambed does, to reduce velocity and provide habitat for macroinvertebrates that support the prey base for Pacific salmon and steelhead. Declining extent and quality of riparian forests have also reduced rearing and refugia habitat provided by large wood, shading by riparian vegetation, which can cool water temperatures, and the availability of leaf litter and the macroinvertebrates that feed on it.

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

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded Pacific salmon and steelhead habitats (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2005, and NOAA Fisheries 2006). 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 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 2005, and NOAA Fisheries 2006). Since 1878, 100 miles of the mainstem Columbia River, its estuary, and Oregon's Willamette River has been dredged as a navigation channel by the Army Corps of Engineers. Originally dredged to a 20 foot minimum depth, the Federal navigation channel of the lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons (PAHs), have been identified in lower Columbia River watersheds in the vicinity of the ports and associated industrial activities.

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

The Columbia River estuary has lost a significant amount of tidal marsh and tidal swamp habitat that are critical to juvenile Pacific salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2005, and NOAA Fisheries 2006). Edges of marsh areas provide sheltered habitats for juvenile Pacific salmon and steelhead where food, in the form of amphipods or other small invertebrates, which feed on marsh detritus, is plentiful, and larger predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile Pacific salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for Pacific salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2005, and NOAA Fisheries 2006). Diking and filling activities that decrease the tidal prism and eliminate emergent and forested wetlands and floodplain habitats have likely reduced the estuary's salmon-rearing capacity. Moreover, water and sediment in the lower Columbia River and its tributaries have levels of toxic contaminants that are harmful to fish and wildlife (LCREP 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as dichlorodiphenyltrichloroethane (DDT). Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns might significantly enhance the estuary's productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats, even in their presently altered state.

The NMFS recently designated critical habitat for southern green sturgeon, including coastal U.S. marine waters within 110 m depth from Monterey Bay, California, including Monterey Bay, north to Cape Flattery, Washington, including the Straits of Juan de Fuca, Washington, to its U.S. boundary; the Sacramento River, lower Feather river, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary up to RM 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, and Yaquina Bay), and Washington (Willapa Bay and Grays Harbor). In addition to the general exclusions listed above, the CHART determined that the following areas within the SONCC Domain will be excluded from critical habitat designations: Elkhorn Slough, Tomales Bay, Noyo Harbor, Eel River estuary, Klamath/Trinity River estuary, and the Rogue River estuary. Excluded estuary areas extend to the head of tide. The CHART based their determination on these areas having a low or ultra-low conservation value and a lack of documentation that southern green sturgeon use these areas extensively.

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

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

Migratory habitat quality in this area has been severely affected by the development and operation of the FCRPS dams and reservoirs in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia river basins. For example, construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al.* 2005), and Grande Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River. Hydroelectric development modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile Pacific salmon and steelhead, and delayed migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles.

Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have drastically altered hydrological cycles. A series of large regulating dams on the middle and upper Deschutes River affect flow and block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope major population (IC-TRT 2003). Similarly, operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly reduced flows and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the IC recovery domain are over-allocated under state water law, with more allocated water rights than existing streamflow conditions can support. Irrigated agriculture is common throughout this region and withdrawal of water increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed Pacific salmon and steelhead species in this area except SR fall-run Chinook salmon.

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

Environmental Baseline

This section describes the effects of past and ongoing human and natural factors within the action area, on the current status of the species, their habitats and ecosystems. 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).

The action area exists in the lower Columbia River basin, that portion of the mainstem Columbia River and its tributaries downstream of Bonneville Dam to its Pacific Ocean terminus. The baseline includes the existing Columbia River I-5 crossing (circa 1917 and 1958) and its connected stormwater infrastructure, thereby creating a transect in which all ESA-listed Columbia basin salmon, steelhead, sturgeon, and eulachon must intersect to fulfill their life histories. Though the Willamette River is downstream of the crossing, NMFS includes UWR fish albeit a lesser degree than other Columbia River basin species due to assumed natural straying. This point and the project's action area serve primarily as a migratory corridor for these species and to a lesser extent rearing. The action and all of its elements will occur in the lower Columbia River.

The current state of the lower Columbia River and the action area baseline originates from hydro effects (Federal Columbia River Power System), tributary habitat effects, estuary and plume habitat effects, predation and disease effects, hatchery effects, harvest effects, and large-scale environmental factors. In general, Columbia River salmon have been adversely affected by a broad number of human activities including habitat losses from all causes (population growth, urbanization, roads, diking, etc.), fishing pressure, flood control, irrigation dams, pollution, municipal and industrial water use, introduced species, and hatchery production (NRC 1996). In addition, salmon populations have been strongly affected by ocean and climate conditions.

The quality and quantity of habitat in many Columbia River basin watersheds have declined dramatically in the last 150 years. Forestry, farming, grazing, road construction, hydrosystem development, mining, and urbanization have changed the historical habitat conditions. Water diversions in Oregon have significantly depleted tributaries flows (NPPC 1992). Depleted tributary streamflows have been identified a major limiting factors for most species in the Interior Columbia basin (PCSRF 2007). Effects in the tributaries extend down into the mainstem Columbia as described in the following section Mainstem Effects.

Historically, the lower Columbia River sub-basin had an active connection between the channel and its floodplain, forming habitat diversity via flow and formation of side channels and deposition of woody debris. The Columbia River estuary is estimated to have once had 75% more tidal swamps. These areas provided feeding and resting habitat for juvenile salmonids in the form of low-velocity marshland and tidal channel habitats (Bottom *et al.* 2005).
The construction of dams, levees, dikes, and shipping channels through dredging between the 1930s and 1970s significantly altered the timing and magnitude of hydrologic events, and significantly reduced connection between the river and its floodplain. The Columbia River estuary historically received annual spring freshet flows that averaged 75–100% higher than current freshet flows. In addition, historical winter flows (October through March) were approximately 35–50% lower than current flows. The greater historical peak and variable flows encouraged greater sediment transport and more flooding wetlands, contributing to a more complex ecosystem than exists today (ISAB 2000). Reduced flow poses particularly high risks for juvenile anadromous fish. Dramatic reductions in flow compared to the historical spring freshet have increased the travel time of juvenile outmigrants. This increases potential exposure to predation, elevated temperatures, disease, and other environmental stressors (NMFS 2008d, Bottom *et al.* 2005).

Land-use practices and the development of multiple reservoir complexes in the Columbia's sub-basins significantly reduced the delivery of large wood and sediment. Availability of aquatic habitat for native fish, particularly those that rely heavily on low-velocity side channel habitat for holding, feeding, and rearing, has declined because of these changes to habitat-forming processes. Active navigation channel management by the Corps of Engineers through dredging has resulted in the filling of shallow-off channel habitats and expanded/created main-stem islands.

Water quality throughout the action area is degraded. Urban, industrial, and agriculture practices across the basin contribute multiple pollutants at levels harmful to aquatic life. The following exhibits the current conditions of pollutant loads within the lower Columbia River. The River and North Portland Harbor are on the DEQ 303(d) list for the following parameters: temperature, PCBs, PAHs, DDT metabolites such as dichlorodiphenyldichloroethylene (DDE), and arsenic (DEQ 2007a). The lower Columbia River is on the Washington State 303(d) list for temperature, PCBs, and dissolved oxygen (WDOE 2009b). The U.S. Environmental Protection Agency (EPA) has approved total maximum daily loads (TMDLs) for dioxin and total dissolved gas in the lower Columbia River (DEQ 1991, 2002).

In addition to the contaminants listed above, dissolved copper, a neurotoxin that damages the olfactory abilities of fish, is known to be present above naturally occurring levels in the lower Columbia River. Studies indicate that dissolved copper in the action area may occur at levels known to injure salmonids (WDOT 2005; WDOE 2006; DEQ 2009). In addition, fertilizers, pesticides and heavy metal contaminants are present in lower Columbia River sediments (DEQ 2007b, as cited in NMFS 2008c). Potentially, resulting in immunosuppression, and reduced growth rates in juvenile fish during their residence in the estuary (Arkoosh *et al.* 1991, 1994, 1998; Varanasi *et al.* 1993; Casillas *et al.* 1995a, 1995b, and 1998a, all cited in NMFS 2008c). It is recognized that roadways contribute pollutants such as copper, zinc, and PAHs into waterways through direct inputs via vehicular wear and by transporting anthropogenic atmospheric sources as well. The network of roadways within the lower Columbia River basin funded, built and maintained by the FHWA and its state DOT and local partners is vast, affecting the hydrology and water quality of the entire basin.

Species within the Action Area

All populations spawning within the Columbia River basin use the Columbia River mainstem and estuary to complete part of their life history, including migration, rearing and smoltification. With few exceptions for populations that spawn below RM 106, every individual from each of those populations must pass through the action area at least twice, during downstream migration as a juvenile and upstream migration as an adult.

The Columbia River and estuary serve three primary roles for outmigrating juveniles as they transition from shallow, freshwater environments to the ocean: (1) A place where juvenile fish can gradually acclimate to salt water; (2) a feeding area (main, and tidal channel, unvegetated shoals, emergent and forested wetlands, and mudflats) capable of sustaining increased growth rates; and (3) a refuge from predators while fish acclimate to salt water. Thus, though the

Columbia River and estuary is important to the survival and recovery of all ESA-listed salmonids, it is particularly important to ocean-type salmon. These stocks may be particularly sensitive to ecosystem changes because of their longer residence times and dependence on this portion of the river for growth and survival. In this consultation, NMFS focused on ocean-type salmon as an indicator of the importance of the lower Columbia River and estuary to all ESA-listed salmonids. NMFS focused on ocean-type salmon because they are an indicator of the most sensitive salmonid response to changes in estuary and river habitats. Neither critical habitat, nor take prohibitions exist for eulachon. For the purposes of this Opinion, the Lower River designates the freshwater fluvial portion of the river from Bonneville Dam downstream to a point above marine and fresh-water mixing or dominance. The Columbia River estuary extends from RM 47 to the Pacific Ocean and includes the zone where marine and freshwater mix.

Ocean-type salmon species in the Columbia River include Chinook species (LCR, SR fall-run, and UWR) and CR chum salmon. These species are the most likely to be affected by potential impacts of the Project, and thus are discussed in detail below. Ocean-type salmon migrate downstream to and through the estuary as subyearlings, generally leaving the spawning area where they hatched within days to months following their emergence from the gravel. Consequently, subyearlings commonly spend weeks to months rearing within the lower portion of the action area before reaching the size at which they migrate to the ocean.

The first outbound migrants of the Columbia River fall Chinook and chum may arrive in the action area as early as late February (Herrmann 1970; Craddock *et al.* 1976; Healey 1980; Congleton *et al.* 1981; Healey 1982; Dawley *et al.* 1986; Levings *et al.*1986). The majority of these fish are present from March through June. Outbound Snake River fall Chinook begin their migration much farther upstream and arrive in the Columbia River approximately a month later.

Ocean-type subyearlings arrive in the lower river and estuarine portion of the action area at a small size. The earliest migrants can be as small as 30 to 40 mm fork length when they arrive because some of these fish hatch only a short distance upstream from the action area. Later spring migrants are generally larger, ranging up to 50 to 80 mm. Subyearlings from the mid-Columbia and Snake Rivers tend to be substantially larger (70 to 100 mm) by the time they reach the lower Columbia River. The larger size of the lower Snake River fall Chinook, compared with the lower Columbia River Chinook and chum, likely indicates some differences in suitable habitat. The larger subyearlings from the Snake River can likely use a greater range of depth and current conditions than the subyearlings of the Columbia River species can.

Once ocean-type subyearlings arrive in the lower Columbia River, they may remain for weeks to months. Because these fish arrive small in size, they undergo extended lower river and estuary rearing before they reach the transitional size necessary to migrate into the ocean (70 to 100 mm). This larger size is necessary to deal with the physical conditions and predators they face in the ocean environment, as well as to be successful in obtaining prey in that environment. At growth rates of about 0.3 to 1 mm per day (Levy *et al.* 1979; Argue *et al.* 1985; Fisher and Pearcy 1990), the subyearlings require weeks to months to reach this larger size. During this time, young Chinook increase by about 5 to 8 grams per day or approximately 6% of their body weight (Herrmann 1970; Healey 1980).

Ocean-type subyearlings migrate through the riverine reach of the action area of the Project during their downstream migration (about 93 miles). Because of this, many spend some time rearing within the riverine reach; however, there is considerable variability in the freshwater rearing period of subyearling populations. Some subyearlings spawned in the lower reaches of coastal tributaries migrate almost immediately to marine areas following emergence from the gravel. Other subyearlings rear in freshwater for weeks to months, particularly those spawned well upstream in larger river systems such as the Columbia. The migration rate for subyearlings undergoing the rearing migration through the riverine reach is likely to be a few to ten km per day. Subyearlings migrating directly to the estuary migrate at rates of 15 to 30 km per day (MacDonald 1960; Simenstad *et al.* 1982; MacDonald *et al.* 1987; Murphy *et al.* 1989; Fisher and Pearcy 1990). Adult salmon returning to the Columbia River migrate through the river mouth throughout the year. The majority move through this area from early spring through autumn.

A number of physical characteristics in the riverine reach affect the quality and quantity of habitat available for salmonids. These include the availability of prey, temperature, turbidity, and suspended solids. Subyearlings are commonly found within a 10 feet of the shoreline at water depths of less than 3 feet. Although they migrate between areas over deeper water, they generally remain close to the water surface and near the shoreline during rearing, favoring water no more than 2 meters deep and areas where currents do not exceed 1 foot per second. They seek lower energy areas where waves and currents do not require them to expend considerable energy to remain in position while they consume invertebrates that live on or near the substrate. These areas are characterized by relatively fine grain substrates. However, it is not uncommon to find young salmonids in areas with steeper and harder substrates, such as sand and gravel.

Young Chinook in the lower Columbia River action area consume a variety of prey, primarily insects in the spring and fall and *Daphnia* from July to October (Craddock *et al.* 1976). *Daphnia* are the major prey during the summer and fall months, selected more than other planktonic organisms. Young salmonids consume diptera, hymenoptera, coleoptera, tricoptera, and ephemeroptera in the area just upstream from the estuary (Dawley *et al.* 1986). Bottom and Jones (1990) recently reported that young Chinook ate primarily *Corophium*, *Daphnia*, and insects, with *Corophium* being the dominant prey species in winter and spring and *Daphnia* the dominant prey species in summer. Salmonids commonly feed on *Corophium* males, which apparently are more readily available than the larger females.

Corophium is commonly discussed as a primary prey item of juvenile salmonids in the Columbia River. *Corophium salmonis* is a euryhaline species tolerating salinities in the range of zero to 20 ppt (Holton and Higley 1984). As shown by the above investigations, it is one of several major prey species consumed by juvenile Chinook under existing conditions. No data are available that indicate its historical role in the diet of Columbia River salmon before substantial modification of the river system. Nutritionally, *Corophium* may not be as desirable as other food sources for young salmon. According to Higgs *et al.* (1995), gammarid amphipods such as *Corophium* are high in chitin and ash and low in available protein and energy relative to daphnids and chironomid larvae.

Subyearling Chinook and chum first enter the estuary at about the same time that they enter the riverine potion of the lower Columbia River because some of the fry move rapidly to the estuary by mid-March rather than rearing in the riverine areas (Craddock *et al.* 1976; Dawley *et al.* 1986; Levy and Northcote 1982; Healey 1982; Hayman *et al.* 1996). As Chinook fry migrate to the estuary, they may remain in the low salinity or even freshwater areas for some time until they have grown somewhat larger (more than 75 mm) (Kjelson 1982; Levings 1982; Levy and Northcote 1982; MacDonald *et al.* 1986; Shreffler *et al.* 1992; Hayman *et al.* 1996). However, some Chinook fry appear to move immediately to the outer edges and higher salinity portions of the estuary (Stober *et al.* 1971; Kask and Parker 1972; Healey 1980; Johnson *et al.* 1992; Beamer *et al.* 2000).

Ocean-type fish commonly have the capacity to adapt to highly saline waters shortly after emergence from the gravel. Tiffan *et al.* (2000) determined that, once active migrant fall Chinook passed McNary Dam 470 km upstream from the Columbia River's mouth, 90% of the subyearlings were able to survive challenge tests in 30 ppt seawater at 18.3^{o}C. Other investigators have found that very small Chinook fry are capable of adapting to estuarine salinities within a few days (Clark and Shelbourn 1985). Wagner *et al.* (1969) found that all fall Chinook alevins tested were able to tolerate 15 to 20 ppt salinity immediately after hatching.

In addition, young salmonids in the estuary continue to eat many of the same organisms as are consumed in the riverine reach of the lower Columbia River, but there are shifts in prey abundance. Young Chinook and chum at Miller Sands in the upper estuarine reach feed primarily on the pelagic prey *Daphnia longispina* and *Eurytemora hirundoides*, the benthic prey *Corophium salmonis*, and chironomid larvae and pupae (McConnell *et al.* 1978). Diet overlaps considerably among the different species. Many yearlings passing through the lower river were found to have empty or less than full stomachs (Dawley *et al.* 1986).

Adult salmon returning to the Columbia River migrate through the river mouth throughout the year although most move through this area from early spring through autumn (Appendix B).

Southern green sturgeon. The following information is summarized from NMFS 2009c and NMFS 2008x. The Columbia River estuary is the center of the largest observed aggregation of North American green sturgeon. Southern green sturgeon mix with non-ESA designated northern fish in large aggregations in marine waters of the lower Columbia River estuary. Patterns of telemetry data suggest that southern fish use the Columbia as summering grounds and overwinter in coastal waters off central California and between Vancouver Island, BC, and southeast Alaska. The upriver extent of marine waters in the Columbia is approximately RM 46, coinciding with the extent of designated critical habitat. However, green sturgeon are assumed to travel to Bonneville Dam (RM 146), though in significantly lower numbers, based on lack of barriers and harvest studies. Tagging studies have only sampled individuals to RM 46, while commercial data suggests some movement to Bonneville Dam based on commercial zone harvest reports. Data from 1981–2004 shows a combined catch of 290 southern and northern fish above RM 52, and approximately 37,000 caught below, primarily below RM 20. The CRC footprint is at RM 106.

After leaving their natal grounds in the Sacramento River at around the age of three years and traveling as sub-adults in marine waters they distribute themselves along the West Coast and estuarine waters. Those adult and subadult green sturgeon that spend transient time in the Columbia River estuary feed on crangonid shrimp, burrowing thalassinidean shrimp (primarily the burrowing ghost shrimp (*Neotrypaea californiensis*), but possibly other related species), amphipods, clams, juvenile Dungeness crab (*Cancer magister*), anchovies, sand lances (*Ammodytes hexapterus*), lingcod (*Ophiodon elongatus*), and other unidentified fishes. Burrowing ghost shrimp made up about 50% of the stomach contents of green sturgeon sampled in 2003. Subadults and adults feeding in bays and estuaries may be exposed to contaminants that may affect their growth and reproduction. Studies on white sturgeon in estuaries indicate that the bioaccumulation of pesticides and other contaminants adversely affects growth and reproductive development and may result in decreased reproductive success. Green sturgeon are believed to experience similar risks from contaminants.

Eulachon. The Columbia River and its tributaries support the largest eulachon run in the world (Hay *et al.* 2002). Eulachon use the mainstem Columbia River portion of action area primarily to migrate to spawning grounds as adults, and as larvae to emigrate out of freshwater into marine waters soon after emergence. Large spawning runs of eulachon occur in the mainstem lower Columbia River and the tributary Cowlitz, Lewis, Sandy (Craig and Hacker 1940), Grays (Smith and Saalfeld 1955), Kalama (DeLacy and Batts 1963), and Elochoman rivers and Skamokawa Creek (WDFW and ODFW 2001). Smith and Saalfeld (1955) stated that eulachon were occasionally reported to spawn up to the Hood River on the Oregon side of the Columbia River prior to the construction of Bonneville Dam in the 1930s. In times of great abundance (*e.g.*, 1945, 1953) eulachon have been known to migrate as far upstream as Bonneville Dam (Smith and Saalfeld 1955, WDFW and ODFW 2008) and may extend above Bonneville Dam by passing through the ship locks (Smith and Saalfeld 1955). The Status Review Update for Eulachon in Washington, Oregon, and California (EBRT 2010) reports that evidence of mainstem exists as well, but notes that additional sampling is needed to determine the extent and amount.

The majority of reproduction occurs in those tributaries downstream of the CRC, with reproduction unpredictable upstream of the CRC. Annual catch records show eulachon to be absent from the Sandy River in 12 one or more consecutive years (JCRMS 2006). Eulachon runs have been recorded 31 of 81 years (1929–2009), with sustained absences in 1958–1970 and 1989–2000. Return run timing of eulachon is varied, the majority of adults entering the Columbia River from the middle of February. Using the Lewis and Sandy Rivers as a proxy to the CRC, the nearest downstream and upstream spawning areas, the majority of the adults should pass through the CRC project area in April and May. Impact driving of pile would occur up to April 15 each year.

Habitat preferences of eulachon within the Columbia River are not well understood. With the exception of preferred spawning habitat (which is typically coarse sand or pea-sized gravel substrate), observational data suggest that migrating eulachon exhibit little preference for habitat type, and may use deep, shallow, brightly lit, and/or shaded portions of the river. Outmigrants may occur anywhere along the river's transect, and at all depths (Langness 2009 personal communication). Larval eulachon have been found in some studies at greater densities at the bottom of the water column, compared to mid-level or near the surface, and may occur in greater densities outside the navigation channel than within the channel (Howell *et al.* 2001). However, because they are relatively weak swimmers, larval eulachon distribution and use of the water column is thought to be determined by local hydraulic conditions rather than by depth at a particular site (Langness 2009 personal communication; Howell *et al.* 2001). Typical or optimal water velocities for eulachon migration or spawning are not known (Langness 2009 personal communication).

The eulachon have declined to what appear to be nearly historically low levels in the Columbia River. The Eulachon Biological Review Team (EBRT 2010) ranked climate change and its impacts to ocean conditions as the most serious threat to eulachon. As well, climate change impacts on freshwater habitat and eulachon bycatch were scored as moderate to high risk, and dams and water diversions in the Columbia River. Variable year-class strength in marine fishes with pelagic larvae is dependent on survival of larvae prior to recruitment and is driven by match-mismatch of larvae and their planktonic food supply (Lasker 1975, Sinclair and Tremblay 1984), oceanographic transport mechanisms (Parrish *et al.* 1981), variable environmental ocean conditions (Shepherd *et al.* 1984, McFarlane *et al.* 2000), and predation (Bailey and Houde 1989). The operation of these dynamic ocean conditions and their impacts on eulachon recruitment were amply illustrated in the Columbia River population where high larval densities were observed in 2000–2003, followed by lower than average adult returns in 2004, 2005, and 2006 (JCRMS 2007). However, the ability of the Columbia River eulachon stock to respond rapidly to the good ocean conditions of the late 1999-early 2002 period illustrates the species' resiliency and the BRT viewed this resiliency as providing the species with a buffer against future environmental perturbations. Recent invasions of Asian copepods into the Columbia River estuary (Cordell *et al.* 2008) may have a negative influence on the Columbia River population as well.

Eulachon, like Pacific salmon and steelhead, must pass through the lower Columbia River, estuary and river mouth twice: Once as juveniles en route to the Pacific Ocean and again as adults when they return to spawn. Moreover, eulchon that spawn in the Sandy River pass through the part of the action area where underwater noise is expected to reach injurious levels. Like other individuals in this species, those fish are likely to be in a stressed condition due to increased water temperatures, insufficient streamflow, altered sediment balances, water pollution, over-harvest, predation, and other adverse habitat conditions in the lower Columbia River.

Eastern Steller Sea Lion. Eastern Steller sea lions occur in Oregon waters throughout the year, and use breeding rookeries at Rogue Reef and Orford Reef and haulout locations along the Oregon coast. There are four haulout sites used by Steller sea lions in the lower Columbia

River and these include the tip of the South Jetty, where greater than 500 Steller sea lions commonly occur, and three locations proximate to and at the Bonneville Dam tailrace area where Steller sea lions occasionally occur.

Over the last nine years, the number of eastern Steller sea lions seasonally present at the Bonneville dam has increased from zero individuals in 2002 to a minimum estimate of 75 subadult and adult male Steller sea lions in 2010, which although an increase is still a relatively small number of individuals (Stansell *et al.* 2008, 2009, Stansell and Gibbons 2010, Stansell *et al.* 2010).

The few eastern Steller sea lions that travel up the lower Columbia River to the tailrace area of Bonneville Dam travel there to forage on anadromous fishes. Some individual Steller sea lions occur at the tailrace area as early as fall; their numbers peak in winter to early spring and they depart by late spring (Stansell *et al.* 2008, 2009, Stansell and Gibbons 2010). Individuals are likely to transit through the river up to the tailrace area within 1-2 days with transit speeds of 4.6 km/hr in the upstream direction and 8.8 km/hr in the downstream direction (based on the transit times of California sea lions, Brown *et al.* 2010). Therefore, individuals likely spend little time in any one location prior to their arrival in the tailrace area.

In-season return trips between the river mouth and the tailrace area may occur, but limited data suggest that eastern Steller sea lions make few if any return trips until their departure from the tailrace area by late spring. Only one of less than 10 individual eastern Steller sea lions tagged with acoustic/satellite-tags was observed to make an in-season return trip; all others made a single trip, departing by late spring (data collected in 2010, B. Wright unpublished data). However, tags were deployed in the middle of the season, and therefore, return trips could occur more commonly or regularly in the early part of the season.

Eastern Steller sea lions that would transit through the action area were affected by an upriver deterrence program from 2008 to 2010 to reduce pinniped impacts on ESA-listed Pacific salmon and steelhead below Bonneville Dam on the lower Columbia River. NMFS previously consulted on the effects of this program, and concluded that the non-lethal deterrence activities that target Steller sea lions are likely to adversely affect, but not likely to jeopardize Steller sea lions (NMFS 2008e).

Eastern Steller sea lions that are likely to be affected by this proposed action have shown increasing habituation in recent years to the various hazing techniques used to deter the animals from foraging on sturgeon and salmon in the Bonneville tailrace area, including acoustic deterrent devices, boat chasing, and above-water pyrotechnics (Stansell *et al.* 2010, Brown *et al.* 2010). Additionally, many of the individuals that travel to the tailrace area return in subsequent years (NMFS 2008e).

Critical Habitat within the Action Area

Critical habitat units are described by their PCEs. PCEs are the physical and biological features of critical habitat essential to the conservation of listed species, including, but not limited to:

(1) Space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and (5) habitats that are protected from disturbance or are representative of the historic geographic and ecological distributions of a species (USFWS and NMFS 1998).

Pacific salmon and steelhead. Four of the six PCEs used to describe Pacific salmon and steelhead critical habitats occur within the action area: freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors. PCEs related to nearshore and marine areas are important elsewhere but do not occur within the action area.

Freshwater spawning sites. Spawning habitat is extremely limited in the action area, and is present for only three species. CR chum spawn in shallow habitat on the north shore of the lower Columbia River, near Government Island at approximately RM 115, where water quantity and quality conditions and substrate do not fully support spawning, incubation, and larval development. The rest of the action area appears to lack suitable spawning habitat, such as gravel substrate influenced by groundwater seeps, or else is at risk when river management lowers water levels and expose the eggs to the atmosphere. Economic development in some upland areas adjacent to spawning sites threatens to reduce groundwater seeps that support good spawning conditions. This PCE has marginal conservation in the action area.

Freshwater rearing sites. Freshwater rearing occurs throughout the action area although it lacks water quantity and floodplain connectivity necessary to form and maintain physical habitat conditions that fully support juvenile growth and mobility; water quality and forage necessary to fully supporting juvenile development; and has extremely limited natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Without these features, juvenile Pacific salmon and steelhead cannot access and use areas as necessary for them forage, grow, and develop behaviors (*e.g.*, predator avoidance, competition) that help ensure their survival. Floodplain connectivity with associated off-channel refugia is limited or absent in the action area. Dikes, levees, and bank armoring are common and urban development extends up to river's edge in many locations. Natural cover is reduced or absent due to the highly altered and managed nature of the river channel. Flow control at Bonneville Dam leads to rapid changes in water levels and sometimes strand or entrap juveniles when water levels drop. The absence of productive riparian vegetation and complex shallow water habitat severely reduce the abundance and diversity of forage available for juvenile salmonids.

Freshwater migration corridors. The entire action area is a migration corridor for juveniles and adults. Although the action area is relatively free of obstruction, it has high levels of predation, poor water quantity and quality conditions, and lacks well-developed 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. The deficiency of those features reduces access within the action area to the variety of habitats necessary for juveniles to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean in a timely manner. Similarly, lack of these features reduce the ability of adults in a non-feeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores. Although no physical barrier completely blocks fish passage through the action area, habitat and food web degradation increase the difficulty of migration and decrease the conservation value of this PCE.

Estuarine areas. The action area includes most of the Columbia River estuary and, although it is relatively free of physical obstructions, water quality, water quantity, and salinity conditions there do not fully support juvenile and adult physiological transitions between fresh- and saltwater. Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels are poor. Juvenile and adult forage is also poor, including lack of aquatic invertebrates and fishes that provide the energy to support growth and maturation. Without better access to those resources in the action area, juveniles are less likely to reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, lack of those features do not fully support adults because they provide less abundant forage as necessary to provide the energy stores needed to make the physiological transition to fresh water, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas. As noted in the Status of Critical Habitat section, above, development of hydropower, industrial harbors and ports, and urban areas have contributed to extensive losses of tidal marshes and swamps in the estuary, and other changes in aquatic habitats and food webs that reduce the conservation value of this important PCE.

Southern green sturgeon. PCEs used to describe critical habitat for southern green sturgeon are less differentiated than PCEs for Pacific salmon and steelhead, but two of the three are present within the action area from the mouth of the Columbia River up to RM 46, including freshwater riverine systems and estuarine areas. PCEs related to coastal marine areas do not occur within the action area.

Freshwater riverine systems. The action area includes poor forage for subadult and adult sturgeon likely to occur there, although substrates for spawning are unnecessary as this population spawns exclusively in the Sacramento River. Management of the lower Columbia River flow regime is likely to have altered the magnitude, frequency, duration, seasonality, and rate-of-change of fresh water discharge over time that is less than optimal for the normal behavior, growth, and survival of southern green sturgeon. Water quality impairments, including temperature, salinity, oxygen content, and other chemical characteristics, are also likely to limit normal behavior, growth, and viability. Conditions for the safe and timely passage of southern green sturgeon within the river, and between the river and the estuary, are present, with many pools greater than 15 feet deep for upstream and downstream holding of adult or subadult fish.

Estuarine habitats. As noted in the Status of Critical Habitat section above, development of hydropower, industrial harbors and ports, and urban areas have contributed to extensive losses of tidal marshes and swamps in the estuary, and other changes in aquatic habitats and food webs that reduce the conservation value of this important PCE. The action area includes poor forage for subadult and adult sturgeon, although it is likely that flows within the estuary are adequate to subadults and adults to successfully orient to the incoming flow and migrate upstream. The water quality impairments that affect the freshwater riverine PCE Water quality also impair the Columbia River estuary. Conditions for the safe and timely passage of southern green sturgeon within the river, and between the river and the estuary, are present, with many pools greater than 15 foot deep for upstream and downstream holding of adult or subadult fish.

Effects of the Action

Effects of the action refers to 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 caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those lacking independent utility apart from the action under consideration.

The primary effects of CRC will include elevated levels of underwater noise, reduced water quality, and physical habitat alteration associated with the structural footprint of the CRC bridges. For reasons explained below, the underwater noise will occur as short-term pulses (*i.e.,* minutes to hours), separated by virtually instantaneous and complete recovery periods. These disturbances are likely to occur several times a day for up to a week, two to 14 weeks per year, for six years (Table 4). Water quality impairment will also occur as short-term pulses (*i.e.,* minutes to hours) during construction, most likely due to erosion during precipitation events, and will continue due to stormwater runoff for the design life of CRC. Physical habitat alteration due to modification and replacement of existing in-water and over-water structure also occur intermittently during construction, and will remain as the final, as-built project footprint for the design life of CRC.

Impact pile driving will produce a variety of underwater noise levels within radii here referred to collectively as the impact zone (Table 24). In the absence of site-specific data, these radii were calculated using the Practical Spreading Loss model for determining the extent of sound from a source (Thomsen *et al.* 2006, Stadler 2010). The contractor will use a bubble curtain and similar devices to provide sound attenuation during impact pile driving. Underwater noise caused by vibratory installation will be less than impact driving (CALTRANS 2009, WDOT 2010b). Moreover, oscillating and rotating steel casements for drilled shafts are not likely to elevate underwater sound to a level that is likely to cause injury or noise that would cause adverse changes to fish behavior.

Table 24. Maximum predicted effects of impact pile driving for the Columbia River Crossing. FHWA and FTA assume that attenuation such as bubble curtains and dewatered cofferdams will achieve a 10 dB noise reduction.

Effect Characteristics (“impact zone”)	**24-inch Pile**		**48-inch Pile**	
	Without Attenuation	With Attenuation	Without Attenuation	With Attenuation
Root mean square sound pressure level radius exceeds 150 dB re: 1 µPa (distance in feet)	13,058	2814	66,144[1]	17,751
Cumulative sound exposure level radius that exceeds 183 dB re: 1 μPa^2•sec (distance in feet)	1466	177	3250	774
Cumulative sound exposure level radius that exceeds 187 dB re: 1 μPa^2•sec (distance in feet)	823	164	1771	449
Peak sound pressure level that exceeds 206 dB re: 1 µPa (distance in feet)	23	16	112	82

[1] Upstream distance; downstream radius is 29,031 feet due to topographic interception.

Pile installation and removal, and installation and operation of the bubble curtain, will disturb the sediments in the action area and result in some re-suspension of coarse-grained material into the water column. Pile removal is likely to expose a greater amount of sediment due to adhesion of sediment to pile. However, because pile occupies a small area of primarily sandy substrates that are often rearranged by river currents, any increase in turbidity will be small.

Sediment and contaminants are likely to be released into the water by construction activities that are part of the proposed action, including geotechnical surveys, excavation, grading, filling, and in-water work area isolation that is necessary to rehabilitate or replace existing roads, culverts, and bridges, and to construct and maintain stormwater facilities. Soil disturbance will increase the rate at which wind and water erosion will carry sediment into the lower Columbia River. Contamination of sediment from the project area is probable from urban practices, industry and automobile releases. Additionally, the use of heavy construction equipment results in small, unpredictable releases of fuel, lubricant, and hydraulic fluids. The release of construction material, though minor is likely to occur as well (grinding slurry, concrete, and rubble). Grinding slurry will be released from the use of underwater wire-cable saws to dismantle the existing I-5 bridge piers. The traceable turbidity extent of slurry is not anticipated to exceed three-hundred feet.

Discharge of stormwater runoff from CIA associated with the proposed action will also contribute a variety of pollutants to the lower Columbia River that originate directly from automobiles and indirectly via aerial deposition from industrial and agricultural production. These pollutants will include, but are not limited to, nutrients, metals (arsenic, copper, chromium, lead, mercury, and nickel), PAHs, sediment, and pesticides (LCREP 2007; Buckler and Granato 1999, Colman *et al.* 2001, Kayhanian *et al.* 2003).

Pollutants like these travel long distances in rivers either in solution, adsorbed to suspended particles, or retained in sediments until mobilized, transported by future sediment moving flows (Anderson *et al.* 1996, Alpers *et al.* 2000a, 2000b). The toxicity of these pollutants varies other water quality speciation and concentration. Regarding dissolved heavy metals, Santore *et al.* (2001) indicates that the presence of natural organic matter and changes in pH and hardness affect the potential for toxicity (increase and decrease). Additionally, organics such (living and dead) can adsorb and absorb other pollutants such as PAHs. The variables of organic decay further complicate the path and cycle of pollutants. The persistence and speciation of these pollutants cause effects and consequentially the action area to extend from the points of stormwater discharge to the downstream terminus of the Columbia River, approximately 106 RM.

Stormwater treatment proposed by the FHWA and FTA is based on a design storm (50% of the 2-year, 24 hour storm) that will generally result in more than 95% of the runoff from all impervious surfaces within the CRC area being infiltrated at or near the point at which rainfall occurs. The treatment will consist of infiltration practices such as bioretention, bioslopes, infiltration ponds, and porous pavement, supplemented with appropriate soil amendments as needed.[5] The stormwater literature identifies these practices as excellent treatments to reduce or eliminate contaminants from highway runoff (Barrett *et al.* 1995, CWP and MDE 2000, NCHRP 2006, WDOT 2006, Hirshman *et al.* 2008).

The FHWA and FTA propose to capture, manage, and treat all of the CIA for the CRC, but 6.8 acres of CIA are still unaccounted for in a stormwater management plan (Table 7). Moreover, the proposed treatment will not eliminate all stormwater pollutants. Thus, some adverse effects of stormwater runoff will exist for the design life of the CRC and, because little to no treatment currently exists for this portion of the I-5 corridor, the CRC will decrease in the level of stormwater pollutants currently discharged into the lower Columbia River.

Construction of the CRC bridges will temporarily displace 2.0 acres in-channel habitat for the isolation of in-water work areas, including temporary sheet piles, and permanently displace 0.17 acres of benthic habitat for bridge columns. CRC will also temporarily create 2.28 acres of new over-water structure due to barges, work platforms, and in-water work isolation areas, and 1.58 acres of permanent over-water structure, although the specific amount of habitat area displaced at any time will vary throughout the construction period.

The river-spanning portion of the CRC is approximately 28 acres, based on an assumed bridge width of 300 feet. Of the 28 acres, approximately 3 acres are shallow-water or nearshore habitat and most of that will occur in the river channel portion of the project footprint, where high water velocities and highly mobile sand substrates reduce habitat values. High quality off-channel habitat does not exist in the project footprint due to the effects of past diking, dredging, and bank hardening.

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[5] See also Memos from Ronan Igloria, HDR (Henningson, Durham, and Richardson, Inc.), to Jennifer Sellers and William Fletcher, Oregon Department of Transportation, dated December 28, 2007 (Stormwater Treatment Strategy Development – Water Quality Design Storm Performance Standard), February 28, 2008 (Stormwater Treatment Strategy Development – Water Quantity Design Storm Performance Standard - Final), and April 15, 2008 (Stormwater Treatment Strategy Development – BMP Selection Tool).

Construction of the CRC will also cause the loss of approximately 10,000 square feet of riparian canopy, including 15 trees, in areas where riparian vegetation has a patchy distributed due to past development.

Conversely, construction of the CRC will remove all in-water components of the I-5 bridges that currently span the mainstem lower Columbia River. The North Portland Harbor bridges will be retained and widened. Because the replacement structures will occupy less in-channel area than the current ones, removal of their in-water components down to the riverbed will release approximately 3,000 square feet of overhead space for unencumbered ecological function.

Of these physical habitat effects, those associated with shade from the temporary work decks and barges area likely to be the most ecologically important because those temporary structures will be in contact or close proximity to the water's surface where, under well-lighted conditions, they can create a sharp contrast to the ambient light gradient (Table 25). Permanent CRC features, like bridge superstructures, will all be approximately 95 feet above the river surface and therefore less likely to affect local light levels.

Table 25. Summary of predicted shade due to over-water for the Columbia River Crossing.

Type of Structure	Columbia River	North Portland Harbor
	Area (acres)	Area (acres)
Temporary		
Work platforms for drilled shafts	3.40	0.69
Tower cranes	0.06	--
Oscillator support platforms	0	0.64
Construction barges	2.44	24.91
Demolition barges	0.10	--
Total acres	5.89	26.23
Permanent		
Shaft caps	1.54	--
New bridge spans	15.52	7.12-9.55
Existing bridge spans to be removed	- 6.52	--
Other overwater structure to be removed	- 0.29-0.81	--
Total acres	9.53-10.04	7.12-9.55

Species within the Action Area

All populations of Pacific salmon and steelhead and eulachon that spawn within the Columbia River basin use the Columbia River mainstem and estuary to complete part of their life history, including migration, rearing and smoltification. Except for populations that spawn below RM

106, every individual from each of those populations must pass through the action area at least twice, during downstream migration as a juvenile and upstream migration as an adult. Southern green sturgeon do not spawn in the Columbia River basin although large aggregations of subadults and adults occur in estuary and occasionally venture as far upstream and the CRC.

Work area isolation. If work area isolation is necessary for Piers 2 and 7, or any other part of the work site, any juvenile salmon or steelhead present in the work isolation area will be captured and released. It is unlikely that any adult salmon or steelhead, or any southern green sturgeon or eulachon will be affected by this procedure, however, because it will occur when adults are unlikely to be present and, if any are present, their size allows them to easily escape from the containment area. Capturing and handling fish causes them stress though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived (NMFS 2002). The primary contributing factors to stress and death from handling are differences in water temperature between the river where the fish are captured and wherever the fish are held, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C (64°F) or dissolved oxygen is below saturation. Proposed design criteria regarding fish capture and release, use of pump screens during the de-watering phase, and fish passage around the isolation area will comply with NMFS guidance to reduce the adverse effects of these activities (NMFS 2000, 2008f).

Underwater noise. Underwater sound pressure waves can injure or kill fish (Reyff 2003, Abbott and Bing-Sawyer 2002, Caltrans 2001, Longmuir and Lively 2001, Stotz and Colby 2001). Fish with swim bladders, including Pacific salmon and steelhead and southern green sturgeon are particularly sensitive to underwater impulsive sounds with a sharp sound pressure peak occurring in a short interval of time (Caltrans 2001). As the pressure wave passes through a fish, the swim bladder is rapidly squeezed due to the high pressure, and then rapidly expanded as the under pressure component of the wave passes through the fish. The pneumatic pounding may rupture capillaries in the internal organs as indicated by observed blood in the abdominal cavity, and maceration of the kidney tissues (Caltrans 2001). Although eulachon lack a swim bladder, they are also susceptible to general pressure wave injuries including hemorrhage and rupture of internal organs, as described above, and damage to the auditory system. Direct take can cause instantaneous death, latent death within minutes after exposure, or can occur several days later. Indirect take can occur because of reduced fitness of fish making it susceptible to predation, disease, starvation, or ability to complete its life cycle.

A multi-agency work group consisting of key technical and policy staff, supported by national experts on sound propagation activities that affect fish and wildlife species of concern, determined that to protect listed species, , sound pressure waves should be within a single strike threshold of 206 dB re: 1 µPa, and for cumulative strikes sound pressure waves should be less than 187 dB re: 1 μPa^2•sec sound exposure level for fish that are larger than 2 grams and less than 183 dB re: 1 μPa^2•sec sound exposure level for fish that are smaller than 2 grams (FHWG 2008). Any salmon or steelhead that occurs within the radius where the root mean square sound pressure level will exceed 150 dB re: 1 μPa^2 may experience a temporary threshold shift in hearing due to a temporary fatiguing of the auditory system that can reduce the survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success (Stadler and Woodbury 2009).

Thus, noise levels that are predicted to be produced by CRC (Table 24) are likely to injure or kill OC chum salmon embryos and alevins, and any juvenile salmon or steelhead weighing less than 2 grams, that occur within the radius where the noise produced by a strike pile strike will exceed 206 dB re: 1 μPa, or where the cumulative sound exposure level will exceed 183 dB re: 1 μPa^2•sec. Similarly, any juvenile salmon and steelhead that weigh more than 2 grams, and any adult salmon or steelhead, that occur within the radius where the noise produced by a pile strike will exceed 206 dB re: 1 μPa, or where the cumulative sound exposure level will exceed 183 dB re: 1 μPa^2•sec are likely to be injured or killed. Finally, any ESA-listed fish that occurs within the radius where the root mean square sound pressure level will exceed 150 dB re: 1 μPa^2 may experience an temporary threshold shift in hearing that will increase the risk that those individuals will be subject to predation and reduce their likelihood of foraging or spawning success.

Reduced water quality. The discharge of stormwater will expose adult and juvenile ESA-listed fish in the Columbia River from the points of discharge within the channel downstream to the mouth. Additionally, effects to LCR species will occur in Burnt Bridge Creek, and exposure of both LCR and UWR juveniles will occur in the Columbia Slough. The later is a terminal slough without adult habitat. Though treatment will occur, the ability to remove pollutants to a level without effect upon ESA-listed fish, or that does not synergistically combine with other sources is technologically limited and unfeasible. Exposure to these ubiquitous contaminants even in low concentrations is likely to affect the survival and productivity of salmonids-juveniles in particular (Loge *et al.* 2006, Hecht *et al.* 2007, Johnson *et al.* 2007, Sandahl *et al.* 2007, Spromberg and Meador 2006). Short-term exposure to contaminants such as pesticides and dissolved metals may disrupt olfactory function (Hecht 2007) and interfere with associated behaviors such as foraging, anti-predator responses, reproduction, imprinting (odor memories), and homing (the upstream migration to their natal stream). The toxicity of these pollutants varies other water quality speciation and concentration. Regarding dissolved heavy metals, Santore *et al.* (2001) indicates that the presence of natural organic matter and changes in pH and hardness affect the potential for toxicity (increase and decrease). Additionally, organics such (living and dead) can adsorb and absorb other pollutants such as PAH. The variables of organic decay further complicate the path and cycle of pollutants.

The release of contaminants is likely to occur. Wind and water erosion is likely to entrain and transport soil from disturbed areas contributing fine sediments that are likely to contain pollutants, and the use of the use of heavy equipment, including stationary equipment like generators and cranes, also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain PAHs, which are acutely toxic to salmonid fish and other aquatic organisms at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz *et al.* 1999, 2000, Incardona *et al.* 2004, 2005, 2006).

However, due to the relatively small amount of time that any heavy equipment will be in the water and the use of proposed conservation measures, including site restoration after construction is complete, any increase in contaminants is likely to be small, infrequent, and limited to the construction period. In addition, pile driving, pile extraction, the use of a bubble curtain, and underwater wire-sawing will cause suspended sediment and increase turbidity. Because these actions will take place in a sandy substrate and will be limited to a small area and a brief portion of the work period, the increase in turbidity is expected to be small. However, fish close to the actions may experience abrasion to their gills and alteration in feeding and migration behavior.

Physical habitat alteration. The action will remove existing riparian and benthic habitat. Juvenile salmonids will experience a reduction of macroinvertebrate prey originating from benthic and riparian habitat, as well as macroinvertebrates likely to feed on or colonize allochthonous riparian plant materials. However, this effect is not likely to be significant since the area removed will be small in comparison to the action area, less than 10,000 square feet. As well, the loss of benthic habitat from the replacement structure will be in more swift and deeper mid-channel portions of the channel. Foraging by juvenile fish is expected to be low as well as the area is primarily a migration zone. Benefits will be realized through the completion of the action. The replacement bridges will have fewer structures in the channel that displace less area than the existing in-water structures, as well as move these bridge elements away from the near-shore and shallow water habitat to the mid-channel with deeper and faster water. While some of this habitat is still lost in the North Portland Harbor, the net increase to habitat available to fish for foraging and migration is approximately 3,000 square feet.

Juvenile and adult fishes' ability to use habitat, how they will use it, and the effects they subsequently experience will be altered by the presence of temporary and permanent structures that alter aquatic habitat. The direct effects include migration behavior modification and fish salvage, while indirect effects include predation.

Migration is likely to affected by the presence of temporary and permanent structure in the path of downstream migrating juveniles and upstream migrating adults. Juveniles have been shown to avoid and circumnavigate lines of shade cast by artificial structure. The use of work trestles, barges, and decks may cause juvenile fish to use habitat not usually used (*e.g.*, deep-water) and expose them to indirect effect including but limited to predation. As well, the path of individual migrating adults is likely to change as navigate around in-water structure causing them to use deep-water instead of shallow water habitat or vice versa depending on flows, species behavior, diurnal cycles *et*c. This may also cause them to slow or pause migration, causing them more vulnerable to predation as well. However, temporary and permanent structure will not occupy a large portion of the channel so its ability to alter migration is considered minimal.

Predation on juvenile salmon and steelhead is likely to increase due to the increase in over-water structure. The project will install multiple piles across the river crossing. Roosting by cormorants is likely, due to their affinity and need for above water structure to roost and dry-out. Without the ability to dry, they are unable to maintain buoyancy or warmth. This is of a concern since juvenile fish from all species migrate through the area. However, the FHWA and FTA have proposed to minimize this effect by installing anti-perching devices to piles planned to be in place 6-months or longer. This and construction work is likely to partially dissuade use.

Northern pike-minnow (*Ptychocheilus oregonensis*), small-mouth bass (*Micropterus dolomieu*), and large-mouth bass (*Micropterus salmoides*) are also predators that consume juvenile salmon and occupy the river-channel. In addition, both species have an affinity for in-water structure such as multiple pile structures. As well, structure such as docks provide a sharp contrast (shade) to ambient light conditions increasing the opportunity of ambush predation upon juvenile salmonids and eulachon.

Both California and Steller sea lions use the action area including the project area. Alterations to adult eulachon and salmon behavior may make them more vulnerable to predation by these species. Changes in cover that congregate fish or cause them to slow or pause migration would likely attract sea lions and take advantage of the opportunity. While individuals of these species are likely to take advantage of such conditions it is not expected to increase predation rates across the run as these features would be small when in comparison to the channel and other ample similar opportunities exist, such as wing walls, throughout the lower Columbia River.

Predation has been identified as one of the limiting factors for all salmonid species in the Columbia River basin, except chum salmon (NMFS 2008g). Increased predator abundance may result from climate change (ISAB 2007). Predator species such as northern pikeminnow, and introduced predators such as largemouth bass, smallmouth bass, black crappie (*Pomoxis nigromaculatus*) white crappie (*P. annularis*) and, potentially, walleye (*Stizostedion vitreum*) (Ward *et al.* 1994, Poe *et al.* 1991, Beamesderfer and Rieman 1991, Rieman and Beamesderfer 1991, Pflug and Pauley 1984, and Collis *et al.* 1995) may use habitat created by in-water structures (Ward and Nigro 1992, Pflug and Pauley 1984) such as piers, float houses, floats and docks (Phillips 1990). Carrasquero (2001), in reviewing the literature regarding impacts of overwater structures, reports that smallmouth and largemouth bass have a strong affinity to structures; forage and spawn in the vicinity of docks, piers and pilings; and, largemouth and smallmouth bass are common predators of juvenile salmonids.

Major habitat types used by largemouth bass include vegetated areas, open water and areas with cover such as docks and submerged trees (Mesing and Wicker 1986). During the summer, bass prefer pilings, rock formations, areas beneath moored boats, and alongside docks. Colle *et al.* (1989) found that, in lakes lacking vegetation, largemouth bass distinctly preferred habitat associated with piers, a situation analogous to slack water areas of the lower Columbia River. Marinas also provide wintering habitat for largemouth bass out of mainstem current velocities (Raibley *et al.* 1997). Wanjala *et al.* (1986) found that adult largemouth bass in a lake were generally found near submerged structures suitable for ambush feeding. Bevelhimer (1996), in studies on smallmouth bass, indicates that ambush cover and low light intensities create a predation advantage for predators and can also increase foraging efficiency.

Pribyl *et al.* (2005), in studies on piscivorous fish in the lower Willamette River found that smallmouth bass were the most prevalent species captured. They found that smallmouth bass were found near beaches and rock outcrops more frequently in the winter and spring, and highly associated with pilings regardless of the season. For largemouth bass, they found that they were found near pilings and beach sites in summer and autumn and near pilings, rock and beach areas during winter and spring. They also indicated that large sized predators were present at very low densities, but juveniles were fairly abundant. Smallmouth densities were highest in riprap, mixed riprap/beach and rock outcrop areas. Largemouth bass densities were low throughout the year, with riprap sites and alcoves being the highest density areas. Zimmerman (1999) and Sauter *et al.* (2004) both indicate that wild fall Chinook are the most vulnerable to smallmouth predation due to their smaller size during emigration.

Black crappie and white crappie are known to prey on juvenile salmonids (Ward *et al.* 1991). Ward *et al.* (1991), in their studies of crappies within the Willamette River, found that the highest density of crappies at their sampling sites occurred at a wharf supported by closely spaced pilings. They further indicated that suitable habitat for crappies includes pilings and riprap areas. Walters *et al.* (1991) also found that crappie were attracted to overwater structures.

Ward (1992) found that stomachs of northern pikeminnow in developed areas of Portland Harbor contained 30% more salmonids than those in undeveloped areas, although undeveloped areas contained more northern pikeminnow. Pribyl *et al.* (2005) found no fish in the stomachs of pikeminnow, but did find fish remains in the stomachs of smallmouth bass.

In addition to piscivorous predation, overwater structures also provide perching platforms for avian predators such as double-crested cormorants (*Phalacrocorax auritis*), from which they can launch feeding forays or dry plumage. Krohn *et al.* (1995) indicate that cormorants can reduce fish populations in forage areas, thus possibly affecting adult returns because of smolt consumption. Because their plumage becomes wet when diving, cormorants spend considerable time drying out feathers (Harrison 1983) on pilings and other structures near feeding grounds (Harrison 1984). Depending upon the final super-structure design the action may provide roosting areas for piscivorous birds.

Structure in the harbor is likely to provide resting and foraging habitat for piscivorous fish, able to prey on juvenile salmonids and adult and juvenile eulachon. Species such as large-mouth bass, northern pike minnow, and walleye pike reside in this portion of the river and are ambush predators in need of slower water velocities provided by in-water structure. While significant structure will occur in the main-stem Columbia River, velocities will remain in excess of these species needs. In addition, a reduction of prey quantity and abundance will occur through the displacement of benthic habitat. However, in higher order streams the food base is primarily pelagic including but not limited to copepods and zooplankton.

Eastern Steller sea lion. Eastern Steller sea lions may be present during the proposed in-water work windows from 2013 through 2021. As described above, the installation of steel sheet and pipe piles will elevate underwater sound in the action area. Sound pressure generated by this activity could injure or disturb Steller sea lions. NMFS is currently developing comprehensive guidance on sound levels likely to cause injury and behavioral disruption for marine mammals in the context of the Marine Mammal Protection Act and Endangered Species Act, among other statutes. Until formal guidance is available, NMFS uses the following thresholds of sound pressure levels from broadband sounds that cause behavioral disturbance - 160 dBrms re: 1µPa for impulse sound and 120 dBrms re: 1µPa for continuous sound - and injury 190 dBrms re: 1µPa for pinnipeds (70 FR 1871).

Based on these thresholds, the FHWA and FTA anticipate that their proposed pile driving would produce sound pressure levels that could disturb or injure eastern Steller sea lions. To insure injury does not occur during project construction, the FHWA and FTA will implement a safety zone during all impact pile driving and during vibratory installation of 120-inch steel casings out to the 190 dB isopleths. FHWA and FTA will also slowly ramp up the initiation of pile installation. These ramp-up procedures provide added insurance to avoid injury of Steller sea lions. For example, in the unlikely event that a Steller sea lion is within the safety zone, but not visually detected, the ramp-up of sound levels will allow the Steller sea lion an opportunity to depart the immediate area prior to the onset of pressure levels that could cause injury. FHWA and FTA established the initial size of safety zones based on worst-case underwater sound modeling (30 feet and 177 feet for 18- to 24-inch and 36- to 48-inch steel piles, respectively, and 16 feet for 120-inch steel casing). FHWA and FTA will monitor the safety zone throughout impact pile installation and vibratory installation of 120-inch steel casings, and pile-driving operations will not initiate or will suspend if a Steller sea lion is detected approaching or entering the safety zone. The safety zone monitoring makes any potential injury of Steller sea lions extremely unlikely, and therefore discountable. FHWA and FTA do not anticipate that noise levels for vibratory installation of steel sheet or pipe piles will be above 190 dB, and therefore do not anticipate implementing a safety zone during vibratory pile driving, with the exception of installing 120-inch steel casings. Hydroacoustic monitoring of both impact and vibratory installation will confirm the anticipated sound levels. FHWA and FTA will use the actual SPL measurements from this monitoring to enlarge or reduce the size of safety zones, based on the most conservative SPL measurements.

Although the safety zone monitoring and shutdown procedures will avoid injury of eastern Steller sea lions, beyond this zone behavioral disruption may occur out to the 160 dB and 120dB isopleths for impact and vibratory driving, respectively. Based on conservative sound modeling, FHWA and FTA anticipate that noise from vibratory installation will not attenuate to the 120dB disturbance threshold before encountering land on the opposite shore and up and down river in either direction. Noise from impact installation is likewise anticipated to extend across the river to the opposite shore, but will attenuate to the 160 dB disturbance threshold both up and down river in closer proximity (within a river reach of 0.4 mile with an attenuation device and within 3.4 miles without an attenuation device).

FHWA and FTA estimated the number of annual eastern Steller sea lion exposures to sound levels above the disturbance thresholds in the project area during the years of in-water construction. They conservatively estimate that the number of individuals traveling up the lower Columbia River will be a three-fold increase above the largest minimum count in 2010 (an increase of this magnitude has occurred in the past year, and may continue). They further estimate that all individual Steller sea lions travelling past the project area will be exposed each time they pass the area and that all exposures would cause disturbance. NMFS agrees that this represents a worst-case scenario and is therefore sufficiently precautionary. Based on their analysis, a combined total of up to 225 subadult and adult males per year and up to 6 repeat exposures per individual per year (three round trips each), or 1,350 total exposures per year could occur each year from 2013 to 2021. NMFS next considers the range of possible behavioral and other changes that such exposures could cause.

It is unlikely that eastern Steller sea lions exposed to sound levels above the disturbance thresholds will temporarily avoid traveling through the affected area. Steller sea lions en route to the Bonneville tailrace area are highly motivated to travel through the action area in pursuit of foraging opportunities upriver (NMFS 2008e). As stated in the Environmental Baseline section, Steller sea lions have shown increasing habituation in recent years to various hazing techniques used to deter the animals from foraging on sturgeon and salmon in the Bonneville tailrace area, including acoustic deterrent devices, boat chasing, and above-water pyrotechnics (Stansell *et al.* 2009). Many of the individuals that travel to the tailrace area return in subsequent years (NMFS 2008). Therefore, it is likely that Steller sea lions will continue to pass through the action area even when sound levels are above disturbance thresholds.

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

Therefore, NMFS finds it unlikely that the amount of anticipated disturbance would significantly change eastern Steller sea lions' use of the lower Columbia River or significantly change the amount of time they would otherwise spend in the foraging areas below Bonneville Dam. Even in the event that either change was significant and animals were displaced from foraging areas in the lower Columbia River, there are alternative foraging areas available to the affected individuals. NMFS does not anticipate any effects on haulout behavior because there are no proximate haulouts within the areas affected by elevated sound levels. All other effects of the proposed action are at most expected to have a discountable or insignificant effect on Steller sea lions, including an insignificant reduction in the quantity and quality of prey otherwise available to Steller sea lions where they would intercept the affected species.

Additionally, the test pile program to commence prior to project construction will include a marine mammal monitoring plan. Under the plan, FHWA and FTA will monitor an area from the location of impact and vibratory pile installation and removal out to the isopleths where the applicable disturbance threshold would be reached (as initially estimated based on worst-case modeled distances described above). FHWA and FTA will not initiate or will suspend pile driving if they detect a eastern Steller sea lion within the monitoring area. The monitoring plan makes it extremely unlikely, and therefore discountable that Steller sea lions will be exposed to sound pressure levels that could cause injury or disturbance.

Effects on Critical Habitat within the Action Area

Designated critical habitat within the action area for the ESA-listed Pacific salmon and steelhead considered in this Opinion consists of a freshwater rearing site and freshwater migration corridor and their essential physical and biological features as listed below. The effects of the proposed action on these features are summarized below as a subset of the habitat-related effects of the action that were discussed more fully above. The noise and water quality effects described will be short-term (minutes to weeks) during and immediately following in-water work involving pile driving.

Pacific salmon and steelhead.

1. Freshwater spawning sites
   a. Substrate. No effect.
   b. Water quality. *Direct* – Increased temperature, suspended sediment, and contaminants; decreased dissolved oxygen; and impoverished community structure, including the composition, distribution, and abundance of prey, due to increased upland erosion and runoff and channel disturbance. *Indirect* – More normal temperature and sediment load, reduced contaminants, and increased dissolved oxygen due to improved stormwater management; more normative community structure.
   c. Water quantity. No effect.
2. Freshwater rearing
   a. Floodplain connectivity. No effect.
   b. Forage. *Direct* – Decreased quantity and quality of forage due to increased suspended sediment and contaminants, decreased space, decreased dissolved oxygen, loss of habitat diversity and productivity, and impoverished community structure due to increased upland erosion and runoff and channel disturbance. *Indirect* – Increased quantity and quality of forage due to increased habitat diversity and productivity caused by improved stormwater management and more normative community structure.
   c. Natural cover. *Direct* – Decreased natural cover quantity and quality for predator refugia due to physical habitat alteration and increase in predator cover. *Indirect* – Return to approximately pre-construction conditions.
   d. Water quality. *Direct* – Increased temperature, suspended sediment, and contaminants; decreased dissolved oxygen; and impoverished community structure, including the composition, distribution, and abundance of prey, due to increased upland erosion and runoff and channel disturbance. *Indirect* – More normal temperature and sediment load, reduced contaminants, and increased dissolved oxygen due to improved stormwater management; more normative community structure.
   e. Water quantity. No effect.

3. Freshwater migration corridors
   a. Forage. As above.
   b. Free of artificial obstruction. *Direct* – Decrease due to decreased water quality and in-water work isolation. *Indirect* – Return to approximately pre-construction conditions.
   c. Natural cover. As above.
   d. Water quality. As above.
   e. Water quantity. As above.
4. Estuarine areas
   a. Forage. As above.
   b. Free of artificial obstruction. As above.
   c. Natural cover. As above.
   d. Salinity. No effect.
   e. Water quantity. As above.
   f. Water quality. As above.

Southern Green Sturgeon.

1. Freshwater riverine systems
   a. Food resources. *Direct* – Decreased quantity and quality of forage due to increased suspended sediment and contaminants, decreased space, decreased dissolved oxygen, loss of habitat diversity and productivity, and impoverished community structure due to increased upland erosion and runoff and channel disturbance. *Indirect* – Increased quantity and quality of forage due to increased habitat diversity and productivity caused by improved stormwater management and more normative community structure.
   b. Migratory corridor. No effect.
   c. Sediment quality. No effect.
   d. Substrate type or size. No effect.
   e. Water depth. No effect.
   f. Water flow. No effect.
   g. Water quality. *Direct* – Increased temperature, suspended sediment, and contaminants; decreased dissolved oxygen; and impoverished community structure, including the composition, distribution, and abundance of prey, due to increased upland erosion and runoff and channel disturbance. *Indirect* – More normal temperature and sediment load, reduced contaminants, and increased dissolved oxygen due to improved stormwater management; more normative community structure.
2. Estuarine
   a. Food resources. *Direct* – Decreased quantity and quality of forage due to increased suspended sediment and contaminants, decreased space, decreased dissolved oxygen, loss of habitat diversity and productivity, and impoverished community structure due to increased upland erosion and runoff and channel disturbance. *Indirect* – Increased quantity and quality of forage due to increased

habitat diversity and productivity caused by improved stormwater management and more normative community structure.

b. Migratory corridor. No effect.
c. Sediment quality. No effect.
d. Water flow. No effect.
e. Water depth. No effect.
f. Water quality. *Direct* – Increased temperature, suspended sediment, and contaminants; decreased dissolved oxygen; and impoverished community structure, including the composition, distribution, and abundance of prey, due to increased upland erosion and runoff and channel disturbance. *Indirect* – More normal temperature and sediment load, reduced contaminants, and increased dissolved oxygen due to improved stormwater management; more normative community structure.

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).

Although the CRC is intended to address a range of issues related to regional travel safety and mobility, and thus is likely to affect transportation patterns over time, the BA only identified one project likely to occur in the action area. That is the Vancouver Waterfront Access Project, also known as the Gramor Development Project, to redevelop the former 32-acre Boise Cascade site. Because this action involves waterfront development, it will require permits from the U.S. Army Corps of Engineers that will be subject to section 7 consultation under the ESA and EFH consultation under the MSA.

Projections to 2040 of population growth rates for the interior Columbia River basin range from 0.3 percent per year to 1.6 percent per year (McCool and Haynes 1996). If the largely migration-driven population growth continues unabated, it will result in a three to seven-fold increase in the population in the Columbia River basin region (Lackey *et al.* 2006).

This trend is likely to include rapid growth of human density in areas with recreational and scenic values adjacent to Federal lands, conflict between demands for fresh-water and needs for salmon, rapid urbanization and human density in areas previously sparsely populated, and land conversion from agriculture to urban uses (ISAB 2007). It will also include the positive effects of on-going regional and local salmon conservation and planning efforts that are underway to address all salmon species within the Columbia River basin, and will involve stakeholders on a more local level (Beamsderfer *et al.* 2010, LCFRB 2010).

Synthesis and Integration of Effects

Species at the Population Scale

ESA-listed Fish. Of 13 species and 189 independent populations and of ESA-listed Pacific fish that are likely to be adversely affected by this proposed action, and that have had a viability analysis completed, few are rated as "viable" and the overall risk of extinction varies from low (1 to 5% chance of extinction in 100 years) to very high (greater than 60% chance of extinction in 100 years). NMFS identified many factors as limiting the recovery of these species, most notably degraded habitat (especially floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, stream substrate and streamflow), hatchery and harvest-related effects, and adverse effects related to mainstem hydropower development.

The NMFS designated critical habitat for all of the species considered in this opinion, except LCR coho salmon and eulachon, for which critical habitat has not been designated or proposed. Critical habitat for Steller sea lion does not have critical habitat designated within the action area. PCEs designated for Pacific salmon and steelhead include physical and biological features that support adult migration and juvenile rearing and migration. The lower Columbia River has been largely significantly altered by the effects of dam and reservoir development upstream, channelized, revetted, and stripped of large wood, thereby significantly diminishing both the complexity and productivity of aquatic habitats.

The environmental baseline within the action area includes a channelized mainstem with highly regulated streamflow, simplified channel habitats, and a river that is disconnected from its floodplain. Extensive development for residential, commercial and recreational use converted much of the shoreline to riprap with little relief, few trees, and many over and in-water structures. The proposed test pile program is in a relatively narrow and deep stretch of the Columbia River that does not provide slow water, shallow areas preferred by juvenile salmonids.

The effects of the proposed action that will have intermittent adverse effects on ESA-listed fish for a period of six years during construction are capture and release of individual fish during work area isolation, underwater noise created during pile driving, reduced water quality due to the construction effects of upland and in-water construction, and physical habitat alteration due to changes in overwater structure. The proposed action will also have adverse effects on ESA-listed fish for the design life of CRC due to reduced water quality from stormwater discharge and physical habitat alteration due to the final, as-built project footprint for the design life of CRC. The intensity, or magnitude, of each of these effects will be such that they are likely to injure or kill individual fish within the action area. Although the effects of impact pile driving are likely to be the most severe, those effects are limited to the construction period.

The CRC Team used the relationship between underwater noise due to pile driving (Table 24) and run timing and duration data for each species of Pacific salmon and steelhead and eulachon considered in this Opinion to evaluate the effects of CRC construction at the population level (Figure 7) (BA, Appendix K). Results of this analysis show that impact pile driving for CRC is likely to have the largest effect on juvenile LCR Chinook salmon, CR chum salmon, and LCR coho salmon, and may injure or kill between 0.4 and 1.0% of the runs and life stages runs of those species over the construction period (Figure 7). All other runs and life stages are likely to have between 0.6 to less than 0.1% mortality over the construction period. Although this model was not able to assign those mortalities to individual populations, these levels are likely to be too low to reduce the abundance or productivity of any affected population because the construction phase of the action has a relatively short duration and adaptive management will be used during the construction phase to allow impacts to be reduced if harm occurs in excess of the estimated levels. Thus, NMFS does not expect CRC to exceed a reasonable level of mortality for Columbia River species when added to take other biological opinions (NMFS 2008d, 2008g, 2008i; Wagner 2011).

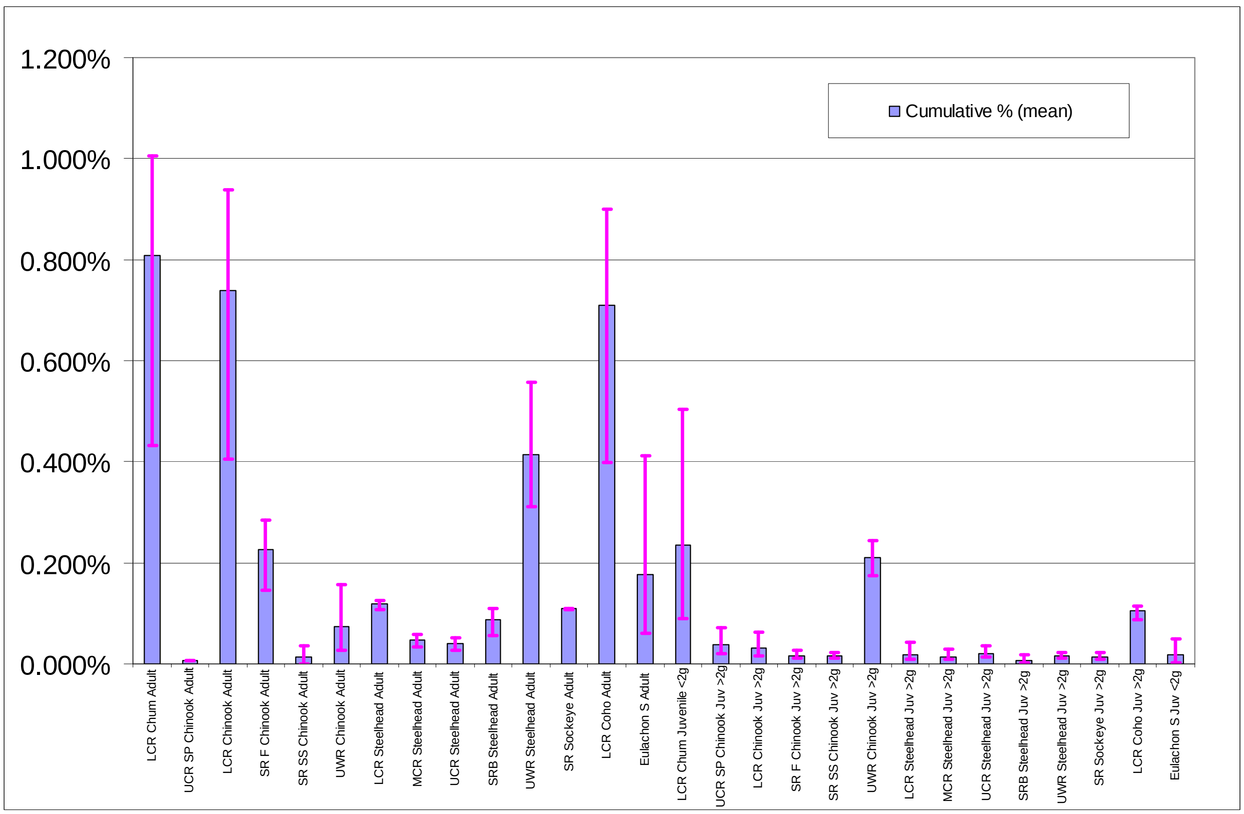

Figure 7. Mean cumulative percent mortality by species and life-stage due to the effect of impact pile driving for the proposed Columbia River Crossing project.

NMFS cannot accurately quantify the short and long-term habitat-related effects of this action that will occur in addition to the effects of pile driving because the precise distribution and abundance of adult and juvenile fish within the action area are not a simple function of the quantity, quality, or availability of predictable habitat resources within that area. Nonetheless, the relatively short-term adverse effects related to underwater noise (four years) and, to a lesser extent, to reduced water quality and physical habitat alteration (six years), caused by construction or CRC are similar to impacts that created the currently degraded baseline conditions for ESA-listed species in the lower Columbia River. These effects are likely to displace juvenile and adult fish from their preferred habitat, reduce benthic prey production, reduce growth or reproductive rates, increase juvenile predation, delay out-migration, and modify migratory or rearing behavior. Modeling of the population-level effects pile driving, the primary source of impacts from CRC, shows that the magnitude and temporary duration of those effects will not increase the risk of extinction faced by these species. Over the long term, for the design life of CRC (50-80 years), stormwater runoff from the project footprint, a heavily used urban transportation corridor that now drains into the Columbia River essentially untreated, will be captured and treated using the best management practices available for removal of PAHs, heavy metals, and other relevant pollutants. Reducing levels of toxic contaminants in the estuary will improve both habitat capacity and the fitness level of individual ESA-listed fish.

These short- and long-term effects can be put into a recovery context using three recovery plans and an estuary module now under development for species considered in this Opinion (NMFS 2008h, Beamesderfer *et al.* 2010a, Beamesderfer *et al.* 2010b, ODFW 2010, LCRFP 2010), and a recovery plan has been completed for MCR steelhead in the IC Recovery Domain (NMFS 2009b). Each of those plans recommend measures to improve water quality, and better stormwater management in particular, as among the most potent and high priority recovery actions. Thus, the long-term contribution of CRC to comprehensive stormwater management and improved water quality is consistent with recovery actions indentified in recovery plans for the lower Columbia River and, combined with the likelihood that take will not exceed 1% of LCR species or 0.6% of all other species, it is unlikely that the proposed action will appreciably reduce the likelihood of survival and recovery of any listed species.

Eastern Steller Sea Lion. Eastern Steller sea lions have a large population, which over the past 30 years has increased approximately 3% per year. Steller sea lions are generalist predators, and able to respond to changes in prey abundance. There are no substantial threats to the species, and the final recovery plan identifies the need to initiate a status review and consider removing the Eastern DPS from the federal List of Endangered Wildlife and Plants (NMFS 2008c).

In recent years, as many as 53 subadult and adult male eastern Steller sea lions have travelled up the Columbia River past the project area en route to the tailrace area of Bonneville dam, where they forage on anadromous fishes. This number has increased at least two-fold in recent years, and the increasing trend may continue into the future. Individuals have exhibited an increasing tolerance for deterrence measures, including acoustic deterrence. The proposed installation of steel sheet and pipe piles will elevate underwater sound within a reach of the Columbia River, and sound pressure generated by this activity could injure or disturb passing Steller sea lions. Although the FHWA and FTA will implement a safety zone, monitoring and shutdown procedures as well as sound ramp-up procedures to avoid potential injury of Steller sea lions, the proposed project may result in as many as 636 exposures of Steller sea lions to sound levels above disturbance thresholds per year, each year from 2013 to 2021.

Eastern Steller sea lions are highly motivated to pass through the project area in order to forage in the tailrace area of Bonneville Dam. Additionally, Steller sea lions have habituated to directed deterrence activities, including acoustic deterrence in the tailrace area. Given these considerations, NMFS finds it unlikely that the amount of anticipated acoustic harassment in the project area would significantly change Steller sea lions' use of the Columbia River or significantly change the amount of time they would otherwise spend in the foraging area below Bonneville Dam. Even in the event that either change was significant and animals were displaced from foraging areas in the Columbia River, there are alternative foraging areas available to the affected individuals. Therefore, the proposed action is not likely to reduce the reproductive success or increase the risk of mortality for any individual Steller sea lions.

Critical Habitat at the Watershed Scale

The same effects of the proposed action that will have an adverse affect on ESA-listed fish and eastern Steller sea lions will also have an adverse affect on critical habitat PCEs for Pacific salmon and steelhead and southern green sturgeon, *i.e.*, underwater noise, water quality reduction, and increase in undesirable over-water structure. Together, these effects are likely reduce the conservation value of critical habitat PCEs for the rearing and migration corridor within the action area, particularly in the impact area for pile driving while that part of construction is taking place. However, those effects are too local and brief to affect the conservation value of the lower Columbia River, or any designated critical habitat, as a whole. Further, the long-term effects of CRC will include the addition of comprehensive stormwater management for the I-5 corridor and improved water quality throughout the lower Columbia River, outcomes with are consistent with actions indentified in recovery plans for the lower Columbia River. Thus, it is likely that critical habitat will remain functional and retain the current ability for PCEs to become functionally established, to serve the intended conservation role for the species.

Conclusion

After reviewing the status of LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, UCR steelhead, MCR steelhead, SRB steelhead, southern green sturgeon, eulachon, and eastern Steller sea lion, the environmental baseline, the effects of the action, and cumulative effects, NMFS concludes that the proposed action will not jeopardize the continued existence of those species.

After reviewing the status of critical habitats of those species (with the exceptions of LCR coho salmon, for which critical habitat is not proposed or designated; eulachon, for which critical habitat is proposed but not designated; and eastern Steller sea lion, which does not have critical habitat designated in the action area) NMFS also concludes that the proposed action will not destroy or adversely modify critical habitat of those species.

For reasons explained in Appendix A of this Opinion, NMFS also concludes that the proposed action is not likely to adversely affect southern resident killer whales.

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 special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as 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. Harass is defined by the U.S. Fish and Wildlife Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, 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. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not prohibited under the ESA, provided that such taking is in compliance with the terms and conditions of an incidental take statement.

The NMFS is not including an incidental take authorization for eastern Steller sea lions at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act or its 1994 Amendments. Following issuance of such regulations or authorizations, the NMFS may amend this biological opinion to include an incidental take statement for Steller sea lions.

Amount or Extent of Take

Actions necessary to complete the CRC will take place in the active channel of the Columbia River when LCR Chinook salmon, UWR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, UWR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, eulachon, and southern green sturgeon are likely to be present.

The action area is used, in a small part, by CR chum salmon as a spawning area, by juveniles of all of these fish species for rearing and migration, by adults of all of fish these species for migration. The habitat that will be affected is rated as having high conservation value (NOAA Fisheries 2005) for each Pacific salmon and steelhead species considered in this consultation, although present conditions in the action area are degraded and the habitat that will be affected is not limited at the site or watershed scale.

Completion of the CRC is reasonably likely to cause the following type of incidental take of ESA-listed fish: 1) capture of juvenile fish during in-water work area isolation, some these fish will be injured or killed; and 2) harassment or harm of fish and sea lions due to the following habitat-related effects of CRC construction and operation: reduced water quality, barotrauma, and loss of benthic foraging habitats.

For this Opinion, the extent of take is defined as the area where the CRC action will: (1) Reduce water quality during construction and through stormwater discharge for the life of the CRC;

(2) produce harmful underwater noise during construction; and (3) convert benthic foraging habitat to less productive aquatic habitat types during construction and for the life of the CRC.

In the accompanying Opinion, NMFS determined that this level of incidental take is not likely to result in jeopardy to the listed species. Exceeding any of these indicators of take will trigger the reinitiation provisions of this Opinion.

Capture of Juvenile Fish during In-water Work Area Isolation. Take due to capture of juvenile fish during work area isolation will occur within the work area isolation site. Construction of the CRC will require two work area isolations. Each work area isolation is likely to result in the capture of 200 or fewer of the ESA-listed fish considered in this Opinion. Of the fish captured, less than 2% are likely to be injured or killed, including by delayed mortality, and the remainder are likely to survive with no long-term adverse effects. Thus, NMFS anticipates that up to 400 juvenile individuals of the ESA-listed fish species considered in the consultation will be captured, and less than eight are likely to be injured or killed because of work necessary to isolate in-water construction areas. Because these fish are from different species that are similar to each other in appearance and life history, and to unlisted species that occupy the same area, it is not possible to assign this take to individual species. NMFS does not anticipate that FHWA and FTA will take any adult fish in this manner.

Habitat-related Effects. Take caused by the habitat-related effects of this action cannot be accurately quantified as a number of ESA-listed fish because the distribution and abundance of fish and sea lions that occur within an action area is affected by habitat quality, competition, predation and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish and sea lions within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish or sea lions that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action. As explained in the synthesis and integration of effects, NMFS estimates that the proposed action is likely to injure or kill an insignificant percentage of the affected populations.

Reduced water quality. Take caused by reduced water quality due to CRC construction activities will occur within 300 feet of the project site. Reduced water quality due to CRC also includes residual pollutants in stormwater runoff that discharge into the Columbia River after passing through the CRC stormwater facilities. These discharges mix with other pollutants in the lower Columbia River where they degrade food webs, reduce the growth and survival of juvenile fish, reduce the survival and fitness of adult fish, and contribute to a variety of additive and synergistic toxic effects throughout the lower Columbia River. Thus, take caused by reduced water quality due to stormwater runoff from CRC during operation will occur in a zone that extends from the project footprint to the confluence of the Columbia River with the Pacific Ocean.

The best available indicators for the extent of take due to reduced water quality are: (1) Turbidity released during construction; and (2) completion of the maintenance program used to maintain stormwater treatment facilities. The first variable is proportional to the amount of construction-related disturbance of upland and stream channel habitats that results in an erosion and suspended sediment in runoff and the water column. NMFS anticipates that these effects should not result in visible turbidity plume more than 300 feet from the project footprint. The second variable is completion of the stormwater maintenance program because that ensures that stormwater runoff from the CRC is receiving the planned level of treatment and consequently removing the identified types and levels of pollutants.

The best available indicators for the extent of take due to reduced water quality are: (1) No more than a 10% cumulative increase in natural stream turbidity 300 feet from an upland or in-water CRC construction activity, as measured relative to a control point immediately upstream of the turbidity causing activity, except for short-term emergency activities; and (2) regular and timely completion of the maintenance program used to maintain stormwater treatment facilities.

Barotrauma. Take due to barotrauma will occur in a zone between approximately RMs 101 and 119. The extent of take due to barotraumas caused by underwater noise is described by an area affected by the radius of underwater noise that will be created by impact driving an attenuated 48-inch pile, *i.e.*, <u>for fish</u>:

1. For all fish, behavioral disturbance, or auditory injury due to impulse sound from impact driving for approximately 66,000 feet upstream and 29,000 feet downstream within the radius where the RMS sound pressure level will exceed 150 dB re: 1 μPa^2.

2. For fish weighing less than 2 grams, external and internal hemorrhage, rupture of internal organs due to impulse sound from impact driving for approximately 3,250 feet upstream and downstream within the radius where cumulative sound exposure exceeds 183 dB re: 1 μPa^2•sec.

3. For fish weighing more than 2 grams, external and internal hemorrhage, rupture of internal organs due to impulse sound from impact driving for approximately 1,771 feet upstream and downstream within the radius where cumulative sound exposure level exceeds 187 dB re: 1 μPa^2•sec.

4. For all fish, external and internal hemorrhage, and rupture of internal organs for approximately 16 feet upstream and downstream where peak sound pressure level that exceeds 206 dB re: 1 μPa.

Benthic foraging habitat. The extent of take due to loss of benthic foraging habitat is described by the area permanently displaced by bridge columns, *i.e.*, 0.17 acre. Thus, the best available indicator for the extent of this loss is 0.17 acre.

Reasonable and Prudent Measures

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

The FHWA and FTA shall:

1. Coordinate with NMFS to insure that completed project plans and updates specific to stormwater management, pile driving, in-water work area isolation, and containment are implemented and include comprehensive monitoring and reporting.

2. Minimize incidental take by applying contract conditions that avoid or minimize the project's adverse effects on aquatic habitats.

Terms and Conditions

The measures described below are non-discretionary, and must be undertaken by the FHWA or FTA for the exemption in section 7(o)(2) to apply. The FHWA and FTA have a continuing duty to regulate the activity covered by this incidental take statement. If the FHWA and FTA (1) fail to assume and implement the terms and conditions or (2) fail to require their grantees to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the FHWA and FTA must report the progress of the action and its impact on the species to the NMFS as specified below.

1. To implement reasonable and prudent measure #1 the FHWA and FTA shall ensure the following:

    a. <u>NMFS Coordination</u> will be regular and shall include an annual report coordination meeting (by June 15 annually) from the FHWA and FTA to discuss the report, and discuss conservation measure effectiveness and any necessary corrective actions. Other meetings will include the FHWA and FTA and their contractors (construction and design), to review the following design plans (30% completion) and reports when available:

        i. A stormwater management plan that addresses treatment of the project's contributing impervious area as described or referenced in the BA.
        ii. A pile-driving and underwater sound management plan.
        iii. In-water work area isolation plans for all in-water work areas.
        iv. <u>Salvage notice</u>. The following notice shall be included as part of the contract and be provided in writing to the general contractor and each subcontractor employed for in-water work:

            If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify NMFS' Office of Law Enforcement at 503-231-6240 or 206-526-6133. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility for carrying out instructions provided by the Office of Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.

v. Annual program report. The FHWA and FTA shall submit a comprehensive annual program report to NMFS by June 1 each year, beginning following the test pile program and continuing until FHWA and FTA confirm that all site restoration is complete. These reports shall give NMFS information about the FHWA and FTA's efforts to carry out these terms and conditions throughout the preceding calendar year and must include the following information:

(1) The FHWA and FTA contacts for all monitoring and reporting.
(2) A summary of overall construction activity.
(3) A summary of coordination conducted with NMFS during the reporting period.
(4) A completed fish salvage reporting form for any project component that required fish capture and removal.
(5) The start and end dates for any in-water work.
(6) A summary of pile installation and removal activity, including the number, type and diameter of any pilings installed, removed, or broken during removal, and results of underwater noise monitoring.
(7) A summary of the results of pollution and erosion control inspections, including construction discharge water management, and any erosion control failures or contaminant releases and the subsequent corrections.
(8) A description of any riparian area cleared within 150 feet of ordinary high water, including the linear feet of bank alteration.
(9) A summary of any project components for which the FHWA and FTA confirm the completion of site restoration or compensatory mitigation.
(10) Any other data or analyses that FHWA and FTA deem necessary or helpful to assess impacts of the project actions on habitat trends.
(11) Annual monitoring reports shall be submitted to:

National Marine Fisheries Service
Oregon State Habitat Office
Attn: **2010/03196**
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232-2778

b. Full Implementation Required. Conservation measures and best management practices outlined in the BA and these terms and condition shall be included as enforceable provisions of the design-build contract. Failure to comply with all applicable conservation measures outlined in the BA, unless they conflict with provisions in these terms and conditions, and all terms and conditions included here may invalidate protective coverage of ESA section 7(o)(2) regarding the incidental take of listed species, and may lead NMFS to a different conclusion regarding the effects of the CRC project on listed species and designated critical habitats.

c. Failure to Provide Reporting May Trigger Reinitiation of Consultation. NMFS shall have the opportunity to conduct timely review and approval (where noted) of information identified above, and FHWA and FTA shall provide annual monitoring reports and participate in the annual coordination meeting, or NMFS may assume the CRC project has been modified in a manner and to an extent not previously considered and may recommend reinitiation of this consultation.

2. To implement reasonable and prudent measure #2 (avoid or minimize adverse effects of construction on aquatic habitats), the FHWA and FTA shall ensure the following:

   a. In-water Work Timing. In-water work timing will occur by activity as follows:
      i. Impact pile driving will be completed between September 15 and April 15, unless FHWA and FTA demonstrate that sound levels will not equal or exceed the following values (re: 1 micropascal):
         (1) 206 dB peak SPL
         (2) 183 dB cumulative SEL between April 15 and July 31
         (3) 187 dB cumulative SEL between August 1 and September 15
         (4) 190 dB RMS at 164 feet from the pile year-round
      ii. Use of an impact hammer will be limited to daylight hours (beginning 30 minutes after civil sunrise and ending 30 minutes before civil sunset) at Pearson Airfield, to avoid peak movements of juvenile and adult Pacific salmon and steelhead.
      iii. Necessary underwater debris removal will occur between November 1 and February 28, using a clamshell bucket.
      iv. Construction and demolition may occur within the active channel year-round, provided that it does not because sound pressures that are injurious to fish, will not violate water quality standards established by ODEQ and WDOE.

   b. Pile Installation. Pile installation shall be conducted as follows:
      i. When engineering limits do not require impact driving, piles shall be advanced by vibration, oscillation, rotation, or pressing.
      ii. During impact driving underwater sound attenuation shall be conducted as follows:
         (1) Completely isolate the pile from flowing water by dewatering the area around the pile while ensuring no physical contact between the pile and confinement vessel.

(2) if water velocity is 1.6 feet per second or less, surround the piling being driven by a confined or unconfined bubble curtain, as described in NMFS and USFWS (2006), that will distribute small air bubbles around 100% of the piling perimeter for the full depth of the water column.

(3) if water velocity is greater than 1.6 feet per second, surround the piling being driven by a confined bubble curtain (*e.g.*, a bubble ring surrounded by a fabric or non-metallic sleeve) that will distribute air bubbles around 100% of the piling perimeter for the full depth of the water column.

c. Underwater Noise Monitoring. An underwater noise monitoring plan for pile installation shall be developed and carried out as described in WDOT (2009), and shall be sufficient to analyze the effects of underwater noise produced by the full range of pile types, installation methods, and environmental conditions that are relevant to construction of the CRC project.

d. Fish Entrapment, Capture and Removal. The following measures shall apply to the treatment of fish in areas of in-water isolation:

i. Isolation will occur in such a manner as to promote fish emigration.

ii. Fish capture and removal shall occur in any isolation area before water quality conditions become unfavorable to fish.

iii. Capture and handling of fish shall comply with NMFS' electrofishing guidelines (NMFS 2000).

iv. A supervisory fish biologist experienced with work area isolation and fish capture will supervise the safe capture, handling and release of all fish and complete the fish salvage reporting forms.

v. Fish may be captured using a seine, electrofishing, or other method that maximizes efficiency and minimizes injury.

vi. Juvenile fish shall be released at a safe release site downstream of the work area; adults shall be released safely upstream.

e. Construction Discharge Water. The following measures shall apply to construction water discharges:

i. All discharge water created by construction (*e.g.*, concrete washout, pumping for work area isolation, vehicle wash water, shall be treated using the best available technology available (given site conditions) to remove debris, nutrients, sediment, petroleum products, metals and other pollutants.

ii. Pollutants such as green concrete, contaminated water, silt, welding slag, sandblasting abrasive, or grout cured less than 24 hours shall not contact any waterbody, wetland, or stream channel below ordinary high water.

f. Temporary Access Routes. The following measures shall apply to temporary access routes:

i. Temporary access routes for motorized equipment shall avoid steep slopes, where grade, soil, or other features suggest a likelihood of excessive erosion (*e.g.*, rills or gullies) or failure.

ii. When possible, construction vehicles shall use existing access routes that will minimize soil disturbance and compaction within 150 feet of any waterbody.

iii. When no longer needed, temporary access routes shall be obliterated, the soil stabilized and the vegetation restored.

iv. Temporary routes in wet or flooded areas shall be restored before the end of the applicable in-water work period.

g. Stationary Power Equipment, Vehicles, and Other Heavy Equipment. Generators, cranes, and any other stationary equipment operated within 150 feet of any waterbody. The following measures shall apply:

i. Equipment will be selected and operated as necessary to minimize adverse effects on the environment.

ii. All vehicles and other heavy equipment will be:

(1) Stored, fueled, and maintained in a vehicle staging area placed 150 feet or more from any waterbody, or in an isolated hard zone with suitable containment measures as outlined in the Spill Prevention, Control and Countermeasures (SPCC). Suitable hard zones include a paved parking lot, barge or work platform.

(2) Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 50 feet of any waterbody.

(3) Steam-cleaned before operation below ordinary high water, and as often as necessary during operation to remain free of all external oil, grease, mud, and other visible contaminants.

h. Preconstruction Activity. Before significant alteration of the action area, contractors shall flag the boundaries of the clearing limits associated with site access and construction to minimize soil and vegetation disturbance, and shall ensure that all temporary erosion controls are in place and functional.

i. Site Preparation. The following measures shall apply to site preparation:

i. Native materials shall be conserved for restoration, including large wood, vegetation, topsoil and channel materials (gravel, cobble, and boulders) displaced by construction.

ii. Native materials shall not be disturbed unnecessarily.

iii. In temporary clearing areas, vegetation shall be clipped at ground level to retain root mass and encourage reestablishment of native vegetation.

j. Drilling and Boring. The following measures shall apply to drilling and boring. The FHWA and FTA shall insure that contractors shall:

i. Isolate drilling operations in wetted stream channels using a steel casing or other appropriate isolation method to prevent drilling fluids from contacting water.

ii. Use containment measures to prevent drilling debris from entering the channel.

iii. Isolate sampling and directional drill recovery/recycling pits, and any associated waste or spoils, from surface waters, off-channel habitats and wetlands.

iv. Cover all waste or spoils if precipitation is falling or imminent.

v. Recover and dispose, or recycle, all drilling fluids and waste to prevent entry into flowing water, off-channel habitats, and wetlands.

vi. Implement all possible efforts to contain drilling fluid or waste when visible in water or a wetland or a drilling casing breaks. Notify NMFS within 48 hours.

vii. Contain, recover, and recycle or dispose of all drilling equipment, drill recovery and recycling pits, and any waste or spoil produced, as necessary to prevent entry into any waterway. Contractors shall use a tank to recycle drilling fluids.

viii. Remove as much of the remaining drilling fluid as possible from the casing (*e.g.*, by pumping) to reduce turbidity when the casing is removed.

k. Pollution and Erosion Control. At any part of the project where there will be materials that are hazardous or toxic to aquatic life, such as motor fuel, oil, or drilling fluid, or where there will be earthwork that is likely to cause discharge of sediment into surface water, contractors must employ effective pollution and erosion control measures, including practices to:

i. Inventory, store, handle, and monitor any hazardous products or materials that will be used as part of the action.

ii. Contain and control a spill of those hazardous materials.

iii. Confine, remove, and dispose of excess concrete, cement, grout, and other mortars or bonding agents, including washout facilities.

iv. Avoid or minimize pollution and erosion at all roads, stream crossings, drilling sites, construction sites, borrow pits, equipment and material storage sites, fueling operations, and staging areas.

v. Prevent construction debris from dropping into any waterbody, and to remove any material that does drop with a minimum of disturbance.

vi. Avoid or minimize resource damage if the action area is inundated by precipitation or high streamflow.

vii. Stabilize all disturbed soils following any break in work unless construction will resume within seven days (May 1-September 30) or two days (October 1 – April 30).

l. Work Area Isolation Plan. At any part of the project, except for piling installation or removal, that involves excavation, backfilling, embankment construction, or similar work below ordinary high water where adult or juvenile listed fish might reasonably be to be present, or 300 feet or less upstream from spawning habitats, contractors must have a plan to ensure that area will be effectively isolated from the active stream. The plan shall:

i. Explain how the work area will be isolated and describe practices to ensure the area will remain effectively isolated throughout the range of flows likely to occur during construction.

ii. Include site sketches, drawings, specifications, calculations, or other information at a level of detail commensurate with the scope of the work area; and include contact information for the person responsible for designing this part of the action.

m. Stormwater Management. The FHWA and FTA shall have a Stormwater Management Plan applicable to stormwater runoff produced by the project's entire CIA. The Stormwater Management Plan shall ensure that stormwater runoff from that area will meet the pollution reduction and flow control requirements described below. The plan shall:

i. Explain how treatment facilities design will capture and remove pollutants from all contributing impervious areas (treatment basins), using site sketches, drawings, specifications, calculations, or other information at a level of detail commensurate with the scope of the work area. The explanation shall:

(1) Specify pollutants of concern and targeted for treatment

(2) Identify and all contributing and non-contributing impervious areas for the project area.

(3) Calculate the volume of stormwater runoff that produced from those contributing impervious areas by the design storm (0.86-in).

(4) Capture and treat a design storm defined as 50% of the 2-year, 24-hour storm as determined by a single event model; or 91% of the average annual runoff, as determined by a continuous flow model.

(5) Describe how stormwater will be treated using one or more of the following specific primary treatment practices and supplemented with appropriate soil amendments, as needed:

(a) bioretention

(b) bioslope

(c) infiltration pond

(d) porous pavement

(e) constructed wetlands

(f) vegetated and soil amended swale designed for infiltration

(g) a treatment train as described in FHWA (2002).

(6) Address unavoidable design constraints limiting successful implementation of the list of primary treatment practices through alternative methods demonstrating pollutant removal equivalency.

ii. Explain how treatment facilities design will capture and manage stormwater discharged into Burnt Bridge Creek, including a description of how flow control methods will achieve a pre-development hydrologic condition using design standards described in the Stormwater Management Manual for Western Washington (WDOE 2005).

iii. Explain how the engineered conveyance and treatment facilities will be maintained and operated. The explanation shall be a completed Maintenance and Operation Plan, and include:

(1) Pollutants of concern.

(2) Provide an inspection and maintenance schedule for each treatment facility.

(3) Identify expiration timelines of treatment media and require amendment and or replacement of treatment media needed to maintain engineered standards.

(4) Identify what FHWA and FTA are responsible for maintaining each engineered treatment facility.

iv. Stormwater Management Commitment Tracking. Coordinate every 6 months or prior to application for 401 Certification as identified by the Critical Path Method to insure that permanent stormwater treatment of the CIA is achieved to a level identified in the Opinion for the CIA and treatment for areas identified in the action as untreated is addressed. FTA and FHWA shall supply sufficient documentation for the aforementioned portions of the CIA, and NMFS will review to ensure consistency and compliance with this Opinion. This coordination process is to ensure the entire CIA shall have permanent stormwater treatment meeting the terms and conditions here in.

n. Site Restoration. Any part of the project that will result in a significant disturbance of riparian vegetation, soils, streambanks, or stream channel must have a post-construction restoration plan to ensure that disturbed areas meet the restoration requirements described below. FHWA and FTA will confirm when site restoration criteria are met.

i. Site restoration. Any part of the project that will result in a significant disturbance of riparian vegetation, soils, streambanks, or stream channel must have a post-construction restoration plan to ensure that disturbed areas meet the restoration requirements described below. FHWA and FTA will confirm when site restoration criteria are met. The post-construction site restoration plan shall consist of practices necessary to ensure that site restoration criteria, including:

(1) Restoring damaged streambanks to a natural slope, pattern and profile suitable for establishment of permanent woody vegetation.

(2) Replanting each area requiring revegetation before the first April 15 following construction with a diverse assemblage of species native to the project area or region, including grasses, forbs, shrubs and trees (noxious or invasive species may not be used); and reusing, when possible, the large wood, vegetation, topsoil and channel materials conserved during site preparation.

(3) Within reasonable limits of natural and management variation, restored upland sites should exhibit these characteristics:

(a) Continuing physical disturbance, if any, is confined to small areas necessary for access or other special management situations.

(b) Areas with signs of significant past erosion are completely stabilized and healed, bare soil spaces are small and well-dispersed.

(c) Soil movement, such as active rills and soil deposition around plants or in small basins, is absent or slight and local.

(d) Native woody and herbaceous vegetation, and germination micro-sites, are present and well-distributed across the site.

(4) Plants have normal, vigorous growth form, and a high probability of remaining vigorous, healthy, and dominant over undesired competing vegetation.
(5) Vegetation structure is resulting in rooting throughout the available soil profile.
(6) Plant litter is well-distributed and effective in protecting the soil with little or no litter accumulated against vegetation as a result of active sheet erosion ("litter dams).
(7) A continuous corridor of shrubs and trees appropriate to the site are present to provide shade and other habitat functions for the entire streambank.
(8) Streambanks are stable, well-vegetated, and protected at margins by roots that extend below baseflow elevation, or by coarse-grained alluvial debris.

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. The NMFS has determined that the FHWA and FTA should implement the following discretionary measure to be consistent with this obligation:

> The FHWA and FTA should continue to develop and carry out plans to better equip their staff and partners with the skills, tools and resources necessary to support collaborative processes such as those used to good effect in the CRC project consultation, and extend them to other FHWA actions in Oregon. FHWA and FTA should also continue to support problem-solving during the ESA consultation process, develop accountability systems that align with higher expectations for collaboration, and to achieve and recognize the superior environmental outcomes that accrue through collaborative problem-solving efforts.

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

Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal agency or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) If the amount or extent of taking specified in the incidental take statement is exceeded; (b) if new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that has an effect to the listed species or designated critical habitat that was not considered in the biological Opinion; or (d) if a new species is listed or critical habitat is designated that may be affected by the identified action (50 CFR 402.16).

To reinitiate consultation, contact the Oregon State Habitat Office of NMFS, and refer to the NMFS Number assigned to this consultation: 2010/03196.

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. 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 habitats, 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 may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) described and identified EFH for groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, coho salmon, and Puget Sound pink salmon (PFMC 1999). The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Chinook and coho. Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have the following adverse effects on EFH designated for Pacific Coast salmon:

- Degradation of water quality required for rearing and migration in the lower Columbia River as described in the Opinion, above.
- Short and discrete alteration of under sound via pile-driving. The elevation of underwater sound will raise underwater sound preventing normal use by Chinook and coho salmon.
- Reduction of benthic habitat that prey species and reduces foraging opportunities.

Essential Fish Habitat Conservation Recommendations

The following two conservation measures are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. These conservation recommendations include a subset of the ESA Opinion’s conservation recommendations and the ESA terms and conditions, and therefore NMFS recommends that FHWA implement the following from the ESA Opinion.

1. Minimize adverse effects due to elevated levels of underwater noise, reduced water quality, and physical habitat alteration associated with the structural footprint of the CRC bridges by applying conservation measures or BMPs for pile driving and construction,

except for fish salvage, as described in Term and Condition 1 in the accompanying Opinion.

2. Ensure completion of a monitoring and reporting program as described in Term and Condition 2 in the accompanying Opinion to confirm the action is meeting its objective of minimizing habitat modification from permitted activities.

The FHWA and FTA 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)].

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

Utility: Utility principally refers to ensuring that the information contained in this document is helpful, serviceable, and beneficial to the intended users.

The Opinion in this document concludes that the proposed Columbia River Crossing Project will not jeopardize the affected listed species. Therefore, the FHWA and FTA can fund this action in accordance with its authority under SAFETEA-LU. The intended users are the FHWA, ODOT, and WDOT.

Individual copies were provided to the FHWA, FTA, ODOT, and WDOT. 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.

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.

Objectivity:

Information Product Category: Natural Resource Plan.

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

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

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

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

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APPENDIX A. SOUTHERN RESIDENT KILLER WHALE DETERMINATION

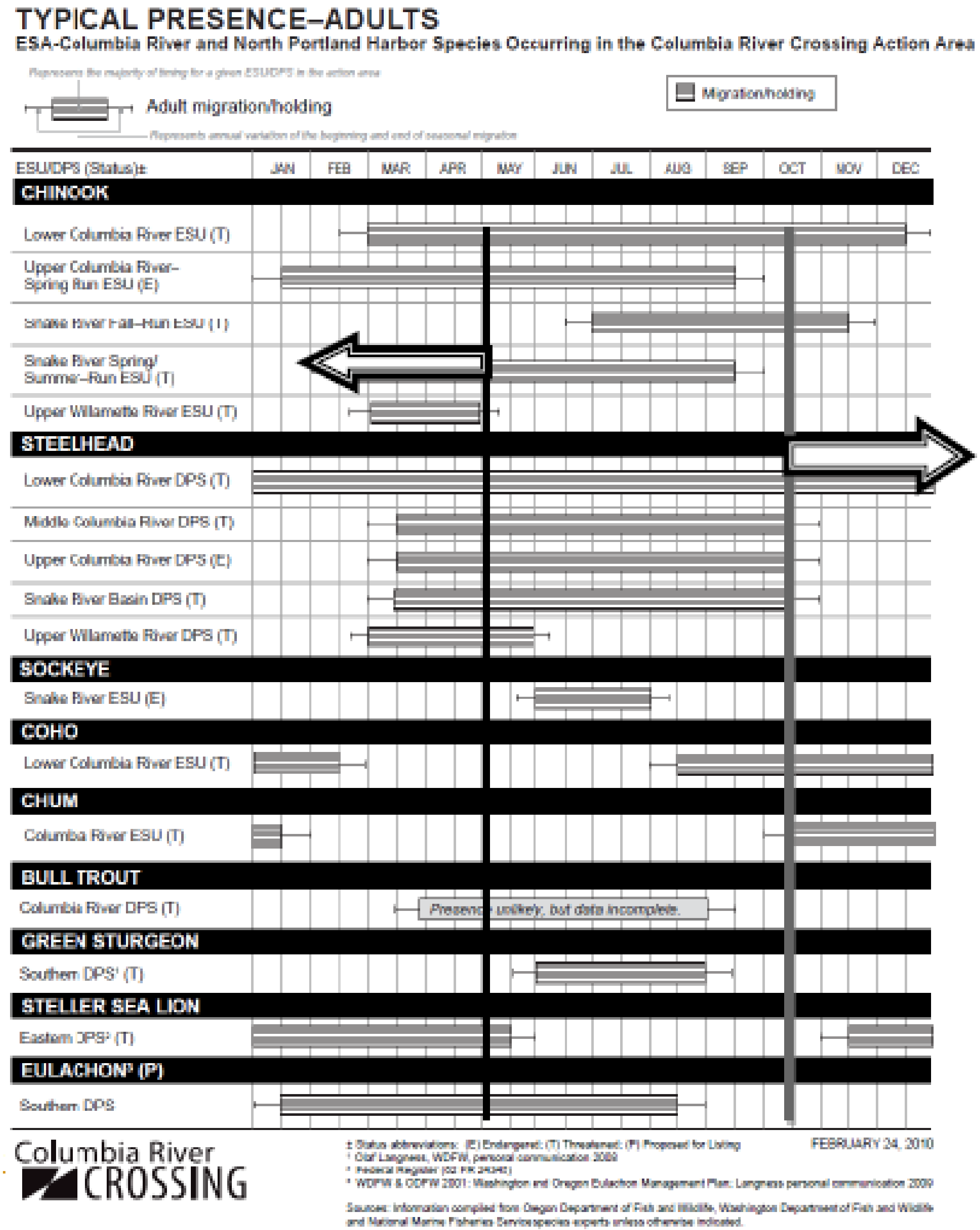
Southern Resident killer whales spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and typically move south into Puget Sound in early autumn (NMFS 2008). Pods make frequent trips to the outer coast during this season. In the winter and early spring, Southern Resident killer whales move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California, including coastal Oregon and off the Columbia River (NMFS 2008). There are no documented sightings of Southern Resident killer whales in Oregon coastal bays. There is no documented pattern of predictable Southern Resident occurrence along the Oregon outer coast and any potential occurrence would be infrequent and transitory. Southern Residents primarily eat salmon and prefer Chinook salmon (NMFS 2008, Hanson *et al.* 2010).

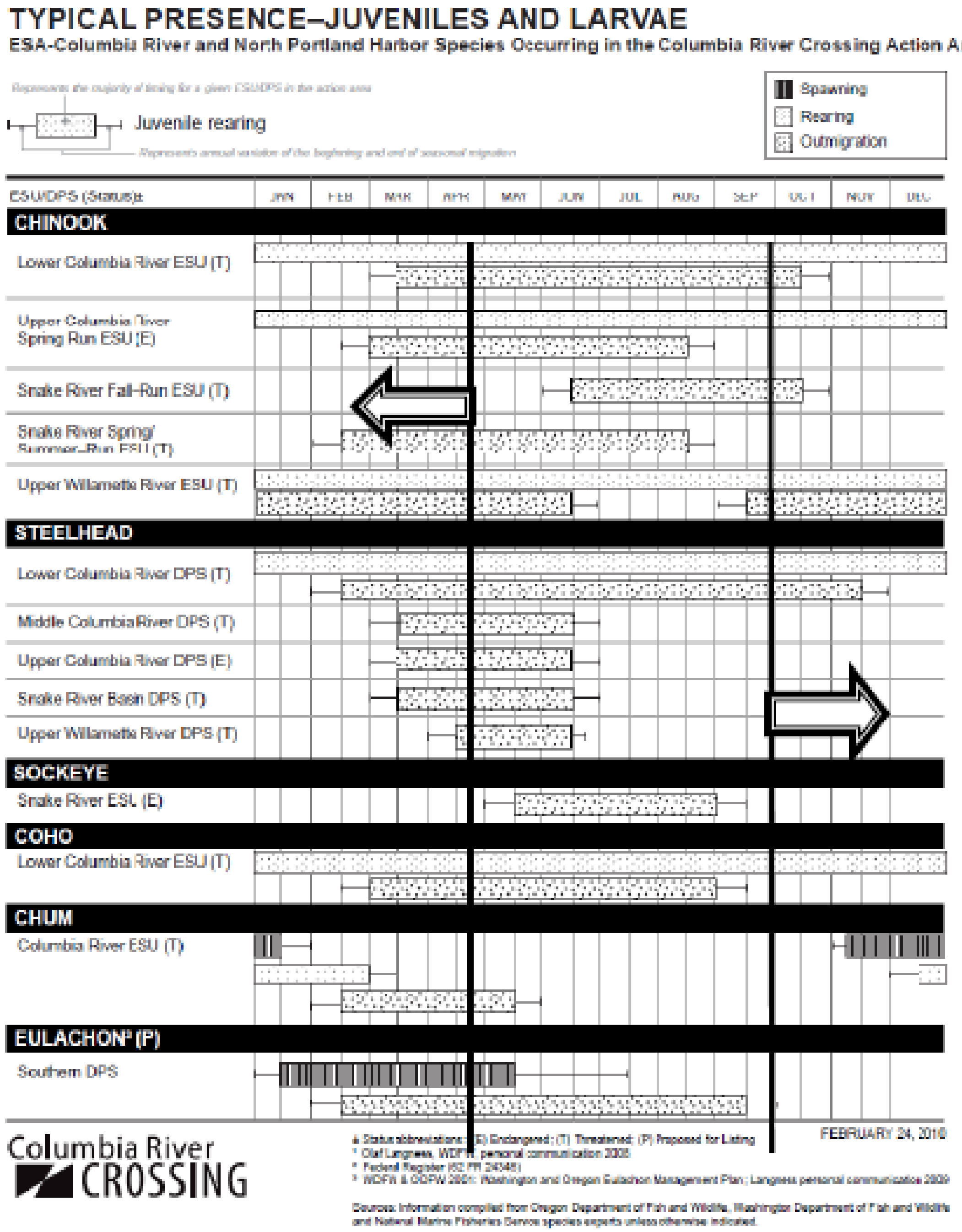
NMFS finds that all effects of the proposed action will either cause no effect or are expected to be discountable, insignificant or beneficial (NLAA) for Southern Resident killer whales. The proposed action would take place in the Columbia River, where Southern Resident killer whales do not occur. Therefore, NMFS does not anticipate any direct effects on Southern Resident killer whales.

As stated above for Steller sea lions, the proposed action may affect the quantity of their preferred prey, Chinook salmon. Any salmonid take including Chinook salmon 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 finds that the proposed action may affect, but is not likely to adversely affect Southern Resident killer whales.

APPENDIX B. RUN TIMING AND PRESENCE OF LISTED FISH IN THE I-5/CRC





Note: Timing of impact pile-driving =