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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No:
WCRO-2019-02613

June 16, 2020

Daniel M. Mathis
Division Administrator
Federal Highway Administration
Suite 501 Evergreen Plaza Building
711 S. Capitol Way
Olympia, Washington 98501-1284

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

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Interstate 405, State Route 522 Vicinity to State Route 527 Express Toll Lanes Improvement Project in King and Snohomish Counties, Washington (Hydraulic Unit Code 171100120400 – Lake Washington – Sammamish River, 171100120302 – North Creek, and 171100120304 – Bear Creek – Sammamish River)

Dear Mr. Mathis and Ms. Walker:

Thank you for your letter and biological assessment of 9/16/2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for Interstate 405, State Route 522 Vicinity to State Route 527 Express Toll Lanes Improvement Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

The enclosed document contains the biological opinion (Opinion) prepared by NMFS pursuant to section 7(a)(2) of the ESA to assess the effects of the proposed action. In the Opinion, NMFS concluded that the proposed action is likely to adversely affect but not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS steelhead. Additionally, NMFS assessed the effects on Southern Resident Killer Whales (SRKWs) due to the potential reduction of prey, primarily Chinook salmon. NMFS concluded the proposed project may affect, but is not likely to adversely affect SRKWs.

As required by section 7 of the ESA, NMFS has provided an incidental take statement (ITS) with the Opinion, the ITS describes reasonable and prudent measures (RPM) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the Federal Highway Administration and Corps of Engineers must comply with to meet those measures. Incidental take from actions that meet these terms and conditions will be exempt for the ESA's prohibition against the take of listed species.

The Opinion includes a description of the action's likely effects on EFH for Pacific Coast Salmon and includes two EFH conservation recommendations to offset impacts to EFH. Federal agencies must provide a detailed written response to the conservation recommendations within 30 days of receipt of measures proposed to avoid, mitigate, or offset the adverse effects that the activity has on EFH.

Please contact Elizabeth Babcock in the North Puget Sound Branch of the Oregon/Washington Coastal Office at 206-526-4505 or by electronic mail at Elizabeth.Babcock@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Rob Woeck WSDOT woeckro@wsdot.wa.gov

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

Interstate 405, State Route 522 Vicinity to State Route 527 Express Toll Lanes Improvement Project

NMFS Consultation Number: WCRO-2019-02613

Action Agencies: Federal Highway Administration and U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No	No
Puget Sound Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	No	No
Southern Resident Killer Whales (*Orcinus orca*)	Endangered	No	No	No	No

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: June 16, 2020

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1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the NMFS Lacey, Washington office.

1.2 Consultation History

The proposed project is funded in part by the Federal Highway Administration (FHWA) and requires a U.S. Army Corps of Engineers (Corps) permit, creating a federal nexus to address 7(a)(2) of the ESA. FHWA will be the federal lead for this consultation.

FHWA and applicant Washington Department of Transportation (WSDOT) provided a biological assessment (BA) to facilitate formal consultation. Early coordination with FHWA and WSDOT took place during the preparation of this BA. A pre-BA meeting was held on December 13, 2018, with representatives from US Fish and Wildlife Service (USFWS), NMFS, FHWA, and WSDOT. A second pre-BA meeting was held on June 20, 2019, to clarify issues that were raised during the December 2018 meeting.

This section of Interstate 405 (I-405) from milepost (MP) 21.79 to MP 27.06 is one of several phases along the entire 30-mile corridor that was originally identified in a 2002 Environmental Impact Statement (WSDOT 2002). Each phase has been consulted on individually as funding and design becomes available.

FHWA anticipates the proposed project May Affect, is Likely to Adversely Affect Puget Sound (PS) steelhead and PS Chinook salmon and will adversely affect essential fish habitat (EFH) for Chinook salmon, coho salmon, and pink salmon. There are no designated critical habitats for listed species in the project action area.

The FHWA did not request to consult on Southern Resident killer whales (SRKWs). We listed this species as endangered on November 18, 2005 (70 FR 6993). The proposed project adversely affects prey species for SRKWs that are themselves at risk of extinction. Therefore, NMFS has considered the effects of this action on SRKWs in Section 2.12.

With the inclusion of information from verbal and email discussions, design details, Muckleshoot Indian Tribal staff meeting with WSDOT that resulted in dropping work on one culvert in exchange for an improved design on stream 25.0L, the BA, and follow up correspondence on March 10, 2020 to update the project design, formal consultation was initiated on December 10, 2019.

1.3 Proposed Federal Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). The FHWA and WSDOT propose roadway designs and construction to address increasing traffic congestion and improve transit reliability on I-405 in the cities of Kirkland and Bothell (located in King County) and a portion of unincorporated south Snohomish County from MP 21.79 to MP 27.06 (Figure 1). This phase is a portion of the larger design to widen and improve traffic flow along the entire I-405 corridor. The SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project (Project) will add a single express toll lane (ETL) in each direction to create a dual ETL system. The new lanes are designed to address congestion issues on the northern portion of I-405 and extend the existing dual ETL system located between NE Sixth Street in Bellevue and just south of State Route (SR) 522 in Bothell. The design-build contract includes replacement bridges in the existing interchange with SR 522, several fish passage barrier improvements, and stormwater treatment facilities.

The Project is scheduled to be constructed from 2021 through 2024. Work conducted below the ordinary high water mark (OHWM) will be completed during an in-water work window from June 1 to September 30. Table 1 summarizes significant project objectives.

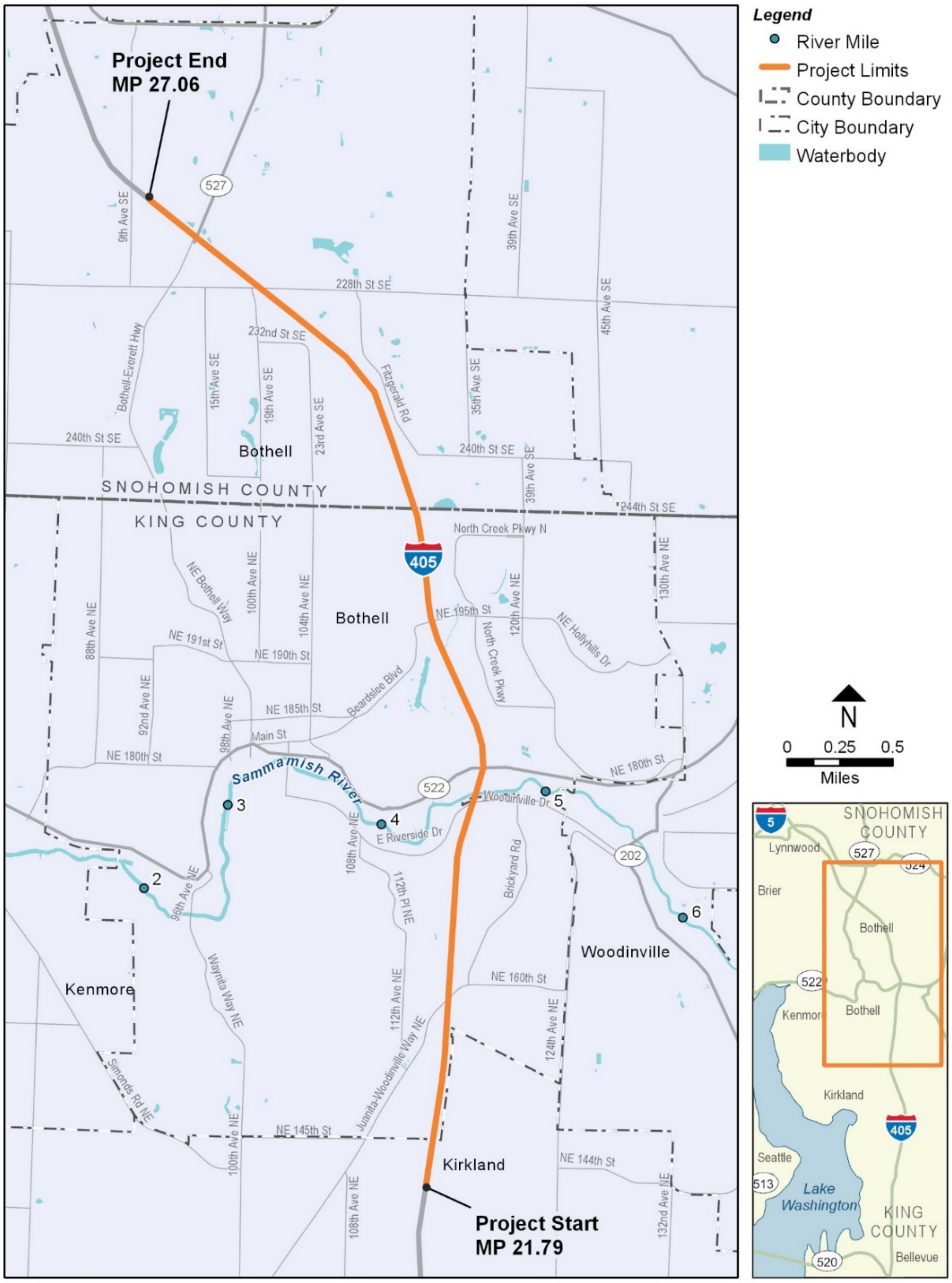

Figure 1. Vicinity Map

Table 1. Project Design Summary

Project Element	I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project
I-405 lanes and shoulders from SR 522 to SR 527	– Create a dual ETL system from milepost (MP) 21.79 (south of the I-405/SR 522 interchange) to MP 27.06 (just north of the I-405/SR 527 interchange). • From MP 21.79 to MP 22.30: Restripe existing lanes to create a dual ETL system. • From MP 22.30 to MP 26.30: Resurface and widen I-405 to add one ETL in each direction. • From MP 26.30 to MP 27.06: Widen I-405 to construct direct access ramps and maintain a single ETL starting near MP 26.30.
I-405 tolling from SR 522 to SR 527	– Construct new tolling gantries to collect tolls for the ETLs and direct access ramps.
SR 522 interchange	– Construct new direct access ramps and two inline transit stations (one in each direction) in the I-405 median. Transit stations would include station platforms, signage, artwork, lighting, fare machines, and site furnishing such as shelters, lean rails, benches, bollards, bicycle parking, and trash receptacles. – Construct a bus station and turnaround loop, pick-up and drop-off facilities, and new non-motorized connection to the existing North Creek Trail near the SR 522 interchange. Funding and construction timeline to be coordinated with local transit agencies. – Construct new I-405 northbound bridge through the SR 522 interchange. • Reconfigure the northbound I-405 to eastbound SR 522 ramp from one lane to two lanes. – Reconfigure I-405 on- and off-ramps. • Realign the southbound I-405 to westbound SR 522 ramp. • Realign the eastbound and westbound SR 522 ramps to northbound I-405. – Add three signalized intersections on SR 522.
228th Street SE	– Widen northbound I-405 overcrossing at 228th Street SE.
SR 527 interchange area	– Construct new direct access ramps to the north, south and east, and two inline transit stations in the I-405 median (one in each direction) just south of SR 527 at 17th Avenue SE. Transit stations would include station platforms, signage, artwork, lighting, fare machines, and site furnishing such as shelters, lean rails, benches, bollards, bicycle parking, and trash receptacles.
17th Avenue SE, 220th Street SE, SR 527	– Reconfigure 17th Avenue SE and portions of 220th Street SE and SR 527 to include a roundabout at the Canyon Park Park and Ride, and bicycle and pedestrian improvements.
Fish barrier corrections	– Replace five fish barriers with restored stream connections at the following streams: • Par Creek – non-fish bearing • Stream 25.0L – post construction* • Perry Creek* • Two fish barriers at Queensborough Creek* * Streams with ESA-listed fish

Project Element	I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project
Sammamish River bridges	– Remove the existing northbound I-405 to eastbound SR 522 bridge over the Sammamish River, including two bridge piers within the OHWM. – Remove the existing northbound I-405 to westbound SR 522 bridge over the Sammamish River, including two bridge piers within the OHWM. – Build a new bridge for northbound I-405 traffic over the Sammamish River. – Build a new bridge over the Sammamish River for the new direct access ramp at SR 522. – Build a new bridge over the Sammamish River for the northbound I-405 to SR 522 ramp.
Noise and retaining walls	– Construct 3 new noise walls. – Construct new retaining walls.
Stormwater treatment	– Provide enhanced treatment for most[1] of the new PGIS (approximately 24 acres). – Retrofit with enhanced treatment designs about 20 acres of existing untreated PGIS and continue to treat stormwater from the approximately 44 acres of PGIS that currently receives enhanced treatment. – Construct three new stormwater outfalls, one on the Sammamish River and two on Perry Creek.
Construction duration	– Construction is expected to last 3 years, from 2021 through 2024.

ETL = express toll lane; I = Interstate; MP = milepost; OHWM = ordinary high water mark; PGIS = pollution-generating impervious surfaces; SR = State Route

Project components relevant to fish and aquatic habitats include work below the OHWM in the Sammamish River, fish barrier corrections, artificial lighting, riparian and wetland vegetation, and stormwater treatment. These components are described below.

Sammamish River Bridges

<u>Demolition of existing bridges:</u>
Two existing bridges will be removed and replaced; a northbound (NB) I-405 bridge ramp to westbound SR 522 and a NB I-405 bridge ramp to eastbound SR 522. Both existing bridges have columns located below the OHWM of the Sammamish River near rivermile 4.5 at the interchange of I-405 and SR 522. The bridges to be removed are cast-in-place box girder superstructures with concrete decks/barriers, founded on concrete columns and deep foundations (either concrete footings on piles or shaft supported). Each existing bridge has two columns waterward of the Sammamish River OHWM for a total of four columns in the water to be removed.

During demolition of the superstructure (deck, rails, etc.), appropriate best management practices (BMPs) will be installed to prevent any demolition materials from entering the Sammamish River. Demolition of superstructures will likely be contained by a barge or temporary work

[1] 0.28 total acres of untreated areas are isolated in three locations within the project limits. Constructing stormwater treatment facilities for these locations would require reducing functional wooded areas and wetlands.

bridge. If a barge is used for containment, it is estimated that the barge will be in the Sammamish River up to eight weeks per bridge.

If temporary work bridges are used for containment, two work trestles will be built approximately 9.5 feet below the existing bridges (each bridge is approximately 35 vertical feet above the River) and span 150 feet. No temporary support piles will be located below the Sammamish River OHWM. The two temporary work trestles will create approximately 8,000 square feet (0.18 acre) of additional over-water shading during the demolition period. These work trestles are estimated to remain in place for up to 16 weeks until the demolition is complete. This includes time to erect the temporary work trestles, demolition of the existing bridges, and removal of the work trestles. After the demolition of the existing bridge superstructures is complete, WSDOT will demolish the remaining columns below the mudline/natural stream bottom (Figure 2).

Figure 2. Sammamish River Bridge Piers

Demolition of the four existing columns within the OHWM will require each column to be isolated within a sheetpile cofferdam during the approved in-water work window. Each cofferdam will isolate approximately 860 square feet for a total of approximately 3,440 square feet. The isolated areas could occur at the same time or consecutively. It is estimated that removal will take approximately one week per column (a total of up to four weeks), which includes installation of a cofferdam, dewatering the work area around the column, demolition of the column, and removal of the cofferdam. Cofferdams will be seated vertically into the substrate and vibratory driven with a crane positioned on the bank or on the barge.

Construction of new bridges:

At the SR 522 interchange, the Project will construct three new bridges: one for the new direct access ramps, one for the reconstructed northbound I-405, and one for the reconstructed northbound I-405 to SR 522 ramps (Figure 3). Construction of the new bridge spans at SR 522 include placement of bridge girders and cast-in-place bridge deck forms, as well as removal of bridge deck forms after deck curing is complete. New bridge girders will be placed by cranes located outside the OHWM. New bridge deck formwork will likely be placed from a false-deck supported from the new girders once set and removed after the deck concrete has cured. All three bridges will full span over the Sammamish River with no piers located below the OHWM.

The new bridges will be up to 80 feet wide bridges, increasing over-water shading of the Sammamish River by approximately 0.3 acre. The new bridges will be similar heights as the existing bridges, approximately 35 to 40 feet above the OHWM of the Sammamish River.

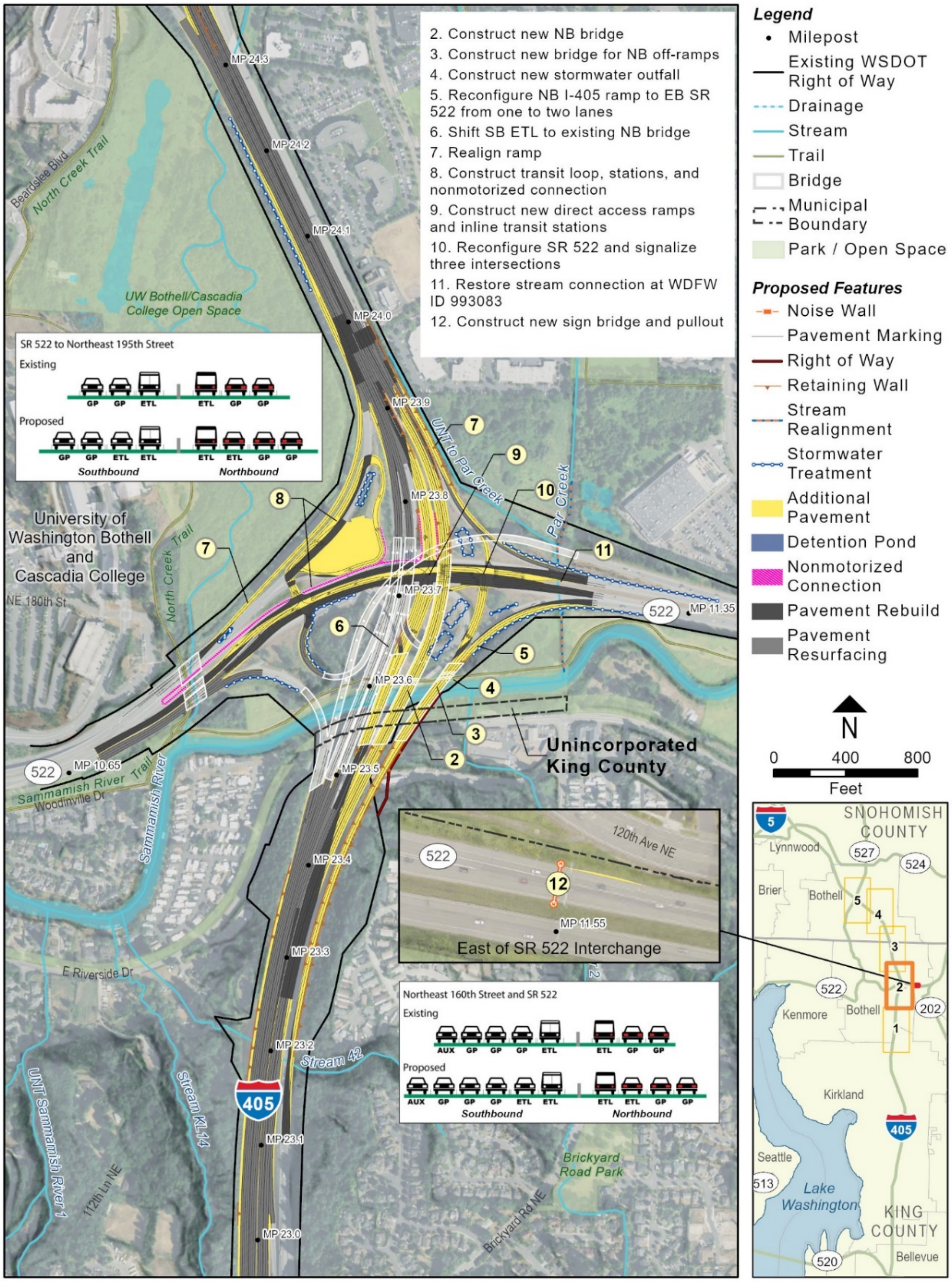

Figure 3. New Bridges Overview

Fish Barrier Corrections
WSDOT identified six fish passage barriers in the project limits that meet the conditions of the federal injunction for replacement (United States et al. vs. Washington et al. No. C70-9213 Subproceeding No. 01-1 dated March 29, 2013 (Injunction). Five of these culverts will be replaced with fish barrier correction designs to allow all life stages of fish to naturally move through to upstream habitats (Table 1). WSDOT, along with Muckleshoot Indian Tribal (MIT) and Washington Department of Fish and Wildlife (WDFW) staff, deemed Stream 66 has minimal habitat gain combined with several downstream barriers; therefore, the funds and effort will be used to restore enhanced access to the adjacent higher quality Stream 25.0L (Figure 4).

Stream 25.0L

The MIT, WDFW, and WSDOT biologists determined that it would be more beneficial for fish to not only correct the Stream 25.0L barrier under I-405, but also to go beyond the minimum requirements of the Injunction and develop the stream connection between Stream 25.0L and nearby North Creek. Figure 4 illustrates the locations of the existing streams, closed conveyance pipes located downstream of the I-405 crossings, and the new channel (i.e., "potential future connection") between Stream 25.0L and North Creek.

Figure 4. Stream 25.0L

The existing course (Figure 4, dotted line) is approximately 3,400 feet of culverts making it difficult to impossible for fish to gain access to habitat upstream of I-405 even when the blockage under I-405 is opened up. Most of the channel for Stream 25.0L downstream of I-405 will be abandoned in favor of directing the flows (dashed line) through a wetland and connect directly to North Creek.

The relocated channel of Stream 25.0L will be approximately 10 feet wide and will run along I-405 southbound before it crosses under I-405. The proposed culvert will be approximately 19 feet wide and 244 feet long. Downstream of the I-405 crossing, the relocated channel will flow approximately 330 feet east between the two business complexes and discharge into a wetland that will be surface connected to North Creek on the eastern end by removing a berm. The new channel portion constructed to connect Stream 25.0L to the wetland will be dug from uplands and will be isolated from the flows of the existing Stream 25.0L during construction at both the upstream and downstream ends of the proposed channel. After the new channel geometry has been constructed and cofferdams are in place, the existing channel will be dewatered to establish the channel connection. During dewatering, WSDOT biologists will implement WSDOT's Fish Exclusion Protocols and Standards (WSDOT 2016) for safe capture and removal of fish from the isolated work area.

WSDOT intends to maintain an existing pedestrian path over the new channel with a new bridge. The pedestrian bridge will be approximately eight feet wide and 30 feet long and located a minimum of five feet above the proposed ordinary high water mark (OHWM) with the abutments five feet outside of the OHWM of Stream 25.0L.

Par Creek, Perry Creek, and two crossings of Queensborough Creek

The proposed fish barrier corrections will meet the design requirements of the Injunction using the stream simulation or confined bridge methodology design criteria (Barnard et. al. 2013). Approximate dimensions and materials of the proposed fish barrier corrections are described in Table 2, below. All design details are not available but typical construction to restore stream connections includes project site delineation, stream isolation, fish exclusion, excavation, removal of the existing fish barrier, installation of the fish barrier replacement, reintroducing the stream flows, and planting the disturbed soils. Realignment of the stream channel may be required depending on configuration of the existing channel alignment. Some clearing of vegetation along the stream channel may be required for access during construction; however, any portions of the stream channels and riparian habitat that are temporarily disturbed during construction will be restored with native vegetation. Each restored stream connection will be constructed within one in-water work window in any construction year.

Table 2. Culverts for Fish Barrier Corrections

Stream Name	WDFW Culvert ID	Existing Fish Barrier Description	Documented or Likely Fish Species Present	Fish Barrier Description	Fish Barrier Correction Description	Permanent Impacts Within OHWM	Temporary Impacts Within OHWM (sq ft/acre)	Permanent Riparian Impact Area (sq ft/acre)	Upstream Habitat Gain (feet)
Par Creek	993083	60-inch concrete pipe at MP 11.31	None documented	Depth	New culvert at MP 11.31. Assume 16'x13' concrete box culvert	No existing channel will be filled by the proposed construction	1,800/0.04	-	8,494
Stream 25.0L	993104	30-inch concrete pipe with a grate at MP 25.00	None documented	WS Drop	New culvert at MP 25.05. Assume 8'x8' concrete box culvert	The new channel and crossing will be located outside of the existing OHWM	3,000/0.07	3,100/0.07	892
Perry Creek	08.0070 A 0.25	60-inch concrete pipe at MP 26.46	Chinook, steelhead, coho, sea run cutthroat, resident trout	Depth	New culvert at MP 26.46. Assume18'x 8' concrete box culvert	Portions of this channel will be realigned to accommodate the new roadway	4,900/0.11	-	8,281
Queensborough Creek	993109	42-inch CST pipe at MP 26.87	Chinook, steelhead, coho, sea run cutthroat, resident trout	Slope	New culvert - assume 15'x8' concrete culvert	Portions of this channel will be realigned to accommodate the new roadway	4,100/0.09	4,400/0.10	5,524

Stream Name	WDFW Culvert ID	Existing Fish Barrier Description	Documented or Likely Fish Species Present	Fish Barrier Description	Fish Barrier Correction Description	Permanent Impacts Within OHWM	Temporary Impacts Within OHWM (sq ft/acre)	Permanent Riparian Impact Area (sq ft/acre)	Upstream Habitat Gain (feet)
Queensborough Creek	993084	48-inch CST pipe at SR 527	Chinook, steelhead, coho, sea run cutthroat, resident trout	Slope	New culvert - assume 15'x9' concrete culvert	Portions of this channel will be realigned to accommodate the new roadway	3,600/0.08	1,900/0.04	1,139[2]
Total							17,400/0.39 ac	9,400/0.21 ac	15,249 ft (2.89 miles)

[2] The total upstream gain of correcting culvert ID 993109 and 993084 is 6,663 feet of upstream habitat

Staging

Staging will occur within the WSDOT right of way and may require soil disturbance and vegetation clearing. Each area will be delineated with High Visibility fencing to identify the work area. Any additional stages areas outside of the right of way will be up to the contractor to procure and permit.

Shading

The three new bridges replacing the two existing bridges are wider and will permanently increase shading of the Sammamish River by 13,000 square feet (0.3 acres). Temporary work trestles will temporarily shade 8,000 square feet (0.18 acres) of the river for approximately 16 weeks.

New Artificial Lighting

The Project will install new permanent light fixtures over the two ramp bridges. If nighttime work is necessary for bridge construction, WSDOT will use temporary nighttime lighting, consisting of individual "cobra head" or similar lamps to the extent feasible to limit ambient lighting to the stream. All permanent and temporary light fixtures will be directed away from the Sammamish River wherever practical. Use of lights at the Sammamish River will also be minimized as much as possible.

Vegetation

Riparian Vegetation

The new bridge locations will permanently remove one acre of riparian habitat that consists mostly invasive Himalayan blackberry. Fish barriers sites will permanently remove 0.2 acres and temporarily impact 0.4 acres of riparian vegetation. Disturbed soils will be replanted with site-appropriate native woody vegetation.

Wetland Vegetation

The proposed design will result in unavoidable permanent impacts to 22 wetlands (3-Category II wetlands, 13-Category III wetlands, and 6-Category IV wetlands). Throughout the project limits, approximately five acres of wetlands and up to three acres of wetland buffers will be permanently cleared, and approximately one acre of wetland buffer will be temporarily affected. Areas proposed for temporary vegetation removal will be replanted with native vegetation. Permanently impacted wetlands will be mitigated along Par Creek and the remaining impacts offset at the Keller Farm Mitigation Bank. Details of the mitigation are being drafted and not available at this time.

Impervious Surfaces and Stormwater Treatment

The proposed project will add 24 acres of new Pollution Generating Impervious Surfaces (PGIS) with widened lanes and bridges across 13 individual Threshold Discharge Areas (TDAs) (Table

3). Stormwater runoff from an equivalent area of all new PGIS will be treated with enhanced treatment facilities (WSDOT 2019a). The design type will vary depending on the gradient and available area. New PGIS in three TDAs will not receive treatment (total of 12,197 square feet [0.28 acres]) because individually they are below the 5,000 square foot (0.87 acres) threshold required by the Highway Runoff Manual (WSDOT 2019a). However, the remaining 10 TDAs will treat additional surfaces in excess of the PGIS created in those TDAs[3]. An additional 20 acres of existing PGIS will be retrofitted with enhanced treatment where none has existed (Table 3).

Table 3. Threshold Discharge Areas

Basin	Receiving Water Body	TDA	Proposed New PGIS in TDA (acres)	Proposed Treatment (acres)	Type of Enhanced Design[4]
Sammamish River	Stream KL14	F2	0.06	0	No additional treatment proposed
	Stream 42	F3	0	0	No additional treatment proposed
	Sammamish River	G2	15.50	47.11	CABS/MFD
	North Creek	G4	0.36	0.46	CABS
North Creek	North Creek	I1	1.88	6.49	MFD/CABS
	Stream 66	I2	0.46	1.66	MFD/CABS
	Stream 25.0L	I3	0.33	1.63	MFD
	Stream 70	I4	0.75	2.36	MFD/CABS
	Stream C-77	J1	0.70	3.06	MFD/CABS/CSW
	North Fork Perry Creek	J2	1.75	14.05	CABS
	North Creek	NW01	0.11	0	No additional treatment proposed
	Queensborough Creek	NW02	2.09	12.16	Wet Pond/CABS/MFD
	North Creek	NW 03	0.11	0	No additional treatment proposed
Total			**24**	**89**	

[3] TDA = threshold discharge area; An on-site area draining to a single natural discharge location or multiple natural discharge locations that combine within 1/4 mile downstream (as determined by the shortest flow path).
[4] CABS = compost-amended vegetated bioswale; MFD = media filter drain; CSW=constructed stormwater wetland

Stormwater Outfalls

The proposed design will add three new stormwater outfalls: one on the Sammamish River and two outletting to Perry Creek. Rip-rap energy dissipation pads at the outlets will be located above the OHWM at each location. Stormwater entering each new outfall will first pass through enhanced treatment facilities. Existing outfalls will continue to be used without modification (Figures 5 and 6).

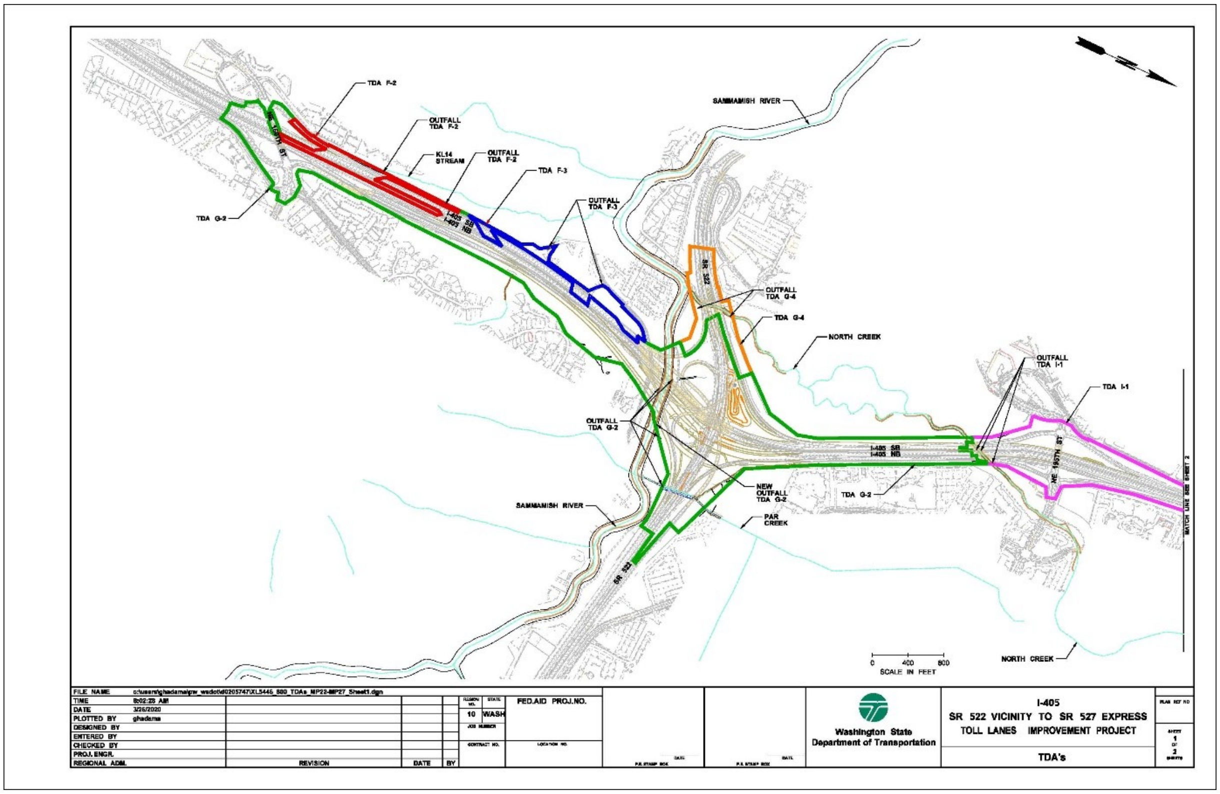

Figure 5. TDAs and outfalls 1

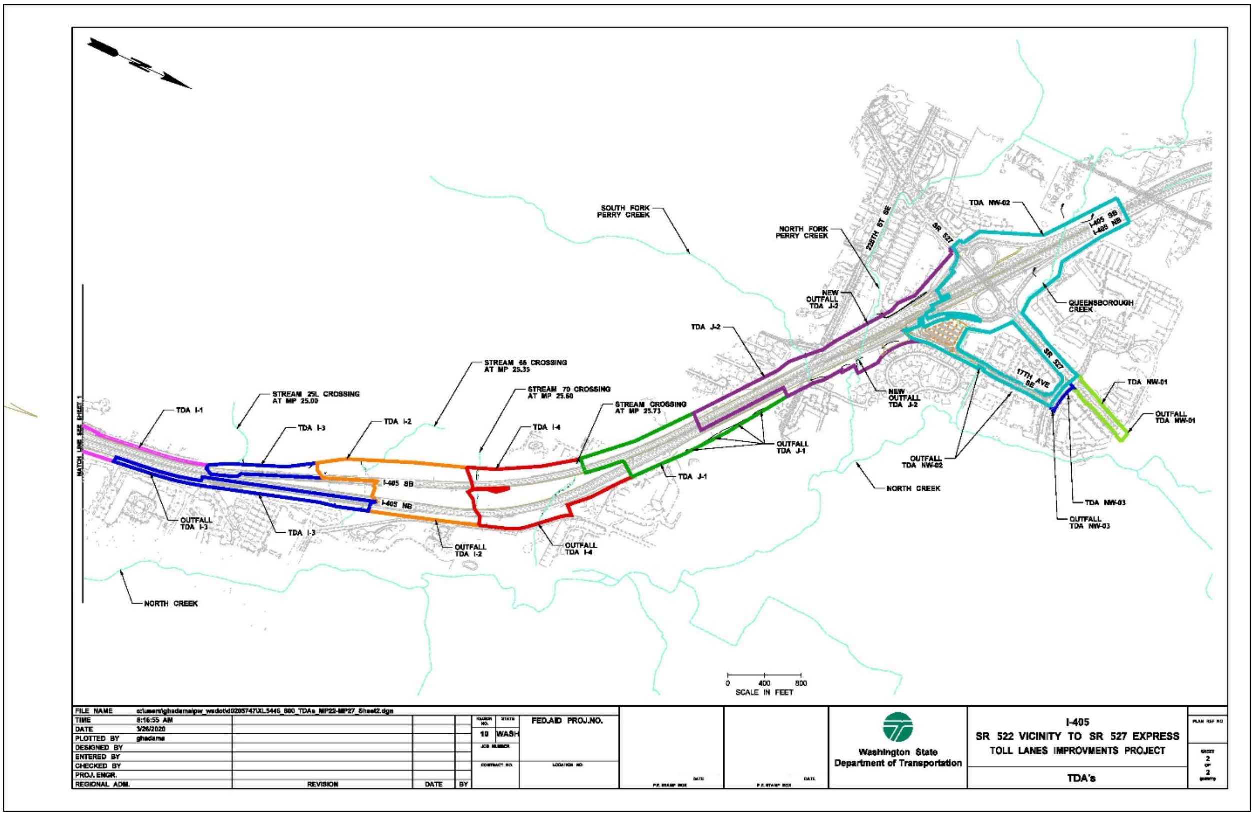

Figure 6. TDAs and outfalls 2

We considered whether or not the proposed action would cause any other activities to occur and determined that it would not.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The FHWA did not include an evaluation of the potential effects of the proposed project on Southern Resident killer whales (SRKW) or their critical habitat. NMFS has determined that the proposed action may affect this species as a result of the adverse effects on salmon, which are the primary prey for SRKWs and vital to their recovery. Although not requested by FHWA, NMFS has evaluated the potential effects independently and reached a determination that the proposed action was not likely to adversely affect SRKW, and therefore did not require formal consultation. This is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12).

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or

indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

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

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4 Fahrenheit (^{0}F) as an annual average, and up to 2°F in some seasons (based on average linear increase per decade) (Abatzoglou et al. 2014; Kunkel et al. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3^0 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015 this resulted in 3.5-5.3ºC increases in Columbia Basin streams and a peak temperature of 26ºC in the Willamette (NWFSC 2015). Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009).

Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004, Raymondi et al. 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright & Weitkamp 2013; Raymondi et al. 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson et al. 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7º Celsius by the end of the century (IPCC 2014). Habitat loss shifts in species' ranges and abundances and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder et al. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38% to 109% increase in acidity is projected by the end of this century in all but the most stringent CO_2 mitigation scenarios and is essentially irreversible over a time scale of centuries (IPCC 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al. 2012, Feely et al. 2012). Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho salmon and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder et al. 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of the Species

Table 4, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), and TRT (Technical Recovery Team).

Table 4. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Puget Sound Chinook salmon	Threatened 6/28/05 (70 FR 37159)	Shared Strategy for Puget Sound 2007 NMFS 2006	NWFSC 2015	This ESU comprises 22 populations distributed over five geographic areas. Most populations within the ESU have declined in abundance over the past 7 to 10 years, with widespread negative trends in natural-origin spawner abundance, and hatchery-origin spawners present in high fractions in most populations outside of the Skagit watershed. Escapement levels for all populations remain well below the TRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound steelhead	Threatened 5/11/07	NMFS 2019	NWFSC 2015	This DPS comprises 32 populations. The DPS is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the Puget Sound Steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the Puget Sound Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 populations. In the near term, the outlook for environmental conditions affecting Puget Sound steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization • Dikes, hardening of banks with riprap, and channelization

2.2.2 Status of the Critical Habitat

There are no designated critical habitats for PS Chinook salmon or PS steelhead in the action area.

2.3 Action Area

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

The project action area relevant to listed fish and aquatic habitats are a portion of the Sammamish River, the five fish barrier culvert sites, and the zones of dilution to background levels at stormwater outlets. The separated portions of the action area cumulatively extend from the limits of the project on I-405 from MP 21.79 to MP 27.06 (Table 2, Figures 5, 6 and 7). However, only areas used or occupied by PS Chinook salmon and PS steelhead are included; these areas are overlaid on the combined zones of effect and the overlap delineates the action area, as described below.

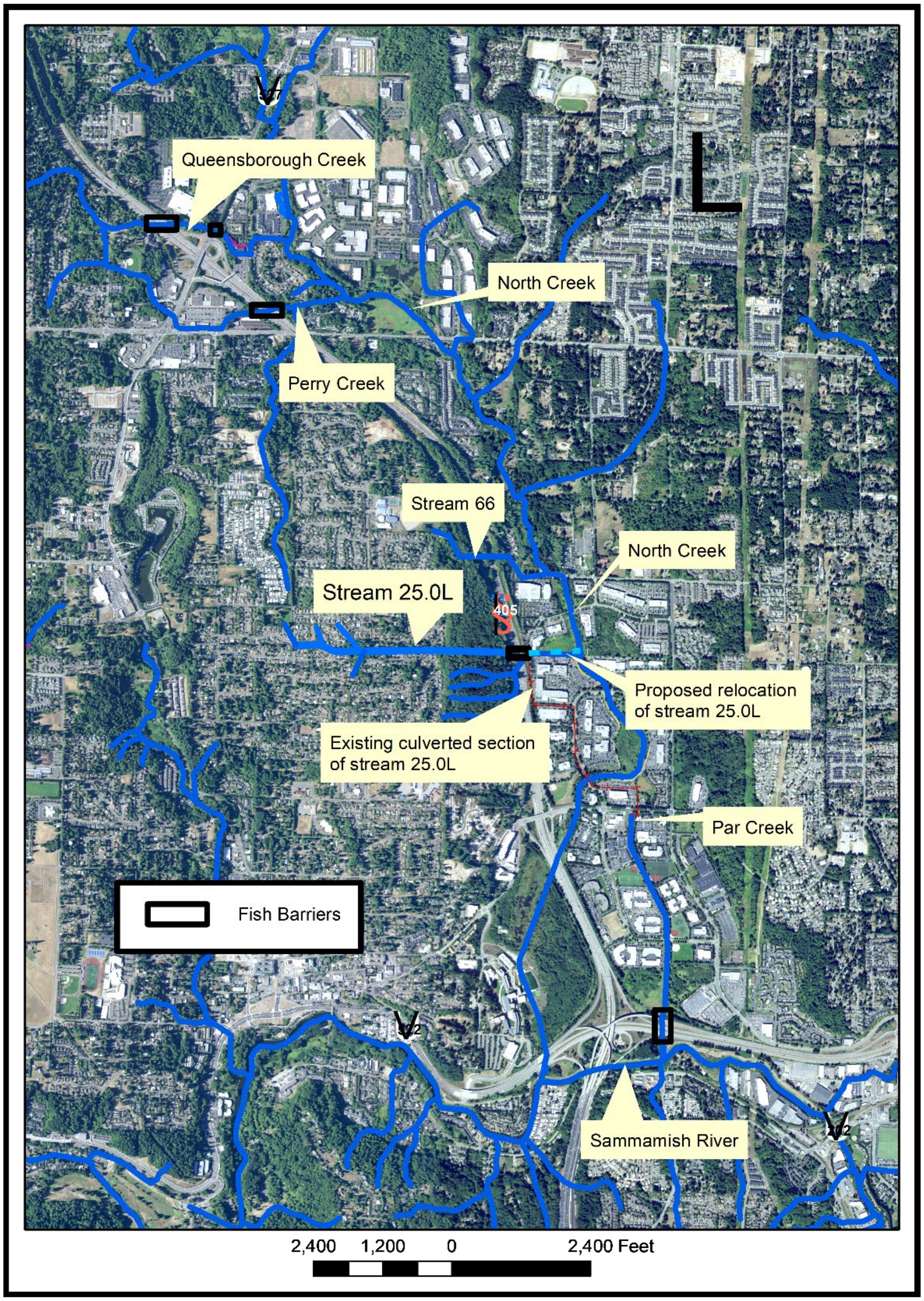

Figure 7. Fish Barrier Streams in the Action Area

Sammamish River

Removing the old bridge columns requires working within the OHWM of the Sammamish River at approximately rivermile (RM) 4.5, upstream of the confluence with Lake Washington. Sheet piles will be temporarily vibrated in and out to isolate the work zones surrounding each column. Underwater sound from vibratory installation is modeled to be elevated above background levels in approximately 2,100 linear feet of the Sammamish River. The background underwater sound level in the action area is conservatively estimated to be 120 decibels root mean squared (dbRMS) (WSDOT 2019b). Underwater sound from vibratory driving is estimated to be 165 dbRMS (SDOT 2012). Using the practical spreading loss calculation, it models underwater sound attenuating to background levels at 6.2 miles from the source. However, underwater noise from this action terminates at bends in the river 1,200 linear feet downstream and 900 feet upstream of the in-water work and defines the extent of the action area at this site.

Fish Barrier Culverts

Construction at each of the five fish barrier correction sites includes removing the existing culvert and replacing it with a structure that allows all life stages to pass through. Thus, some may just include the footprint of the barrier structure others some may require stream grading upstream and downstream of it. Stream 25.0L is unique in that the almost the entire downstream course will be relocated to improve open connectivity to fish habitat in North Creek. All streambeds will be temporarily disturbed, dewatered, reconstructed, and rewatered. These actions will create turbidity not to exceed five Nephelometric Turbidity Units (NTUs) 100 feet downstream of the source. All disturbed riparian areas will be replanted with native woody vegetation. The new fish passage structures will open up fish access to a total of 4.6 miles of habitat (Table 5).

Table 5. Fish Barrier Correction Streams

Stream Name	Existing Fish Barrier Description	Documented or Likely Fish Species Present	Fish Barrier Correction Description	Permanent Impacts Within OHWM	Temporary Impacts Within OHWM (sq ft/acre)	Permanent Riparian Impact Area (sq ft/acre)	Aquatic Habitat Restored or Improved (feet)	Upstream Habitat Gain (miles)
Par Creek	60-inch concrete pipe at MP 11.31	None documented	New culvert at MP 11.31. Assume 16'x13' concrete box culvert	No existing channel will be filled by the proposed construction	1,800/0.04	-	60	1.61
Stream 25.0L	30-inch concrete pipe with a grate at MP 25.00	None documented	New culvert at MP 25.05. Assume 8'x8' concrete box culvert	The new channel and crossing will be located outside of the existing OHWM	3,000/0.07	3,100/0.07	505	0.17
Perry Creek	60-inch concrete pipe at MP 26.46	Chinook, steelhead, coho, sea run cutthroat, resident trout	New culvert at MP 26.46. Assume18'x8' concrete box culvert	Portions of this channel will be realigned to accommodate the new roadway	4,900/0.11	-	-	1.57
Queensborough Creek	42-inch CST pipe at MP 26.87	Chinook, steelhead, coho, sea run cutthroat, resident trout	New culvert - assume 15'x8' concrete culvert	Portions of this channel will be realigned to accommodate the new roadway	4,100/0.09	4,400/0.10	-	1.05
Queensborough Creek	48-inch CST pipe at SR 527	Chinook, steelhead, coho, sea run cutthroat, resident trout	New culvert - assume 15'x9' concrete culvert	Portions of this channel will be realigned to accommodate the new roadway	3,600/0.08	1,900/0.04	-	0.22

Stormwater

All existing stormwater facilities will continue to be used for existing runoff and all new PGIS constructed in the 13 Threshold Discharge Areas (TDAs) feeding into the facilities. Three new outfalls will capture additional stormwater runoff: one discharges to the Sammamish River and two discharge to Perry Creek. The TDAs were evaluated for specific pollutants including total suspended solids (TSS), total zinc (TZn), total copper (TCu), dissolved zinc (DZn), and dissolved copper (DCu). Most sites were further evaluated for distance to dilution to background levels when the probability to exceed biological thresholds may occur (WSDOT 2009). Stormwater analysis was only conducted on streams that currently or may in the future support fish, which includes: Sammamish River, North Creek, Stream 25.0L, Perry Creek, and Queensborough Creek. Other streams in the limits of the action area have inconsistent surface flows or multiple downstream barriers precluding fish presence. The target stormwater pollutants dilution areas are conservatively expected to remain at the same level in Perry Creek but for a shorter portion of the year (up to 1,000 feet downstream of the outlet) but the remaining TDAs will reduce pollutant loads and dilution areas to less than one foot due to improved treatment facilities.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The action area includes two main water bodies: Sammamish River and North Creek, a tributary of the Sammamish River. Puget Sound fall-run Chinook salmon use the Sammamish River for migration but are found mainly in North Creek and its tributaries, which is used by all life stages. The Sammamish River drains into Lake Washington. Adult fall Chinook salmon enter Lake Washington from June to September and enter the Sammamish River or North Creek to spawn in September through early November (Berge *et al.* 2006). Juvenile Chinook salmon outmigrate from April to June to Lake Washington (Kiyohara and Zimmerman 2011). Thus, adults and some late outmigrating juvenile Chinook salmon will be present in the action area during the in-water work window.

The Sammamish River PS Chinook salmon population in the action area is small, has a slightly negative general trend, and a large proportion of the populations' spawners are hatchery-origin fish. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS Chinook salmon. Commercial and recreational fisheries also continue to impact this species.

The environmental baseline within the action area has been degraded by the effects of intense streambank and shoreline development and by aquatic activities. The baseline has also been degraded by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance. Riparian vegetation along the river banks is limited to narrow bands of trees and shrubs that are scattered along the length of the river, with riparian vegetation being completely absent along much the river's length. Along its length, about 26 bridges cross the river, and many docks and piers line its banks, creating harsh over-water shadows that limit aquatic productivity and reduce the river's value as rearing and migration habitat for juvenile salmonids. Additionally, those over-water structures provide habitat conditions that favor fish species that prey on juvenile salmonids, especially the non-native smallmouth bass. Other predators in the lake include the native northern pikeminnow and the non-native largemouth bass (Celedonia *et al*. 2008a & b; Tabor *et al*. 2010).

PS winter steelhead are documented to be present in very low numbers with a strong negative trend in the Sammamish River and North Creek. There have been almost no steelhead in the Lake Washington basin since 2000 (WDFW 2019a; Kerwin 2001; Steward and Associates 2004). However, a few seem to have entered because according to the recent juvenile salmon production studies by WDFW, 12 steelhead smolts were captured in the Cedar River but none were captured in Bear Creek (another tributary to the Sammamish River upstream of the confluence with North Creek) in 2014 (Kiyohara 2015). In 2017, there were eight steelhead smolts captured in the Cedar River and one steelhead smolt in Bear Creek (Lisi 2018). Although their presence has not been documented in Perry Creek and Queensborough Creek, steelhead may occur based on suitable habitat and the presence of other anadromous species, such as Chinook salmon and coho salmon. Winter steelhead use the Sammamish River and its tributaries primarily for foraging and as a migratory corridor to their spawning habitat located upstream of the action area (WDFW 2019b). Adult steelhead typically enter rivers and streams in the Lake Washington system from November through May and spawn between February and June. Smolts outmigrate between mid-March and early June and stragglers may be present during the in-water work window (Myers et al. 2015).

2.4.1 Sammamish River Basin

Historically, the Sammamish River is believed to have been a complex, highly sinuous, meandering channel and abundant "swampy" areas that were filled with peat and diatomaceous earth. It was approximately twice as long as it is today and overflowed its banks regularly. Its corridor was densely forested with cedar, hemlock, and Douglas-fir, with willows and deciduous vegetation dominating close to the river banks (Stickney and McDonald 1977).

Today, the Sammamish River is approximately 13.8 miles long, originates at the north end of Lake Sammamish, and ends at the river mouth at the northern tip of Lake Washington (Williams et al. 1975). The basin encompasses approximately 153,600 acres (WSDOT 2011). Much of the historic plant assemblages were removed by heavy logging from the 1870s through the early 20th century, which essentially cleared the old growth forest. The creation of the

Chittenden Locks in 1916, which lowered Lake Washington about 9 feet, effectively drained most of the sloughs and wetland habitats throughout much of the corridor, especially in the lower reach (Stickney and McDonald 1977). Lake Sammamish was lowered by this action as well, which increased the elevation difference between the lakes to approximately 12 feet, straightening the river. Around this same time, farmers in the Sammamish Valley formed a drainage district, which began to straighten the upper reach of the river dramatically (King County 1911).

By the mid-1920s, the river had largely been placed in its current location, though not at its current depth. The lowering of the lake, the channelization of the river, and the construction of drainage ditches in the river valley eliminated much of the complexity of the floodplain, including wetlands, side-channels, and many spring-fed streams that had flowed into the river from neighboring hillsides. Beginning in 1962, the Corps systematically dredged and channelized the mainstem of the Sammamish River into its current channel, primarily as a flood control project to prevent flooding of adjacent farmland during high spring flows. This action deepened the river by five feet throughout the valley and hardened the river's banks throughout most of its length, dramatically decreasing its remaining connection with the floodplain and cutting off most of the smaller tributaries to the river as refugia or forage areas (Martz et al. 1999; Kerwin 2001).

Much of the Sammamish River basin is highly urbanized with impervious surfaces, and water quality in the Sammamish River is considered poor during summer months. Lack of shade, riparian vegetation, and low flow in the summer months contribute to high water temperatures and low dissolved oxygen levels. The Sammamish River has been identified on the 303(d) list for temperature, bacteria, and dissolved oxygen (Ecology 2019). Sediment loads are likely high due to lack of riparian vegetation, large woody debris (LWD) accumulations, and sufficient number of pools. Submerged aquatic vegetation (SAV) is abundant in the project vicinity of the Sammamish River and North Creek because of slow currents and urban runoff. Particularly during the summer growth season.

King County collected water, sediment, and benthic community samples in the Sammamish River from 2001 to 2003 (King County 2005). According to their study, five pesticides were detected in the water samples, but concentration levels were all below aquatic life thresholds. In sediment samples, eleven polycyclic aromatic hydrocarbons (PAHs) were detected, and five PAHs exceeded the threshold effects level farther upstream from the action area. However, recorded concentration levels do not exceed probable effects level, and the risk of adverse effects to aquatic life is considered low (King County 2005). King County also assessed the conditions of the benthic invertebrate community, and it was concluded that the benthic community in the Sammamish River is stressed and impaired (King County 2005).

The Sammamish River has no fish barriers within the action area or farther downstream of the action area (WDFW 2019c). However, high water temperatures in the river can pose a thermal barrier to migrating salmonids. Channel complexity, floodplain connectivity, and riparian condition and function are degraded due to channelization of the river and dredging activities.

The Sammamish River and the tributaries described below support PS fall-run Chinook salmon and PS winter steelhead. In the action area, PS Chinook and PS steelhead use the Sammamish River for migration and rearing. They use its tributaries for spawning, rearing, and foraging. Critical habitats for PS Chinook and PS steelhead have not been designated in the Lake Washington watershed, which includes the project action area.

Sammamish River

The Sammamish River crosses I-405 at MP 23.60 on the south side of the I-405/SR 522 interchange. Within the action area, the Sammamish River is mostly channelized with sparse vegetative cover along the river banks. The banks are mostly vegetated with Himalayan blackberry and reed canarygrass (*Phalaris arundinacea*) and lack canopy cover; however, some newly planted native vegetation and LWD have been installed along the banks immediately upstream of the I-405/SR 522 interchange as part of the recent restoration efforts by King County and the city of Bothell. The Sammamish River is approximately 70 to 75 feet wide, and in-stream habitat in this reach is mostly dominated by glide habitat where migrating salmonids are found. The dominant substrates of the Sammamish River in most reaches are silt and clay with 10 to 30 percent sand, large gravel, and cobble (King County 2002).

2.4.2 North Creek Basin

North Creek is one of the major tributaries of the Sammamish River. North Creek originates in highly urbanized south Everett in the Everett Mall area and flows southward through Mill Creek and Bothell, where it discharges into the Sammamish River on the west side of the I-405/SR 522 interchange at river mile 4.4 (Kerwin 2001). The North Creek basin covers approximately 28.5 square miles (18,240 acres), and roughly two-thirds of the basin is in unincorporated Snohomish County (Snohomish County 2002). The creek is approximately 13 miles long, begins in a gently sloping plateau (approximately 525 feet in elevation), and flows through a valley that gradually broadens into a floodplain on the Sammamish River valley floor (Kerwin 2001). Within the basin, the major tributaries include Silver Creek, Penny Creek, Nickel Creek, Tambark Creek, Greening Creek, Filbert Creek, and Sitka Creek (Snohomish County 2002), and the basin also includes Silver Lake, Ruggs Lake, and Thomas Lake (Kerwin 2001).

Approximately 85 percent of the North Creek basin is developed. Headwaters of North Creek were historically dominated by forested wetlands; however, commercial and residential establishment have altered the historical stream conditions over time. Today, the basin consists of approximately 11 percent of a mixed deciduous and evergreen forest and 3 percent of wetlands (King County 2018).

North Creek is listed on the 303(d) list for dissolved oxygen, bioassessment (low biological integrity), and temperature, and Queensborough Creek is also listed for dissolved oxygen and temperature (Ecology 2019). Similar to Juanita Creek and the Sammamish River, high temperatures and low concentrations of dissolved oxygen have been recorded during summer months. Between 2012 and 2014, the highest recorded temperature was 22.37 degrees Celsius, and similar high temperature readings were recorded in July 2010, 2011, 2013, 2015, and 2016 (Bothell 2017). From 2011 to 2015, annual average concentrations of dissolved oxygen have decreased at the downstream reach of North Creek near SR 522, which correlated to higher temperature readings. Conductivity levels at monitoring stations along North Creek have been recording higher than natural background levels, indicating that urban stormwater runoff is a contributing source of dissolved metal ions (Bothell 2017).

No fish barriers are identified along North Creek within the action area as most of the crossing roads are bridged (WDFW 2019c). North Creek is reported to have slightly better habitat conditions than the Sammamish River but is still considered degraded (King County 2002). Long stretches of stream banks have been armored due to residential and commercial developments, which contributed to alteration of flows, increase of sediment loads, reduction of channel complexity and connectivity, alteration of riparian habitat, and reduction of LWD recruitment (Steward and Associates 2004). However, some restoration activities have been occurring along North Creek. One of the larger-scale restoration sites for North Creek is located at the lower end of North Creek near the University of Washington Bothell/Cascadia College campus. This 53-acre site reconnected the stream channel with its historical floodplain with a high-flow auxiliary channel to reduce flood impacts on the main channel. Micro topography was created, and extensive amounts of native vegetation and LWD were installed throughout the site (Steward and Associates 2004).

The action area also includes approximately six feet of North Creek and portions of three of its tributaries: Stream 25.0L, Perry Creek, and Queensborough Creek. These portions of the action area are described below. North Creek and the tributaries described below support PS fall Chinook and PS winter steelhead. Spawning only occurs in North Creek itself upstream of the action area but rearing and foraging is expected in the action area.

North Creek

Within the action area, North Creek generally flows southwest, crosses I-405 under a bridge at MP 24.30, flows through a recently restored floodplain at the University of Washington Bothell/Cascadia College campus for approximately 3,500 feet south, and crosses SR 522 under a bridge at MP 11.08, discharging into the Sammamish River. At the upstream crossing, the channel is approximately 25 to 30 feet wide. A setback levee is present on the right bank, approximately 50 feet east from the stream channel. Himalayan blackberry and reed canarygrass are the dominant vegetation observed near the crossing; however, some planted willows are present further upstream near NE 195th Street.

Under the I-405 bridge crossing, the stream is relatively confined as both banks are armored with riprap. Armoring continues further downstream of the crossing. Downstream of the I-405 bridge crossing, North Creek flows through a mitigation site for the University of Washington Bothell/Cascadia College campus, and this reach of the channel was restored with a meandering stream channel in early 2000. According to the baseline monitoring report, the bankfull width of the restored channel varies from 34 to 48 feet, and the thalweg depth ranged from 3.3 feet to 6 feet (LC Lee & Associates 2002). Twenty plant communities including cottonwood, Oregon ash (*Fraxinus latifolia*), red alder, Douglas-fir, western red cedar, Western hemlock, a variety of willows, salmonberry, Douglas spiraea (*Spiraea douglasii*), and red-osier dogwood (*Cornus sericea*) were planted. Douglas-fir and red alder trees, red-osier dogwoods, and willows (*Salix* spp.) were observed along the banks during the site visits; however, reed canary grass and Himalayan blackberry were also present. Signs of beaver activities were observed throughout this reach. No LWD was present for approximately 500 feet upstream and downstream from the I-405 bridge crossing, but some LWD was observed at the mitigation site.

Perry Creek

Perry Creek is a tributary to North Creek located in the action area and has two forks. South Fork passage under I-405 is not a fish passage barrier while the North Fork culvert must be replaced to improve fish passage. The stream starts east of I-405 as the north and south forks of Perry Creek join approximately 400 feet east of I-405, just west of 20th Avenue SE. Perry Creek in this reach is approximately 8 feet wide and 4 to 5 feet deep. Riparian vegetation observed along the channel includes red alder, western red cedar, and Himalayan blackberry. Observed substrates in this reach are fines and some gravels. Since 2010, accumulated fines have increased from 20 percent to 30 percent, which will likely have adverse effects on benthic invertebrates and fish productivity (Bothell 2017).

Perry Creek flows under 20th Avenue SE via a 48-inch culvert and eventually discharges into North Creek approximately 800 feet downstream from the 20th Avenue SE crossing. WDFW assessed the stream crossing at 20th Avenue SE and determined that the culvert is a partial blockage to fish (WDFW 2019). The report also states that the pipe may become backwatered during higher flow events.

According to the city of Bothell assessment (2017), instream pool habitat for Perry Creek is poor. Pool surface area for Perry Creek has dropped from 22 percent to 14 percent since 2010. No LWD was observed, and future recruitment of LWD to the stream channel appears to be limited due to absence of large trees in the riparian corridor (Bothell 2017).

Low numbers of juvenile Chinook salmon, steelhead, and resident fish may use Perry Creek for foraging, rearing, and off-channel refugia.

North Fork Perry Creek

North Fork Perry Creek is a low-gradient stream that originates west of the I-405/SR 527 interchange. It generally flows east through a residential neighborhood and forested area near Cedar Grove Park. The stream is piped under SR 527 and a business park. The channel then opens up just east of the business park and flows through a confined forested area dominated by red alder, vine maple, salmonberry, and Himalayan blackberry. The channel is approximately 8 to 10 feet wide and 1 to 2 feet deep in this reach. North Fork Perry Creek crosses I-405 via a 60-inch concrete culvert at MP 26.46. The culvert outlet is armored with riprap, and a 20- to 25-foot-wide scour pool is present at the outlet.

Downstream of the culvert crossing, the stream flows through a wetland for approximately 400 feet before it meets with South Fork Perry Creek. Dominant riparian vegetation observed along the channel includes vine maple, salmonberry, and Himalayan blackberry with some black cottonwood and western red cedar. Substrates are mostly fines and gravels. Some LWD is present along the channel, primarily on the upper reach of the channel.

According to the WDFW assessment, the I-405 crossing is a partial fish barrier due to the presence of baffles inside the concrete culvert (WDFW 2019c).

South Fork Perry Creek

South Fork Perry Creek originates from a series of manmade ponds located north of 242nd Street SE in the city of Bothell. According to the city of Bothell's Best Available Science document (Steward and Associates 2004), the lowest pond has been altered with a manual release gate to prevent ponds from flooding during high storm events. Downstream of the ponds, the stream flows north through a confined forested ravine for approximately 2,500 feet and then crosses 19th Avenue SE through two 24-inch culverts. The channel opens up for approximately 100 feet before it crosses 228th Street SE via a 48-inch culvert. Downstream of the culvert crossing, South Fork Perry Creek flows north through a wetland for approximately 500 feet before it meets with North Fork Perry Creek.

Near the culvert crossing, bigleaf maple trees and Himalayan blackberry are present. In addition, riparian vegetation observed further downstream include red alder, vine maple, Japanese knotweed (*Polygonum cuspidatum*), and salmonberry. The channel in the lower reach is approximately 3 to 4 feet wide and 2 to 3 feet deep. Substrates are mostly fines and silt with a few gravels. According to the WDFW assessment (WDFW 2019c), the 228th Street SE crossing is not a fish barrier. However, this portion of Perry Creek has been isolated from fish presence for many years and the proposed project to connect Perry Creek to North Creek will increase rearing habitat.

Elements of the proposed project will only occur on the North Fork of Perry Creek; therefore, the two forks will collectively be addressed as Perry Creek.

Queensborough Creek

Queensborough Creek is a tributary to North Creek that crosses I-405 at MP 26.87. According to the city of Bothell (2017), the stream originates in a residential area between 216th Street SW and 224th Street SW. It flows east through a residential area and a forested area before it crosses I-405 via a 42-inch culvert. Downstream of the I-405 crossing, the stream flows approximately 700 feet southeast through a forested area and crosses SR 527 through a 48-inch culvert. It then flows through a confined forested area between a business park and the Canyon Park Park and Ride and crosses 17th Avenue SE via a 56-inch culvert. From there, Queensborough Creek is channelized, flows north for approximately 200 feet along 17th Avenue SE, makes a 90 degree turn, and then enters North Creek approximately 700 feet east.

In general, the channel of Queensborough Creek is approximately 7 to 8 feet wide, but the channel depth varies from 2 to 7 feet. The lower reach of Queensborough Creek downstream of the I-405 crossing and along 17th Avenue SE is heavily incised, and signs of erosion were observed. According to the city of Bothell's stream health assessment and the Best Available

Science documents (Steward and Associates 2004; Bothell 2017), excessive amounts of sediment are caused by mass wasting in the upper watershed, and accumulated sediment levels have ranged from 36 to 52 percent between 2010 and 2016. Queensborough Creek has been recorded to have high temperatures in the summer months. The city of Bothell recorded 20.98 degrees Celsius in Queensborough Creek in July 2015, which was the highest temperature recorded between 2010 and 2016, potentially creating mitigation barriers for migrating adult salmon (Bothell 2017).

A setback levee is present behind the business park between SR 527 and 17th Avenue SE. Vegetation along the channel is mostly dominated by red alder, vine maple, and Himalayan blackberry. Some western red cedar trees are also present along the channel. Substrates are mostly sands and gravels. The culvert crossings at I-405 and SR 527 are currently complete fish barriers according to the WDFW assessments (WDFW 2019c). Low numbers of juvenile Chinook salmon, steelhead, and resident fish may use Queensborough Creek for foraging, rearing, and off-channel refugia in the reach between downstream-most barrier culvert and the confluence with North Creek.

As discussed in Section 2.2, climate change is expected to affect the Sammamish River and North Creek drainages with flashier flows, cause severe storm events and warmer and drier summers, and increase water temperatures. These factors will negatively affect fish habitat by altered flow regimes, streambed scouring, making portions of the streams unusable, and adversely altering microhabitats used by juvenile salmonids and thus hampering salmonid recovery.

2.5 Effects of the Action

Under the ESA, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

Construction-related Fish Removal: Fish salvage coincident with the installation of the work area isolation barrier around piers in the Sammamish River and at each of the fish barrier correction sites will adversely affect juvenile PS Chinook salmon and PS steelhead. Adults of both species are expected to avoid in-water work activities in the Sammamish River based on their greater swimming abilities and are not expected to be able to access the fish barrier correction sites due to low flows and shallow water.

FHWA/WSDOT qualified biologists will plan and direct work area isolation and fish removal. The directing biologist shall coordinate with construction and environmental staff to plan the sequence and methods for work area isolation, fish removal, and dewatering to provide the best conditions for safe capture and removal of fish. This work would be done in compliance with the WSDOT Fish Removal Protocol and Standards (WSDOT 2016). Fish removal would begin with deploying minnow traps and the use of a fine-mesh herding net to drive the juveniles out from behind the isolation barrier before it is closed off. Exposure to herding may cause short-term minor effects on the normal behaviors of exposed individuals, but it is extremely unlikely to cause detectable effects on their fitness. Small fish that remain within the isolation barrier after multiple passes with the herding net will be exposed to capture with dip nets or traps, electrofishing, and entrainment or impingement from dewatering pumps.

Once the isolation barrier is constructed, nets and traps will be used to capture any juveniles remaining in the isolation area. Contact with nets causes scale and skin damage, and overcrowding in traps causes stress and injury. Debris buildup in traps also injures or kills fish. Small fish experience physical trauma and physiological stress responses if care is not taken during the various handling and transfer processes (Moberg 2000; Shreck 2000). The primary contributing factors to stress and mortality from handling are: (1) Difference in water temperatures between the river and the holding buckets; (2) dissolved oxygen levels; (3) the amount of time that fish are held out of the water; and (4) physical trauma. Stress from handling increases rapidly if water temperature exceeds 18ºC (64ºF), or if dissolved oxygen is below saturation. However, the potential for and the intensity of most or all these factors is reduced because these activities are proposed to occur in compliance with the WSDOT Fish Removal Protocol and Standards (WSDOT 2016), but some juveniles will be injured or killed.

Electrofishing and capture can also result in stress, trauma, and mortality of juvenile fish. Electrofishing causes effects that range from increased respiratory action to mortality under certain conditions. Dalbey *et al*. (1996), Emery (1984), and Snyder (2003) describe responses that range from muscular contractions to mortality from exposure to electrofishing. Depending on the pulse train used, and the intensity and duration of exposure, muscular contractions may cause a lactic acid load and oxygen debt in muscle tissues (Emery 1984). It can cause internal hemorrhage and spinal fractures in 12% to 54% of the exposed fish, and acute mortality in about 2% (Dalbey *et al*. 1996). Severe interruption of motor function can stop respiration, and combinations of lactic acid load and oxygen debt may be irreversible, causing delayed mortality in apparently healthy fish. Obvious physical injuries often lead to reduced long-term growth and survival, whereas uninjured to slightly injured fish showed long-term growth and survival rates similar to unexposed fish of similar age (Dalbey *et al*. 1996). Only a small amount of juvenile fish will be exposed to electrofishing because it would be used only after multiple net passes within the isolation area yield no fish. Further, the biologist and environmental staff would adhere to the guidelines for initial and maximum power settings for backpack electrofishing identified in the WSDOT Fish Removal Protocol and Standards (WSDOT 2016).

WSDOT will isolate and screen the pump intakes used to dewater the isolation area, in compliance with the WSDOT Fish Removal Protocol and Standards (WSDOT 2016). Therefore, the risk of entrainment or impingement during de-watering of the isolation area is extremely unlikely to occur.

FHWA/WSDOT gave no estimate of the number juvenile Chinook salmon and steelhead that will be exposed to fish salvage activities. A recent Opinion completed for restoration activities in the Pacific Northwest Region estimated that an average of 132 ESA-listed salmon and steelhead are captured per stream restoration project, and that up to 5% of the captured fish would be seriously injured or killed by the activity (NMFS 2013). Therefore, the estimate of affected individuals used in this analysis is based on the regional average. We also took the location and timing of the proposed action into consideration because PS Chinook salmon and PS steelhead populations within the action area are both very small. Also, the in-water work window begins towards the end of the juvenile out-migration season in this river when overall numbers are typically lower. Therefore, the regional average likely well exceeds any reasonable expectations for the number of juvenile Chinook salmon and steelhead that will be captured during this project's fish salvage activities. Overall, NMFS estimates that up to half of the regional average will be captured during work area isolation for this project, and that up to 5% of those fish would be seriously injured or killed (NMFS 2013). In short, up to 66 juvenile Chinook salmon and/or steelhead will be captured, with up to four individuals being seriously injured or killed. The remaining fish would likely experience sub-lethal effects that are unlikely to affect their fitness or survival.

Noise and Sound Wave Effects:
Vibratory installation and removal of temporary sheetpiles located below the OHWM will reduce migration habitat during construction due to isolating 3,440 square feet of the Sammamish River. NMFS does not consider vibratory noise to be injurious to fish but would disturb them or dissuade them within 1,200 feet downstream and 900 feet upstream; thus, delaying them during migration. However, the migration instinct to move upstream or downstream may outweigh the avoidance behavior in some individuals, and others may be swept through the area of acoustic effect by the current. Smolt steelhead may be present in the action area when in-water construction occurs.

Up to eight sheet piles will encase each pier requiring two working days (16 to 20 hours) per pier for a total of 80 hours over a single construction season. Vibratory hammer sheet pile installation is anticipated to be between average peak decibels (dB) of 170-174 measured at 10 meters from the source (Caltrans 2015). Thus, the installation of sheet piles to isolate the construction site will produce underwater noise at levels less than 206 dBpeak, the agreed upon level that exposure to vibratory sound is not expected to cause bodily injury to fish (FHWG 2008).

Turbidity:
The effects of turbidity on fish are somewhat species and size dependent. In general, severity typically increases with sediment concentration and duration of exposure, and decreases with the increasing size of the fish. Newcombe and Jensen (1996) reported minor physiological stress in juvenile salmon only after about three hours of continuous exposure to concentration levels of about 700 to 1,100 mg/l. Water quality is considered adversely affected by suspended sediments when turbidity is increased by 20 NTU for a period of four hours or more (Berg and Northcote 1985; Robertson *et al*. 2006). The intensity of turbidity is typically measured in NTUs that describe the opacity caused by the suspended sediments, or by the concentration of total suspended sediments (TSS) as measured in milligrams per liter (mg/L). A strong positive correlation exists between NTU values and TSS concentrations. Depending on the particle sizes, NTU values roughly equal the same number of mg/L for TSS (i.e. 10 NTU = ~ 10 mg/L TSS, and 1,000 NTU = ~ 1,000 mg/L TSS) (Campbell Scientific Inc. 2008; Ellison *et al*. 2010). Therefore, the two units of measure are easily compared.

Proposed sheetpile installation/removal and other in-stream construction work would mobilize bottom sediments that would cause episodic, localized, and short-lived turbidity plumes with relatively low concentrations of TSS. As an example, vibratory removal of hollow 30-inch steel piles in Lake Washington mobilized sediments that adhered to the piles as they were pulled up through the water column (Bloch 2010). Much of the mobilized sediment likely included material that fell out of the hollow piles. Turbidity reached a peak of about 25 NTU (~25 mg/L) above background levels at 50 feet from the pile, and about 5 NTU (~5 mg/L) above background at 100 feet. Turbidity returned to background levels within 30 to 40 minutes. Pile installation created much lower turbidity than removal. The installation/extraction of sheetpiles in the Sammamish River is extremely unlikely to mobilize as much sediment as described above, because the piles all have much smaller surface areas for sediments to adhere to, and the sheet have no tube to hold packed-in sediments. Therefore, the mobilization of bottom sediments, and the intensity of resulting turbidity from the sheetpile removal is extremely unlikely to exceed the levels reported by Bloch, and may be much less, but given river currents, turbidity plumes may extend up to 300 feet from pile removal and not exceed five NTUs above baseline past that point. Turbid plumes would occur at each of the four piers in the Sammamish River during installation and removal.

Channel grading at the fish barrier correction locations will occur only after fish have been excluded and the stream routed around the work zones. Grading and stabilizing the new channels exposes significant amounts of soil; however, careful and slow rewatering of the isolated work areas following WSDOT Fish Exclusion Guidelines greatly minimizes the exposure to turbid plumes in the small streams to less than 100 feet not exceed five NTUs above baseline past that point until the full flow is reestablished (WSDOT 2016).

Based on the best available information, construction-related turbidity would be episodic and short-lived causing temporary, non-injurious behavioral effects such as avoidance of the plume, minor gill flaring (coughing), and slightly reduced feeding rates and success. None of these potential responses, individually, or in combination would affect the long-term fitness of exposed individuals.

Benthic Prey:
Dewatering the construction sites will temporarily reduce the amount of benthic invertebrates. These benthic organisms constitute forage for juvenile salmonids. The reduction in prey base will last for a period of weeks until it is colonized by invertebrates that drift into the area from nearby areas. The affected area is approximately 3,440 square feet in the Sammamish River and approximately 2,000 square feet at each of the five fish barrier sites, such that the temporary reduction in prey base and alteration to substrate is not anticipated to substantially affect the prey base of juvenile salmonids because there are other unaffected adjacent areas to forage in. There will be an improvement of benthic prey habitat after the barrier culverts are removed with access to more habitat along with improved substrate material, riparian vegetation, and habitat niches

Riparian Vegetation:
Habitat features within the riparian areas will initially decline by temporarily removing two acres of vegetation. All temporarily disturbed areas will be replanted with site appropriate native vegetation and habitat conditions will slowly and consistently improve. However, it will take

years or decades for replanted species to provide adequate shade to affect water temperature or provide natural cover. Once mature, native plant species will improve habitat functionality in comparison to existing invasive species. One acre of riparian vegetation will be permanently impacted. Permanent impacts will be mitigated by purchasing credits at the Keller Farm Mitigation Bank and at opportune locations in the project action area; however, amounts, specific locations, and details are not yet available.

Wetland Vegetation:
The proposed project will permanently impact 22 wetlands (3 Category II wetlands, 13 Category III wetlands, and 6 Category IV wetlands). Approximately 5 acres of wetlands and up to 3 acres of wetland buffers will be permanently cleared, and approximately 1 acre of wetland buffers will be temporarily affected. Areas proposed for temporary vegetation removal will be replanted with native vegetation while permanently impacted areas will be mitigated with credits purchased at the Keller Farm Mitigation Bank.

Stormwater:
The proposed project will add 24 acres of new PGIS. Most (23.7 acres) new and 20 acres of existing untreated PGIS will receive enhanced treatment designed to reduce TSS and metals before outletting to the Sammamish River and North Creek basins. Modeling using HI-RUN conservatively estimates stormwater pollutant loads, concentrations and distance to dilute to background levels (WSDOT 2019b). The data indicates any pollutants remaining after treatment will dilute to background levels within one foot at most outlets. The exception is stormwater released to Perry Creek, a tributary to North Creek: While stormwater pollutant loads are expected to decrease compared to existing conditions due to the proposed treatment of runoff from new and existing impervious surfaces, elevated levels may still may extend to 1,000 feet downstream of the outlet. Chinook salmon and steelhead potentially occur in Perry Creek but it is degraded habitat and there is far better habitat in North Creek. The distance from outlet into Perry Creek and North Creek is approximately 1,000 feet; thus, contributing stormwater will be indistinguishable from baseline conditions in North Creek. Dissolved copper, and zinc and TSS in stormwater can impair predator avoidance and fitness. The proposed project will reduce these components below baseline conditions with enhanced treatment options. With the exception of Perry Creek, exposure to elevated stormwater pollutants is limited to the one-foot dilution zone at each outlet in North Creek and the Sammamish River.

The level of exposure and response to these effects varies based on the different densities and life history stages of the ESA-listed fish that will be present in the action area during the construction window. Due to the proposed in-water construction window from June 1 through September 30, not all species or life stages will experience exposure from construction and ongoing operations and presence of the project. However, some late outmigrating juvenile Chinook salmon and steelhead and returning adult Chinook salmon will be exposed to construction effects. We anticipate construction timing will reduce exposure of the species considered in this Opinion. All known spawning of listed species occurs upstream of the project action area.

Shade:
The temporary work trestles will be in place for up to 16 weeks casting an 8,000 square foot (0.18 acres) shadow on the Sammamish River. The three new permanent solid-decked bridges

would increase the existing overwater footprint by 13,068 square feet (0.3 acres) and it would cast hard shadows completely across the river. Though they are at least 35 feet above the OHWM, the bridge's shadow would reduce aquatic productivity. It is also likely to delay juvenile migration, and increase exposure and vulnerability to predators for juvenile salmon. The intensity of these effects are likely to vary based on the brightness and angle of the sun, being most intense on sunny days, and less pronounced to possibly inconsequential on cloudy days.

Shade limits primary production and can reduce the diversity of the aquatic communities under over-water structures (Nightingale and Simenstad 2001; Simenstad *et al*. 1999). Because the bridge would be solid-decked and casts a hard shadow over water and substrate that is otherwise supportive of SAV and benthic invertebrates, it is highly likely that the bridge shadow would reduce the growth of SAV and limits the diversity of the organisms that are prey for juvenile salmonids. However, the size of the shade-impacted habitat would be very small compared to the amount of unshaded habitat along most of the adjacent river either side of the bridge. Further, mixing with the waters from the higher productivity areas adjacent to the bridge would quickly diminish the effects of any prey reduction at the site. Therefore, the effects of shade-related impacts on productivity would be too small to cause detectable effects on the fitness or normal behaviors of juvenile Chinook salmon and steelhead in the area.

Shade affects juvenile salmon migration, and the new bridge would cast a harsh shadow completely across the only route available to out-migrating juvenile Chinook salmon and steelhead. Numerous studies demonstrate that juvenile salmonids, in both freshwater and marine habitats, are more likely to avoid the shadow of an overwater structure than to pass through it (Celedonia *et al*. 2008a and b; Kemp *et al*. 2005; Munsch *et al*. 2014; Nightingale and Simenstad 2001; Ono *et al*. 2010; Southard *et al*. 2006). The intensity of the effect increases with proximity of the structure to the water and the increased contrast between light and dark areas. Celedonia *et al*. (2008b) report that two thirds of the juvenile Chinook salmon tracked during their study experienced a detectable delay in their migration under the SR 520 Lake Washington Bridge. One-third of the fish experienced an average delay of 15-minutes. One-third experienced delays of under one minute, and one-third showed no delay. Although the SR-520 Lake Washington Bridge is an imperfect analog for the proposed project, it supports the understanding that migration past the project site would be delayed for at least some of the juvenile PS Chinook salmon that encounter the bridge shadow. Tabor et. al. (2004) noted that up to 45 percent of sockeye fry were predated when intense light was directed on the Cedar River during nighttime outmigration. Therefore, migration delays are likely to increase predation rates of juveniles in the action area. Out-migrating juvenile steelhead are typically two to three years old and larger than the majority of the out-migrating juvenile Chinook salmon that move through this section of the river and are not as likely to experience similar migration delays.

Bridge shade is likely to increase juvenile salmonid exposure and vulnerability to predators. Shade and deep water both favor freshwater predatory species, such as smallmouth bass and northern pikeminnow that are known to prey heavily on juvenile salmonids (Celedonia *et al*. 2008a; Tabor *et al*. 2010). The bridges combined would cast about 40,000 square feet of shade completely across the river. The shadow would not increase the population of predatory fish in the action area, but it is likely to concentrate predatory fish within it. Therefore, it is likely that juvenile Chinook salmon and steelhead would be more likely to encounter predatory fish under the bridge than in areas away from it. For juveniles that swim into deeper water in their attempt to avoid the shadow, the risk of predation would increase further because the occurrence of larger predatory fish is likely higher in deeper water. Also, juvenile salmonids are more vulnerable to attack in deeper water because the increased water volume allows predators to attack from below and from the sides instead of from just one side as would be the case in shallow water along the shore. Juvenile Chinook salmon and steelhead are more likely to be exposed to predators under the bridge than away from it, and some of those individuals would be more vulnerable to attack than they would be in the absence of the shadow. Those that fail to escape would be killed. Individuals that do escape would experience reduced fitness due to increased energetic costs and stress-related effects that may reduce their overall likelihood of survival.

In summary, structure-related shade would continue to cause a combination of altered migratory behaviors and increased risk of predation that would reduce fitness or cause mortality for juvenile PS Chinook salmon and juvenile PS steelhead that pass the site. The bridges are anticipated to have a 50-year lifespan; thus, the affects would persist for the duration of the bridge's existence. We cannot predict the annual number of fish impacted by this stressor, and the number is likely to vary greatly over time due to the complexities of predator/prey dynamics as well as variations in environmental conditions. However, the available information about predator/prey dynamics suggest that the probability of exposure to a predator at the site would be very low for any individual fish, and only a subset of the interactions would result in successful attacks. Therefore, the annual numbers of individuals that would be killed or experience reduced fitness due to the bridge shadow would be too low to cause detectable population-level effects.

Artificial Lighting:
The post-construction bridge lighting system would continue to cause artificial illumination of the river along the bridge's length for the duration of the bridge's anticipated 50-year lifespan. Artificial lighting attracts fish (positive phototaxis) and often shifts nocturnal behaviors toward more daylight-like behaviors. It may also affect light-mediated behaviors such as migration timing.

Tabor and Piaskowski (2002) report that juvenile Chinook salmon in lacustrine environments typically feed and migrate during the day, and are inactive at night, residing at the bottom in shallow waters. They tend to move off the bottom and become increasingly active at dawn when light levels reach 0.8 to 2.1 lumens per square meter. Tabor *et al*. (2017) found that subyearling salmon (Chinook, coho, and sockeye) exhibit strong nocturnal phototaxic behavior when exposed to levels of 5.0 to 50.0 lumens per square meter, with phototaxis positively correlated with light intensity. Celedonia and Tabor (2015) found that juvenile Chinook salmon in the Lake Washington Ship Canal were attracted to artificially lit areas at 0.5 to 2.5 lumens per square meter. They also found that the quality of the light played a role, with orange-colored sodium lamps being more attractive to juvenile Chinook salmon than fluorescent and cooler wavelength lights. The authors also reported that attraction to artificial lights may delay the onset of morning migration by up to 25 minutes for some juvenile Chinook salmon migration through the Lake Washington Ship Canal.

The new bridge lighting system is designed to limit illumination of the river to the lowest practicable light level based on the pole placement and spacing required to meet the roadway light-level standards developed by the Illuminating Engineering Society of North America (IESNA). It is unknown what strength or wavelength of lighting will be used but WSDOT is progressively changing out all lighting to light-emitting diode and installing “clam shell” guards on poles above water to contain light casting.

The available information suggests that artificial illumination levels from the bridge would be above the illumination levels where the onset of daylight activities and phototaxis are expected to occur. Therefore, juvenile salmonids that are under or alongside of the bridge are likely experience some level of nocturnal phototaxis, and may experience other altered behaviors, such as delayed resumption of migration in the morning (Tabor et. al. 2004). Over the life of the bridge, it is likely that small subset of the exposed individuals would experience reduced fitness and/or altered behaviors that could reduce their overall likelihood of survival.

The annual numbers of juvenile PS Chinook salmon and PS steelhead that would experience measurably reduced likelihood of survival due to bridge lighting is unquantifiable with any degree of certainty. However, the proportion of any year’s cohort that would be exposed to the bridge’s lighting would be extremely small because the majority would pass through the action area during the day, when artificial light would cause no effect. Further, only a small portion of the exposed individuals would experience reduced likelihood of survival. Therefore, the numbers of either species that would experience reduced likelihood of survival due to artificial lighting would be too low to cause any detectable population-level effects.

Beneficial Effects

Beneficial effects to streams and stream habitat include the removal of existing piers from the Sammamish River and restoring stream connections at Queensborough, 25.0L, and Perry creeks. Having no structures within the Sammamish River will benefit the overall habitat for listed salmonid species in the river by reducing predation risks. The removal of existing culverts, upgrade of existing fish-passage barriers to restored stream connections, and realignment of the stream channel will provide additional access to upstream habitat for Puget Sound Chinook salmon and steelhead within each of these streams. Portions of the opened habitat would provide rearing, off channel refugia, and spawning areas.

The proposed restored stream connections will provide improved access to approximately 1.57 miles of the stream channel for Perry Creek and 1.27 miles of habitat gain for Queensborough Creek. At the Queensborough Creek crossing at MP 26.87, the proposed culvert will be shortened by 63 feet. At the Perry Creek crossing, the proposed culvert will be reduced by approximately 35 feet. Replacement of fish barriers will also benefit prey species of the listed fish species, including coho salmon and other resident fish.

Additionally, all stormwater runoff generated from the Project corridor will receive treatment, which will have a beneficial effect on listed species present in the action area as the Sammamish watershed generally has poor water quality conditions. WSDOT will minimize the effects of increases in pollutant loading (i.e. TSS, total copper, and zinc) with enhanced treatment of most of the new highway runoff and 20 acres of existing untreated highway runoff.

In summary, effect pathways from the proposed project include fish handling, underwater sound, turbidity, benthic prey, stormwater, shade, and artificial lighting. These pathways may adversely affect PS Chinook salmon and PS steelhead at different life stages in various ways ranging from disturbance to death. However, the project also improves existing conditions by treating stormwater to decrease dissolved metals discharging into the Sammamish River and North Creek and removing fish passage barriers to open up habitat that has been isolated for decades.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

The primary cumulative effects potentially affecting federally listed species stem from development projects occurring within the action area that do not have federal funding or federal permit requirements. Other cumulative actions that could potentially affect listed species and their habitat include:

Planned regional growth, which includes residential, commercial and industrial development or redevelopment. Between 2010 and 2017, the population in the central Puget Sound region, including King, Kitsap, Pierce, and Snohomish counties, and their 82 cities and towns, increased by 10 percent to 4.1 million people. Forecasts project this number to increase to nearly 5.8 million people by 2050 (PSRC 2019). As the human population in the action area continues to grow, demand for commercial, industrial, and residential development is also likely to grow. The effects of new development caused by that demand are likely to reduce the conservation value of the habitat within the action area. However, NMFS is not aware of any specific future non-federal activities within the action area that would cause greater effects to a listed species or a designated critical habitat than what presently occurs.

Sound Transit's I-405 Bus Rapid Transit (BRT) project is not a federally funded project but builds upon the WSDOT's I-405 Master Plan as well as Sound Transit 3, a ballot measure proposed by Sound Transit and approved by regional voters in 2016. Sound Transit is currently in the planning phase of the I-405 BRT project. Construction is expected to begin in 2023 with BRT open for service in 2024. If the BRT project triggers a federal nexus, Sound Transit will have its own ESA consultation but that is not anticipated at this time.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

As described in more detail above at Section 2.2, climate change is likely to increasingly affect the abundance and distribution of the ESA-listed species considered in the Opinion. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous. However, climate change is reasonably likely to cause reduced instream flows in some systems, and may impact water quality through elevated in-stream water temperatures and reduced DO, as well as by causing more frequent and more intense flooding events.

Climate change may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. The proposed action will cause direct and indirect effects on the ESA-listed species considered in the Opinion well into the foreseeable future. However, the action's effects the biological environment are expected to be of such a small scale that no detectable effects on ESA-listed species through synergistic interactions with the impacts of climate change are expected.

PS Chinook Salmon and PS Steelhead

Both of the species considered in this Opinion are listed as threatened, based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and an array of limiting factors as a baseline habitat condition. Both species will be affected over time by cumulative effects, some positive – as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that habitat trends are negative, as described below, effects on viability parameters of each species are also likely to be negative. In this context we consider the effects of the proposed action's effect on individuals of the listed species at the population scale.

The environmental baseline within the action area has been degraded by the effects of intense streambank and shoreline development and by aquatic activities. The baseline has also been degraded by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance.

The linear project intersects the Sammamish River and small tributaries to North Creek. The sites provide rearing habitat for juveniles, as well as migratory habitat in the Sammamish River and North Creek for juveniles and adults. Documented spawning habitat occurs upstream from the sites. The planned in-water work window overlaps with returning adult Chinook salmon and with the year-round presence of juveniles.

Short-term construction-related impacts, and long-term structure-related impacts, are likely to cause a range of effects that both individually and collectively would cause altered behaviors, reduced fitness, and mortality in low numbers of exposed individuals for decades to come.

The annual number of juveniles that are likely to be injured or killed by action-related stressors is unknown. However, the numbers are expected to be very low, and to represent such a small fraction of any annual cohort that it would have no detectable effect on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for this PS Chinook salmon and PS steelhead population.

As compared to undisturbed habitats, the proposed action would slightly reduce the functional levels of habitat features nearest some of the project sites while improving habitats at other locations. However, the negative impacts would not prevent the recovery of this species within the action area while the beneficial effects would support recovery goals. Based on the best available information, the scale of effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any population level impacts on PS Chinook salmon and PS steelhead. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon and PS steelhead. No critical habitat has been designated or proposed for this species; therefore, none was analyzed.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

Harm of juvenile Puget Sound Chinook salmon and Puget Sound steelhead from

- exposure to fish salvage,
- exposure to turbidity,
- exposure to temporally reduced riparian and wetland vegetation,
- exposure to stormwater pollutants,
- exposure to increased shade,
- exposure to altered lighting,

The NMFS expects that a maximum of 66 juvenile Chinook salmon and/or steelhead may be captured during fish salvage activities, with up to 4 of those fish being seriously injured or killed.

The NMFS cannot predict with meaningful accuracy the number of PS Chinook salmon and PS steelhead that are reasonably certain to be injured or killed by exposure to any of the remaining stressors. The distribution and abundance of fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can the NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action.

Additionally, the NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may experience these impacts. In such circumstances, the NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions to describe the extent of take as a numerical level of habitat disturbance.

The most appropriate surrogates for take are action-related parameters that directly relate to the magnitude of the expected take. Timing of work is applicable because the planned work windows were selected to reduce the potential for fish presence at the project site. Therefore, working outside of the planned work window would increase the number of fish likely to be exposed to construction-related impacts that are likely to cause injury or reduce fitness.

The extent of the turbidity plumes around sheetpile installation/extraction, stream dewatering, streambed grading, and rewatering the channel is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS steelhead from exposure to construction-related turbidity. We anticipate low numbers of salmonids could be present during this in-water work but density information is not available and therefore it is not possible to enumerate or monitor the take from this pathway, as such, we will rely on the extent of disturbed habitat as a surrogate to measure take. The specific surrogate is the area in which the plume will occur at a level that has the potential to harm salmonids by gill abrasion, elevated cortisol levels, and behavior alteration. Temporarily dewatering sections of streams to replace fish barriers will reduce prey for foraging salmonids in those areas until flows are reestablished and the site is recolonized. We estimate intermittent turbid plumes from construction could adversely affect listed salmonids. Therefore, as a surrogate we will use a turbidity plume of 300 feet for sheet pile extraction, 100 feet for fish barrier replacements, and not to exceed five NTUs above background at those distances.

This surrogate is rationally connected to the anticipated extent of take because take will expand or diminish with both the size and intensity of the plume. Turbidity monitoring will be performed by FHWA/WSDOT to document that take from turbid plumes does not exceed 300 feet or 100 feet from the source, as appropriate.

Approximately one acre of riparian vegetation will be permanently removed and two acres temporarily impacted by the widening I-405 and restoring fish passage barriers. Additionally, three acres of wetland buffer vegetation will be permanently removed and one acre temporarily removed. The surrogate for the loss of permanent and temporary reductions of vegetation will be areas affected by the project. Take from the loss is reasonably connected to negative impacts on stream and wetland habitats by decreased natural shading and organic input.

The width of the new bridges and the size and intensity of the nightime artificial illumination alongside of it are the best available surrogates for the extent of take of juvenile PS Chinook salmon and PS steelhead from exposure to structure-related altered lighting and shading. The length of the bridge is not a factor because it is set by the river's width, and is not a variable. The length of the river reach that would be artificially shaded during the day is positively correlated with the width of the bridge. As the width of the bridge increases, the width and intensity of its shadow, and the amount of available habitat for piscivorous predators within it would increase. As the amount of predator habitat increases along the migratory route, the likelihood that any juvenile salmonid would encounter a predator in the area would increase. As the size and/or intensity of the artificially illuminated area alongside the bridge increases, the greater the number of fish that would be exposed to the light, and/or the more intense the behavioral modifications are likely to be for exposed individuals.

The size of the new bridges and the enhanced treatment efficiencies and sufficient capacity of the stormwater treatment system are the best available surrogates for the extent of take of juvenile PS Chinook salmon and PS steelhead from exposure to structure-related contaminated water. This is because, as the size of the impervious surface area of the bridges increases, the concentration of pollutants in, and the volume of, vehicle-contaminated stormwater runoff from the bridges would increase. Conversely, as the capacity of the stormwater treatment system is reduced, the earlier and more frequently untreated stormwater would bypass the system. As the volume of untreated stormwater from the bridges increases, the concentration of contaminants reaching the river would increase, and the likelihood of juvenile PS Chinook salmon and PS steelhead being exposed to the contaminants would increase.

In summary, for Puget Sound Chinook salmon and Puget Sound steelhead, the extent of take for this action is defined as:

- A combined total of 66 juvenile PS Chinook salmon and PS steelhead captured, with a maximum of 4 seriously injured or killed during fish salvage;
- In-water work June 1 through September 30 for each of the three construction years;
- A turbidity plume not to exceed 5 NTUs past 300 feet from the project site during pile extraction and 100 feet during fish barrier replacements.
- The permanent and temporary losses of riparian and wetland buffer vegetation include:
    - Permanent:
        - One acre riparian and three acres wetland buffer.
    - Temporary:
        - Two acres riparian and one acre wetland buffer.
- The removal of two bridges and replacement with three new bridges. The new bridges are up to 80 feet wide and increase shading by up to 0.3 acres;
- A new lighting system that would prevent light straying off the bridge decks and onto the water surface by narrowly focusing the illuminated area;
- Construction of facilities to manage stormwater runoff from approximately 23.72 acres of new and retrofit 20 acres of existing PGIS using enhanced treatment designs in compliance with the WSDOT Highway Runoff Manual.

Some of these take surrogates could be construed as partially coextensive with the proposed action. However, they nevertheless function as effective reinitiation triggers. The construction-related take surrogates will likely be monitored on a near-daily basis; thus any exceedance of the surrogates will be apparent in real-time and well before the project is completed. Further, if the size the bridge or its lighting system exceeds the proposal, it could still meaningfully trigger reinitiation because the FHWA has authority to conduct compliance inspections and to take actions to address non-compliance, including post-construction (33 CFR 326.4).

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

The FHWA shall:

1. Minimize incidental take of PS Chinook salmon and PS steelhead from fish salvage.

2. Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to turbidity.

3. Mitigate incidental take of PS Chinook salmon and PS steelhead from the loss of riparian and wetland vegetation.

4. Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to structure-related altered light.

5. Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to stormwater pollutants.

6. Ensure the implementation of monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the FHWA or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The FHWA or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1) The following terms and conditions implement reasonable and prudent measure 1:

Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to fish salvage, the FHWA shall:

a) Limit fish salvage to June 1 through September 30.
b) Comply with the most recent WSDOT Fish Removal Protocol and Standards.

2) The following terms and conditions implement reasonable and prudent measure 2:

Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to construction-related turbidity, the FHWA shall:

a. Monitor and ensure turbidity plumes do not exceed five NTUs above background past 300 feet from the source in the Sammamish River and North Creek and 100 feet in tributary streams, including Perry Creek, Stream 25.0L, and Queensborough Creek.

3) The following terms and conditions implement reasonable and prudent measure 3:

Minimize incidental take of PS Chinook salmon and PS steelhead from the loss of riparian vegetation the FHWA shall:

a. At a minimum, restore the temporarily disturbed riparian and wetland buffer areas with site-appropriate native vegetation.

b. At a minimum, obtain riparian and wetland buffer restoration credits at an established mitigation bank with coverage for the project action area. Credit habitat quality shall be equal to or better than habitat lost.

4) The following terms and conditions implement reasonable and prudent measure 4:

Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to structure-related shading and altered light the FHWA shall:

a. Ensure that the widths of the new bridges do not exceed 80 feet; and
b. Ensure that nighttime artificial illumination is focused onto the bridge deck.

5) The following terms and conditions implement reasonable and prudent measure 5:

Minimize incidental take of PS Chinook salmon and PS steelhead from exposure to stormwater pollutants, the FHWA shall:

a. Implement the programmatic approach to monitoring detailed in the Programmatic Monitoring Approach for Highway Stormwater Runoff in Support of Endangered Species Act (ESA) Section 7 Consultations (WSDOT 2009);
b. Use the HI-RUN model if the effects to listed species and their habitats may be above the biological thresholds; and

6) The following terms and conditions implement reasonable and prudent measure 6:

Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded, FHWA shall collect and report details about the take of listed fish. That plan shall:

a. Require WSDOT to maintain and submit fish salvage logs to verify that all take indicators are monitored and reported. Minimally, the logs should include:
    i. The identity (name, title, organization), qualification, and contact information of the persons conducting fish salvage, and the person completing the report;
    ii. The location, date, time, and air and water temperatures;
    iii. The method(s) of capture and handling procedures that were used; and
    iv. The species and quantities of captured fish, and their disposition at release (i.e. alive with no apparent injuries, alive with apparent minor/serious injuries, dead with/without apparent injuries).
b. Include monitoring of the river surface to ensure that new artificial illumination does not stray onto the water surface. If this is not feasible, FHWA/WSDOT shall discuss options with NMFS and optimally adjust the lighting.
c. Monitor turbidity during in-water work to ensure compliance with the identified limitations.
    i. Provide monitoring logs to NMFS within 30 days of the annual completion of in-water work.

d. Report as-built riparian and wetland buffer areas that are permanently and temporarily impacted and how these impacts were offset. At a minimum, this will include documentation of credits purchased and planting plans.
e. Report to NMFS the total pre- and post-project amount of Pollution-Generating Impervious Surface (PGIS) in acres and the net increase in PGIS. The report shall include amount of new and retrofit PGIS receiving stormwater treatment and the level of treatment.
f. Submit electronic post-construction reports annually to NMFS within six months of the close of the in-water work window. Send the reports to: projectreports.wcr@noaa.gov. Be sure to include the NMFS Tracking number for this project in the subject line: Attn: WCRO-2019-02613.

2.10 Conservation Recommendations

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

1. The FHWA should encourage WSDOT to install stormwater detention vaults or other devices that would prevent system bypass for area-average fall storm events, and to maximize the delay of system bypass for larger storm events.

2. The FHWA should encourage WSDOT to install the stormwater effluent diffusers as far inland as practicable, and in a manner that would increase infiltration and decrease direct discharge to river waters.

3. The FHWA should encourage WSDOT to create off-channel and enhance salmon rearing habitat in the Sammamish River to partially offset the increased shading from the bridges.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Interstate 405, State Route 522 Vicinity to State Route 527 Express Toll Lanes Improvement Project. As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

Southern Resident Killer Whales

The Southern Resident killer whale (SRKW) Distinct Population Segment (DPS), composed of J, K and L pods, was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). A 5-year status review under the ESA completed in 2016 concluded that SRKW should remain listed as endangered and includes recent information on the population, threats, and new research results and publications (NMFS 2016).

The limiting factors described in the final recovery plan included reduced prey availability and quality, high levels of contaminants from pollution, and disturbances from vessels and sound (NMFS 2008). This section summarizes the status of SRKW throughout their range. This section summarizes information taken largely from the recovery plan (NMFS 2008), recent 5-year review (NMFS 2016), as well as new data that became available more recently.

The SRKW 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 then move south into Puget Sound in early autumn. While these are seasonal patterns, SRKW have the potential to occur throughout their range (from central California north to the Queen Charlotte Islands) at any time during the year.

Critical habitat for the SRKW includes approximately 2,560 square miles of Puget Sound, excluding areas with water less than 20 feet deep relative to extreme high water. The three specific areas designated as critical habitat are (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca.

SRKWs and SRKW critical habitats do not occur in the proposed project action area. The proposed project action area is not within SRKW critical habitat and SRKWs will not be present in the action area. However, Lake Washington basin salmon, particularly Chinook salmon, serve as primary prey for SRKWs. The proposed project construction and long-term operation and maintenance of the structures are expected to adversely affect two species of salmonids: Chinook salmon and steelhead. Though deleterious effects to these species is anticipated to be low, some individuals of each species may experience a risk of exposure and thus diminish available prey for SRKW recovery. And, as stated above in Section 2.5, the total number of individuals, particularly Chinook salmon, affected by this project are expected to be inconsequential to supporting sufficient prey abundance to measurably affect SRKWs. Therefore, prey quantity as a habitat feature is only insignificantly affected. Based on this analysis, the proposed action is not likely to adversely affect SRKW, or their designated critical habitat.

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

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

This analysis is based, in part, on the EFH assessment provided by the FHWA/WSDOT and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce. The EFH definition of a Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

3.1 Essential Fish Habitat Affected by the Project

The waters and substrates of the action area is designated as freshwater EFH for Pacific Coast salmon, which within the Sammamish River basin include Chinook and coho salmon. Freshwater EFH for Pacific Coast Salmon is identified and described in Appendix A to the Pacific Coast salmon fishery management plan (PFMC 2014), and consists of four major components: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat.

Those components of freshwater EFH for Pacific Coast salmon depend on habitat conditions for spawning, rearing, and migration that include: (1) water quality (e.g., dissolved oxygen, nutrients, temperature, etc.); (2) water quantity, depth, and velocity; (3) riparian-stream-marine energy exchanges; (4) channel gradient and stability; (5) prey availability; (6) cover and habitat complexity (e.g., LWD, pools, aquatic and terrestrial vegetation, etc.); (7) space; (8) habitat connectivity from headwaters to the ocean (e.g., dispersal corridors); (9) groundwater-stream interactions; and (10) substrate composition.

The action area provides rearing habitat for juvenile Chinook and coho salmon, as well as a migration corridor for juveniles and adults of both species. No salmon spawning habitat occurs within the action area, and the action area includes no known habitat features that meet the definition of habitat areas of particular concern (HAPC) for Pacific Coast Salmon.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the proposed action and its adverse effects on ESA-listed species and habitats important for all life stages, and is relevant to the effects on EFH for Pacific Coast Salmon. Based on the analysis of effects presented in Section 2.5 the proposed action will cause small scale long-term adverse effects on EFH for Pacific Coast Salmon through direct or indirect impacts as summarized below.

1. <u>Water quality:</u> – The proposed action would cause a long term mix of minor adverse effects and minor beneficial effects on water quality. Construction would briefly increase suspended sediments. Low levels of pollutants from road runoff would episodically enter the water over the life of the infrastructure. Detectable effects are expected to be limited to the area within 300 feet of the source.

2. <u>Channel gradient and stability:</u> – The proposed action would cause long term beneficial effects by removing piers out of the Sammamish River channel and fish passage barriers removed from tributary streams. Detectable effects are expected to be limited to the area within about 300 yards of the project site.

3. <u>Prey availability:</u> – The proposed action would cause long term minor adverse effects on prey availability. The construction and the enlarged bridge would reduce riparian vegetation that would slightly reduce the input of terrestrial-origin organic material to the river. The bridge shadow would also slightly reduce aquatic productivity under the bridge. Detectable effects are expected to be limited to the area within about 300 feet of the project site.

4. <u>Cover and habitat complexity:</u> – The proposed action would cause long term minor adverse effects on cover and habitat complexity. Riparian vegetation removal would slightly reduce in-stream branch and leaf litter, and the bridge shadow would slightly reduce submerged aquatic vegetation growth under the bridge, both of which would reduce the available cover for juvenile salmonids. Detectable effects are expected to be limited to the area within about 300 feet of the project site.

5. <u>Space:</u> – Removing four piers out of the Sammamish River removes obstacles in the migration path. Similarly, removing culvert barriers will allow fish passage to upstream habitats.

6. <u>Habitat connectivity from headwaters to the ocean:</u> – No changes expected.

7. <u>Groundwater-stream interactions:</u> – The proposed action would cause long term minor adverse effects on groundwater-stream interactions. During construction, the temporary isolation barrier and stream diversions will disrupt flows. Detectable effects are expected to be limited to the area under the bridges and in the footprint of the fish barrier removal sites over the three years of construction.

8. Substrate composition: – The proposed action may cause long term beneficial effects on the substrate composition at fish passage barrier removal sites. Detectable effects are expected to be limited within the footprint of streambed grading of each site.

3.3 Essential Fish Habitat Conservation Recommendations

In addition to those Recommendation listed in the ESA section 2.10, NMFS includes the following:

1. NMFS recommends the applicant increase instream habitat function by placing large woody material to compensate for juvenile rearing habitat limited by the transportation infrastructure that precludes riparian forests.
2. Ensure that riparian vegetation planted in the disturbed area has an 85% survival rate after three years.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately one acre of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

The FHWA must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are FHWA and USACE. Other interested users could include WSDOT, citizens of King and Snohomish counties, and Tribes. Individual copies of this opinion were provided to the FHWA and USACE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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