WSDOT

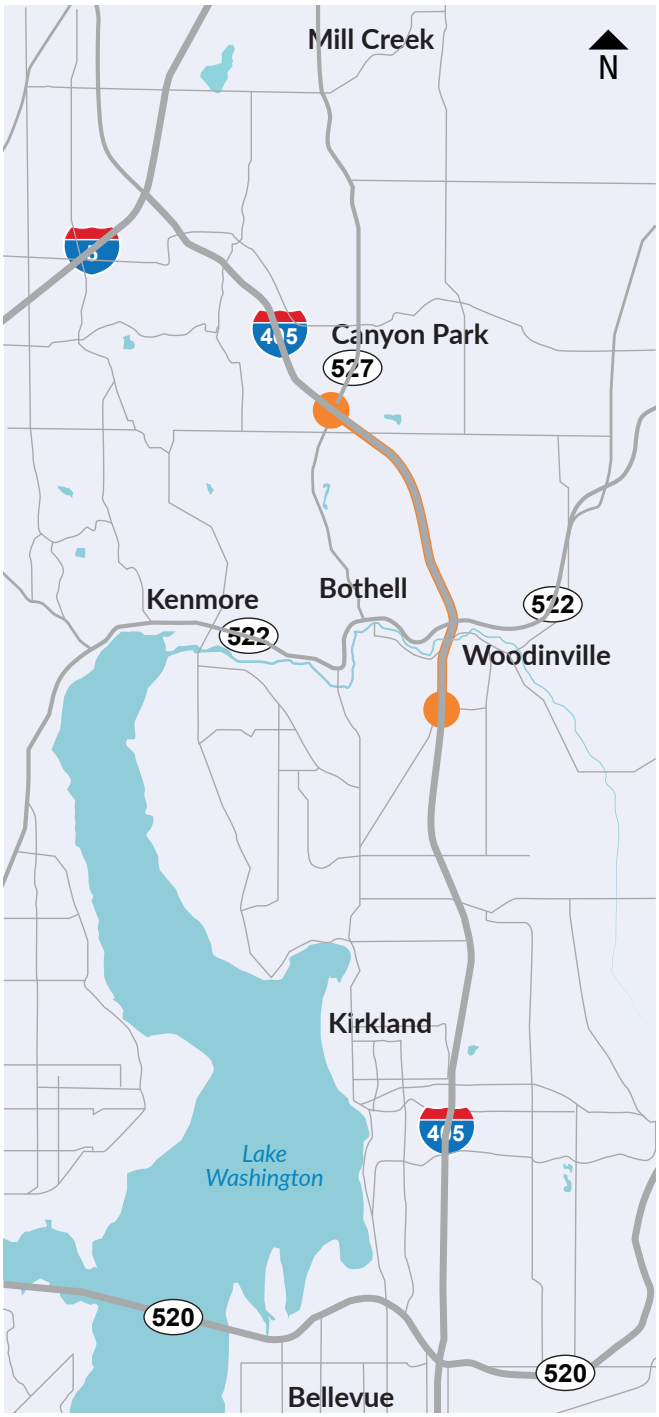
U. S. Department of Transportation
Federal Highway Administration

NOVEMBER 2019

ENVIRONMENTAL ASSESSMENT

Appendix N: Biological Assessment

I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project (MP 21.79 to 27.06)



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BIOLOGICAL ASSESSMENT

I-405, SR 522 Vicinity to SR 527
Express Toll Lanes Improvement Project

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Washington State Department of Transportation

EXECUTIVE SUMMARY

Consistent with the long-term Interstate 405 (I-405) Master Plan (WSDOT 2002), the Washington State Department of Transportation (WSDOT) proposes to construct roadway improvements between the State Route 522 (SR 522) vicinity and SR 527 to address increasing traffic congestion and improve transit reliability on I-405 in the cities of Kirkland and Bothell. Table ES1 shows improvements proposed with the I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project (Project). The Project is scheduled to be constructed from 2021 through 2024.

Table ES1. Improvements Proposed with the I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

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 nonmotorized connection to the North Creek Trail near the SR 522 interchange. Funding and construction timeline to be coordinated with local transit agencies. – Construct new 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.

Project Element	I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project
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 six fish barriers with restored stream connections at the following streams: • Par Creek • Stream 25.0L • Stream 66 • North Fork of Perry Creek* • Two fish barriers at Queensborough Creek* This list is considered preliminary as field investigation is still ongoing. * Streams with ESA-listed fish
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 management	– Provide enhanced treatment for 100 percent of new PGIS (approximately 24 acres). – Retrofit about 20 acres of existing untreated PGIS and continue to treat stormwater from the approximately 44 acres of PGIS that currently receives treatment. – Construct three new stormwater outfalls, one on the Sammamish River and two on the North Fork of 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

The proposed Project requires design approval from the Federal Highway Administration (FHWA) as well as a permit from the U.S. Army Corps of Engineers (Corps). These requirements create a federal nexus for the Project. WSDOT prepared this biological assessment, which was reviewed and approved by FHWA. It will support FHWA's request for formal consultation, fulfilling requirements under Section 7(c) of the Endangered Species Act (ESA).

The action area accommodates all potential Project effects including Project-related terrestrial noise, in-water noise, and in-water turbid discharges. The noise impacts of the proposed activities are generated from construction equipment such as an impact pile driver, a vibratory pile driver, and shears (on backhoe). Impact pile driving will only occur in uplands and not in any water bodies. The extent of Project-related in-air noise is estimated at approximately 1.9 miles. The disturbance area for aquatic species addressed in this report will be 1,200 feet downstream and 900 feet upstream of the proposed in-water work locations at the Sammamish

River. The aquatic portion of the action area is defined by the in-water noise impacts from installation of the sheet piles. Some fish barrier correction work will occur within streams. The potential disturbance area for fish barrier correction work is proposed to be 200 feet downstream from the in-water work locations. The aquatic portion of the action area includes potential upstream habitat gain from the I-405 crossing.

Table ES2 lists the federally threatened or endangered species and associated critical habitat that have the potential to occur within the Project vicinity based on the Information for Planning and Consultation (IPaC) Resource List obtained from the U.S Fish and Wildlife Service (USFWS) website and species list obtained from National Oceanic and Atmospheric Administration (NOAA) Fisheries.

Table ES2. ESA-Listed Species Identified by the U.S. Fish and Wildlife Service and NOAA Fisheries as Occurring in the Project Vicinity

Species	ESU/DPS[a]	Status	Federal Jurisdiction	Critical Habitat in Project Area
Gray wolf (*Canis lupus*)	N/A	Endangered	USFWS	N/A
North American wolverine (*Gulo gulo luscus*)	N/A	Proposed Threatened	USFWS	N/A
Marbled murrelet (*Brachyramphus marmoratus*)	N/A	Threatened	USFWS	None in action area
Streaked horned lark (*Eremophila alpestris strigata*)	N/A	Threatened	USFWS	None in action area
Yellow-billed cuckoo (*Coccyzus americanus*)	N/A	Threatened	USFWS	None in action area
Chinook salmon (*Oncorhynchus tshawytscha*)	Puget Sound ESU	Threatened	NOAA Fisheries	None in action area
Steelhead (*Oncorhynchus mykiss*)	Puget Sound DPS	Threatened	NOAA Fisheries	None in action area
Bull trout (Salvelinus confluentus)	Coastal/Puget Sound DPS	Threatened	USFWS	None in action area

[a] ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment

This biological assessment addresses impacts to ESA-listed species that may occur in the Project action area, including Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound steelhead (*Oncorhynchus mykiss*), coastal/Puget Sound bull trout (*Salvelinus confluentus*), marbled murrelet (*Brachyramphus marmoratus*), and yellow-billed cuckoo (*Coccyzus americanus*). Critical habitat for Puget Sound Chinook salmon, steelhead and bull trout is also addressed; however, none of the streams in the action area is designated critical habitat for Chinook salmon, Puget Sound steelhead, or coastal/Puget Sound bull trout. There is no critical habitat for yellow-billed cuckoo within the action area. To avoid and minimize impacts to the environment and listed species, several minimization measures will be incorporated into Project activities.

This biological assessment does not address impacts to gray wolf (*Canis lupus*), North American wolverine (*Gulo gulo luscus*), marbled murrelet (*Brachyramphus marmoratus*), and streaked horned lark (*Eremophila alpestris strigata*), as these species are not documented to occur in the action area, and no suitable habitat for these species is located in the action area.

Based on the effects and exposure analyses and implementation of all best management practices (BMPs), WSDOT has determined that the Project activities, as proposed, warrant the following effects determinations:

- **May affect and is likely to adversely affect** Puget Sound Chinook salmon, Puget Sound steelhead, and coastal/Puget Sound bull trout.
- **May adversely affect** Pacific salmon Essential Fish Habitat (EFH).
- **May affect, not likely to adversely affect** yellow-billed cuckoo.
- **No effect** on gray wolf, North American wolverine, marbled murrelet, and streaked-horned lark due to a lack of suitable habitat within the action area.

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1.0 INTRODUCTION

The Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) propose to construct roadway improvements to address increasing traffic congestion and improve transit reliability on Interstate 405 (I-405) in Kirkland, Bothell, and south Snohomish County. 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 provide consistency with the existing dual ETL system to the south, between NE Sixth Street in Bellevue and just south of State Route (SR) 522 in Bothell.

In addition to the new lanes, the proposed Project improvements include:

- Constructing new direct access ramps to the express toll lanes at SR 522 and near SR 527
- Removing/replacing bridge piers at the I-405/SR 522 interchange
- Widening the I-405 bridge over 228th Street SE
- Constructing new noise and retaining walls
- Constructing new stormwater treatment facilities
- Constructing improvements to local streets (signalized intersections)
- Constructing transit improvements, including inline transit stations at SR 522 and SR 527 and a bus stop and turnaround loop, and pick-up and drop-off facilities at the I-405/SR 522 interchange
- Providing bicycle and pedestrian access to transit stations
- Constructing restored stream connections at several locations.

The Project generally includes a 6-mile segment of I-405 extending from south of the I-405/160th Street interchange to just north of the I-405/SR 527 interchange (Figure 1). The Project is located within the cities of Kirkland and Bothell, Washington (Sections 5, 8, and 9 in Township 26 North and Range 5 East, and Sections 30 and 32 in Township 27 North and Range 5 East). The southern limit of the Project occurs at approximately milepost (MP) 21.79, and the northern limit occurs at approximately MP 27.06. The Project crosses the Sammamish River at river mile (RM) 4.6, and it is located within the Cedar-Sammamish Water Resource Inventory Area (WRIA) 8 and Hydraulic Unit Code 171100140403.

Figure 1. Vicinity Map

The Project team biologist obtained endangered species listings from the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries websites, respectively, on July 12, 2019 (See Appendix A). The listings indicate the potential presence of coastal/Puget Sound bull trout (*Salvelinus confluentus*), North American wolverine (*Gulo gulo luscus*), gray wolf (*Canis lupus*), marbled murrelet (*Brachyramphus marmoratus*), streaked horned lark (*Eremophila alpestris strigata*), yellow-billed cuckoo (*Coccyzus americanus*), Puget Sound Chinook salmon (*Oncorhyncus tshawytscha*), and Puget Sound steelhead (*Oncorhyncus mykiss*). Table 1 summarizes listed species potentially present in the action area and the supporting rationale for preliminary effect determinations for each species.

Table 1. Listed Species and Designated Critical Habitats in the Action Area

Name	Listing Status	Effect Determination and Supporting Rationale
Aquatic Species		
Coastal/Puget Sound DPS bull trout	Threatened Critical habitat designated	Likely to adversely affect, In-water work necessary
Puget Sound DPS steelhead	Threatened Critical habitat designated	Likely to adversely affect, In-water work necessary
Puget Sound ESU Chinook salmon	Threatened Critical habitat designated	Likely to adversely affect, In-water work necessary
Terrestrial Species		
Gray wolf	Endangered	No effect There is no suitable habitat in the action area
North American wolverine	Proposed Threatened	Will not jeopardize the continued existence because there is no suitable habitat present in the action area. If wolverine becomes listed in the future, the Project will have no effect on North American wolverine.
Marbled murrelet	Threatened Critical habitat designated	No effect No documented detections in the action area; low-quality habitat present
Streaked horned lark	Threatened Critical habitat designated	No effect No suitable habitat is present in the action area
Yellow-billed cuckoo	Threatened Critical habitat proposed	Not likely to adversely affect A small patch of suitable habitat is present within the action area

DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

The Sammamish River is also essential fish habitat (EFH) for the Pacific salmon fishery as defined by the Magnuson-Stevens Act of 1996.

WSDOT biologists conducted multiple field visits to the Project sites during December 2018 and June 2019. The purpose of the site visits was to gain a thorough understanding of the proposed activities, evaluate the existing habitat of listed and proposed species in the action area, and identify potential Project impacts on these species. Species under USFWS and NOAA Fisheries jurisdiction were further investigated by means of personal communications with local fish and wildlife authorities and review of pertinent literature, including the Washington Department of Fish and Wildlife's (WDFW) priority habitats and species database (WDFW 2019a).

There are no known occurrences of gray wolf, North American wolverine, marbled murrelet, and streaked horned lark within the action area. In addition, suitable habitat for gray wolf and streaked horned lark does not exist within the action area. For marbled murrelet, the USFWS has defined murrelet habitat as 5 acre or greater conifer dominated stands with at least 1 platform that is a minimum of 4 inches wide and 33 feet above the ground. WSDOT evaluated potential suitable habitat by using a GIS layer (Davis layer) that shows potential marbled murrelet habitat with over 5 acre of conifer dominated stands, followed by a site evaluation in June 2019. Within the action area, the Davis layer detected two contiguous coniferous forested stands; however, neither sites consisted of a contiguous coniferous stand with trees larger than 15-inch diameter at breast height (DBH). Coniferous trees observed in these areas generally lack platforms that are at least 4 inches wide and 33 feet above the ground. Due to lack of occurrence of these species, lack of suitable habitat, and absence of designated critical habitat within the action area, they will not be further addressed in this biological assessment.

1.1 CONSULTATION HISTORY

The Project requires design approval from FHWA and a U.S. Army Corps of Engineers (Corps) permit, creating a federal nexus and triggering Section 7 consultation. Project proponents with a federal nexus are required to consult with the USFWS and NOAA Fisheries to evaluate potential impacts to species listed as threatened or endangered under the Endangered Species Act (ESA) of 1973. WSDOT and FHWA prepared this biological assessment to comply with Section 7(c) of the ESA. Early coordination with USFWS and NOAA Fisheries took place during the preparation of this biological assessment. A pre-biological assessment meeting was conducted for the Project on December 13, 2018, with representatives from USFWS, NOAA Fisheries, FHWA, and WSDOT I-405 team members. A second pre-biological assessment meeting was held on June 20, 2019 to clarify some of the issues that were raised during the December 2018 meeting. The pre-biological assessment meeting notes are included in Appendix B.

2.0 PROJECT DESCRIPTION

2.1 PROJECT SUMMARY

WSDOT and FHWA propose to construct roadway improvements on I-405 to increase traffic capacity and improve transit reliability in Bothell and south Snohomish County. The Project will extend the dual ETL system from its current end point, located south of the SR 522 interchange at approximately MP 21.79, to the SR 527 interchange, located at approximately MP 26.30.

The Project will be constructed using the design-build delivery method. In design-build, WSDOT prepares the preliminary design, defines the basic project objectives, and develops outcome-based requirements to ensure that the Project is designed and constructed in accordance with those requirements. Once selected by WSDOT, the design-build contractor develops the final project design and completes construction. WSDOT will continue to work with the design builder as the design gets refined. The effects analysis in this biological assessment was designed to capture reasonably predictable variations that will minimize but not eliminate the potential for reinitiation of this ESA consultation. WSDOT will update FHWA and the Services on design changes and refinements to determine if the refinements require an update or reinitiation to this ESA consultation as design progresses.

The Project will make improvements at both the SR 522 and SR 527 interchanges, including direct access ramps to the ETL at SR 522 and just south of SR 527 at 17th Avenue SE. The SR 522 interchange will include transit improvements, including two inline transit stations on the direct access ramps in the I-405 median and a bus stop, turnaround loop, and non-motorized connection in the northwest quadrant of the interchange. The SR 527 interchange will include two inline transit stations in the I-405 median, and a pedestrian bridge structure connecting to the existing pedestrian bridge on the west and the Canyon Park Park and Ride on the east. The Project will also include related infrastructure improvements, such as toll gantries, stormwater facilities, restored stream connections, signing, illumination, intelligent transportation systems, and planting.

The anticipated extent and methods associated with the construction or implementation of each of these Project elements are described in detail below. The next sections also describe the replacement of fish barriers with restored stream connections, the Project-wide extent of clearing and grubbing, stormwater facilities, and anticipated impact minimization measures. Figure 2, Sheets 1 through 5, provides a more detailed visual depiction of Project components.

Figure 2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project
Sheet 1 of 5

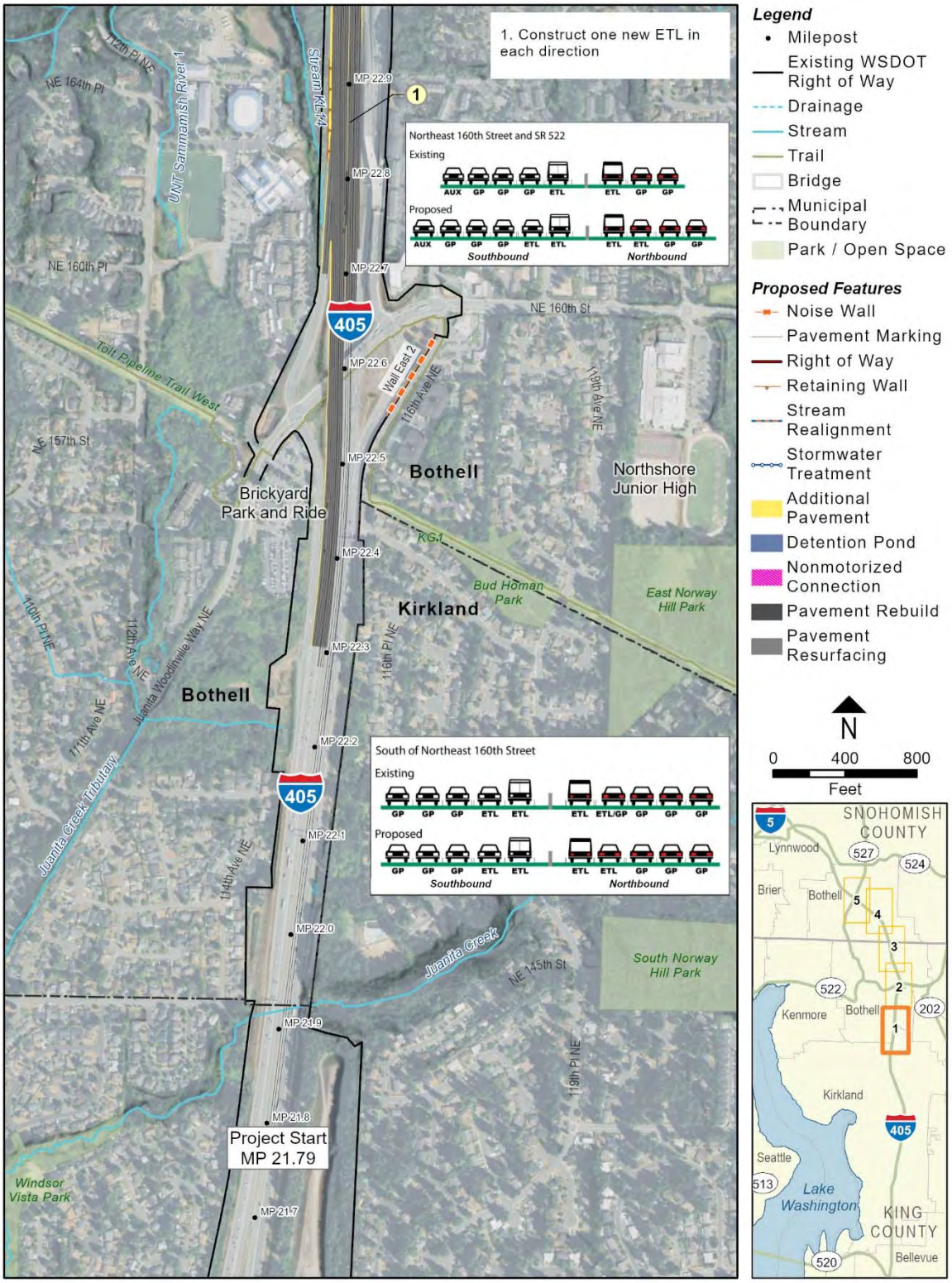


Figure 2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project Sheet 2 of 5

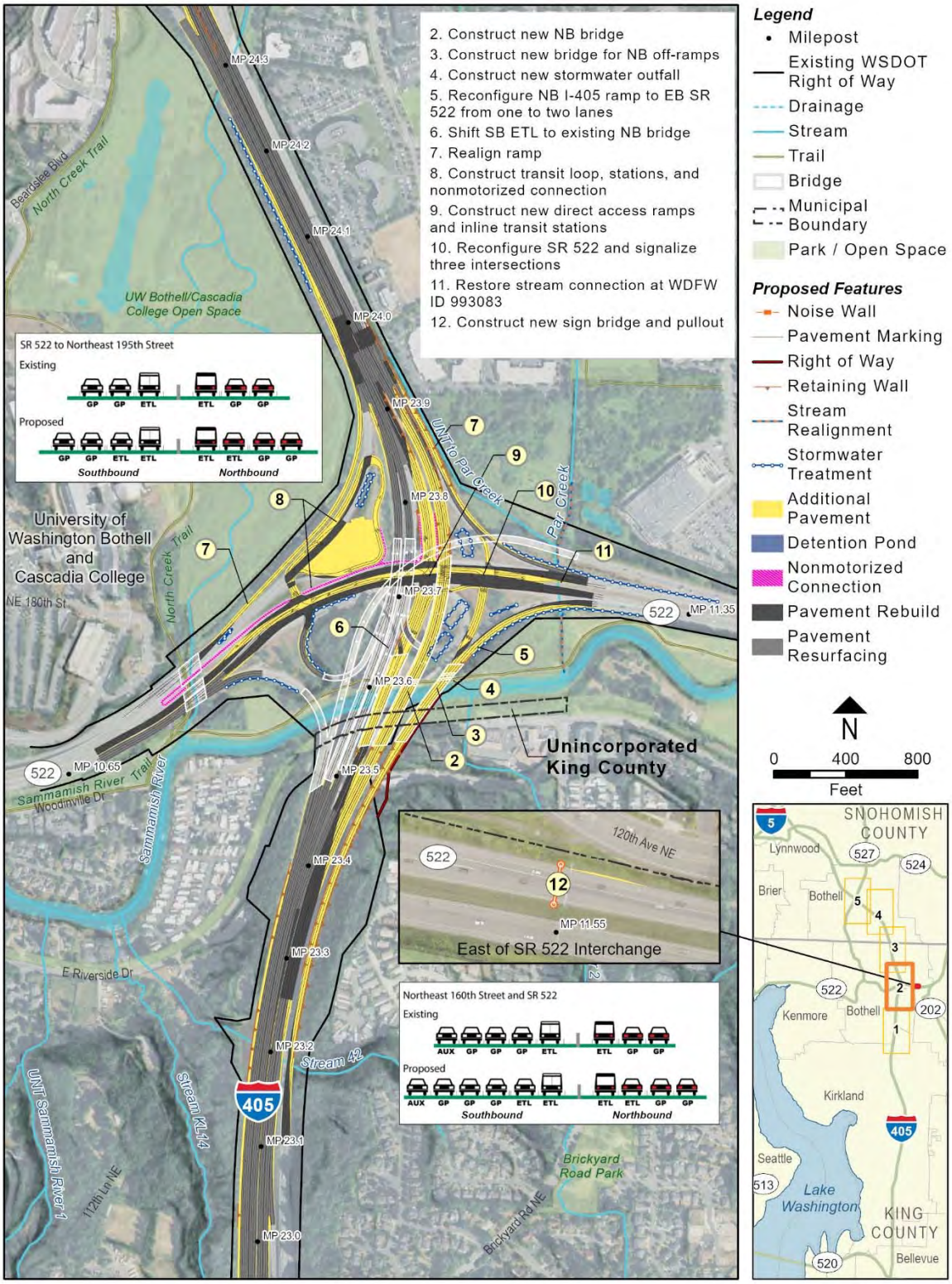


Figure 2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project Sheet 3 of 5

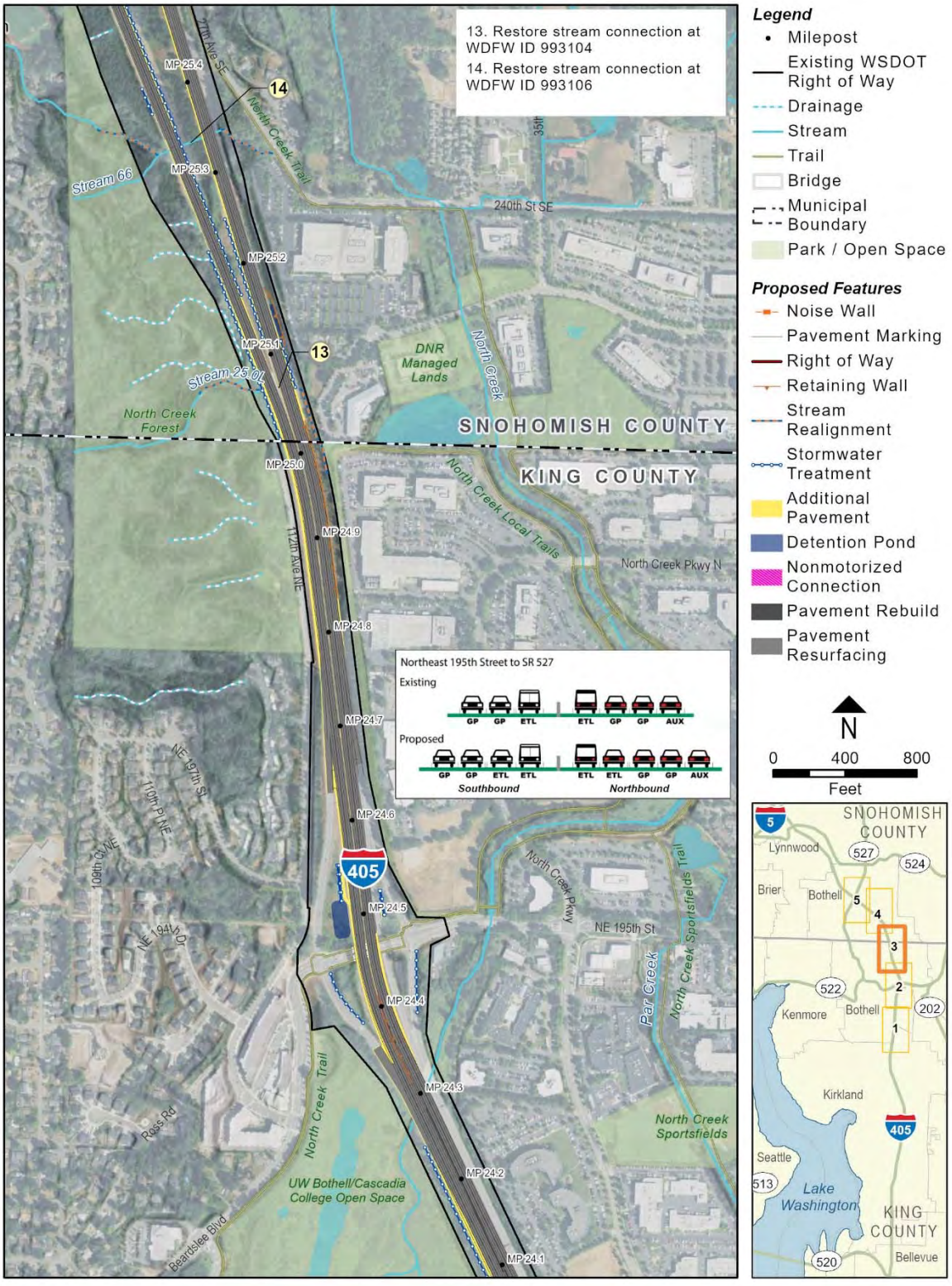


Figure 2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project
Sheet 4 of 5

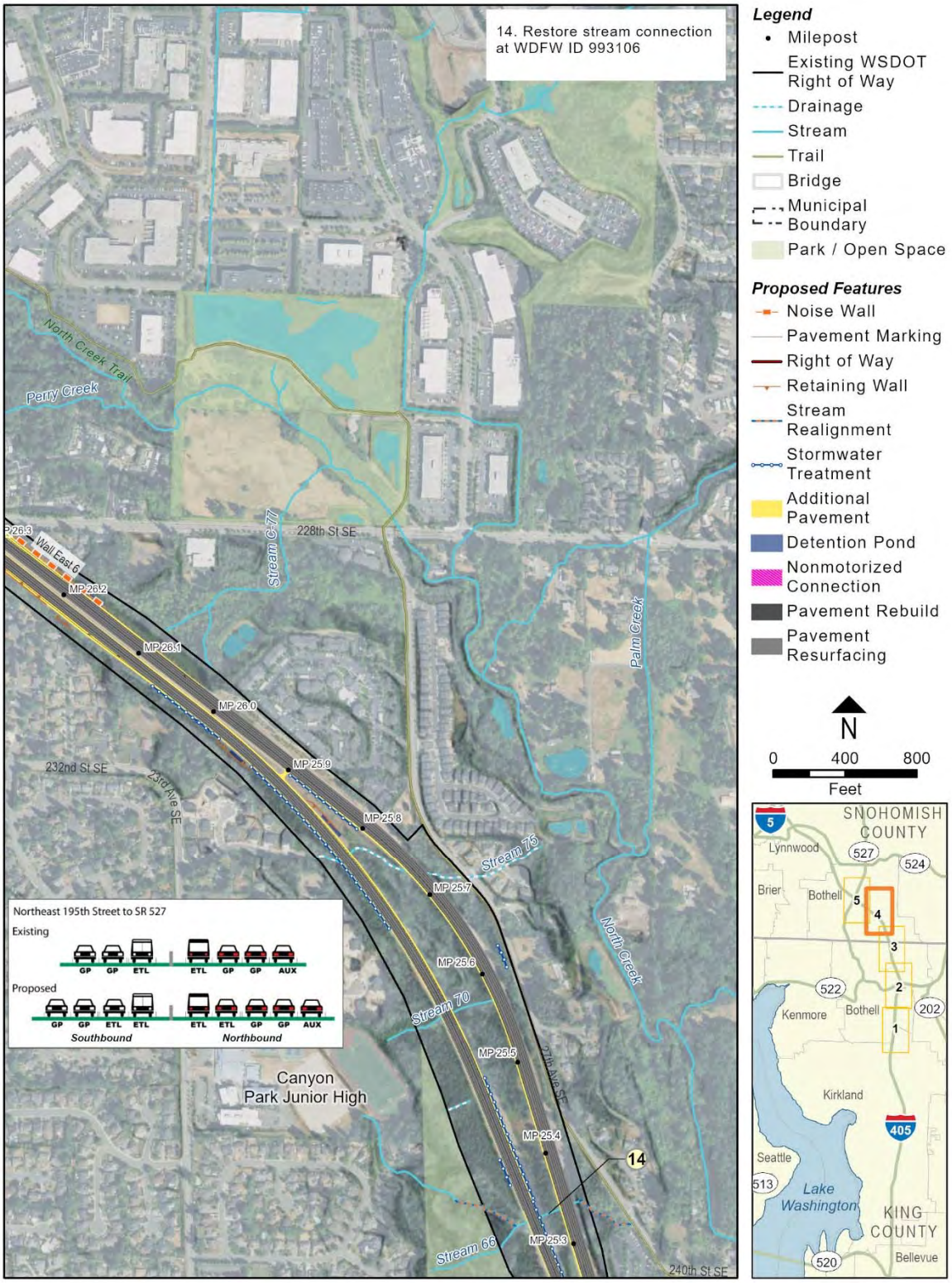
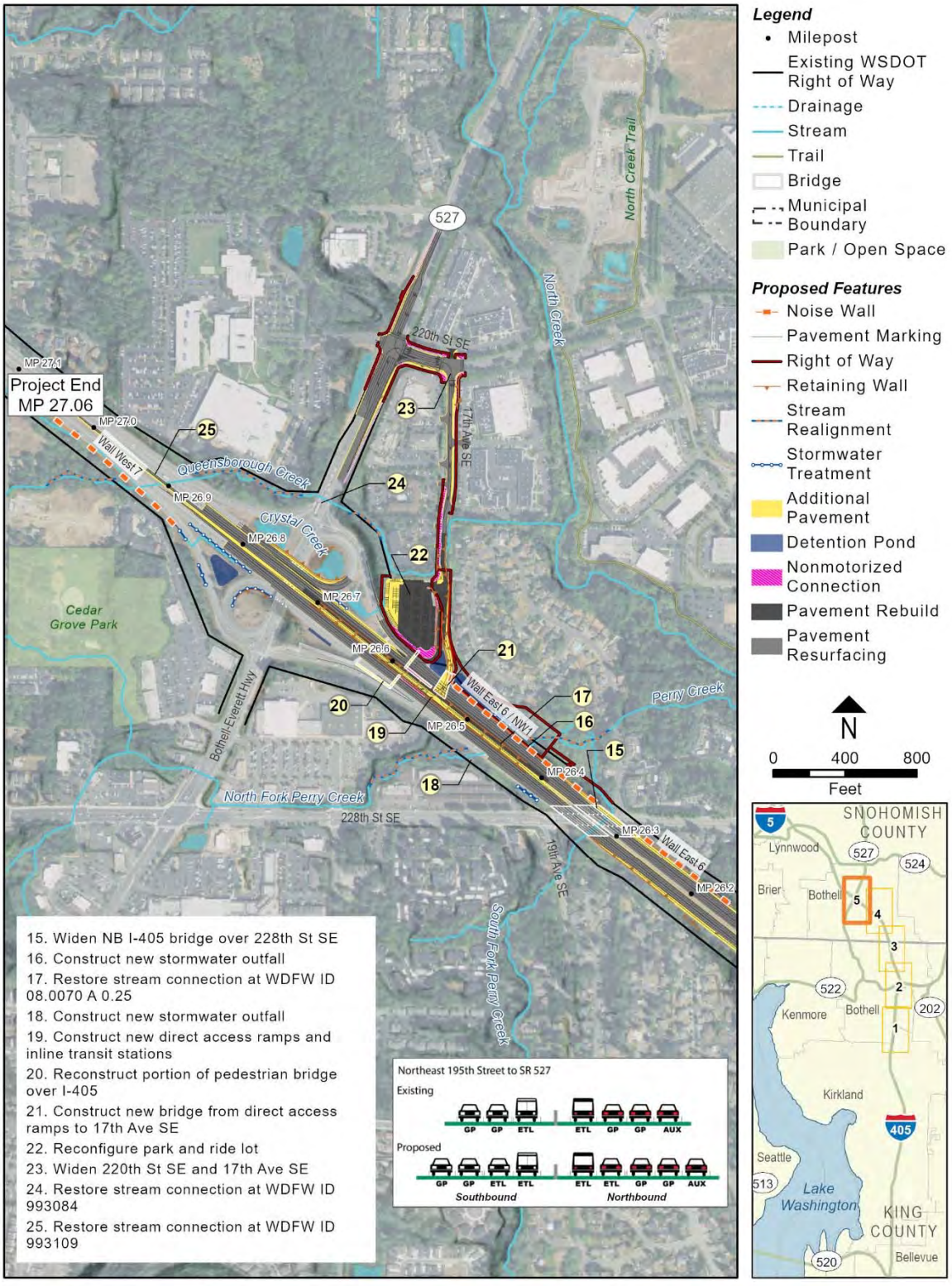


Figure 2. I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project Sheet 5 of 5



2.2 EXPRESS TOLL LANE SYSTEM AND TOLLING GANTRIES

The Project will extend the dual ETL system from the current end south of NE 160th Street, approximately MP 21.79, north to the SR 527 interchange, approximately MP 26.30. The new ETL will be added through a combination of restriping existing lanes and widening the roadway. The Project will restripe the existing lanes of I-405 between MP 21.79 and MP 22.30 (near the NE 160th Street interchange) to create the dual ETL system. I-405 will be widened between MP 22.30 and 26.30 to add the second ETL in each direction. Through the SR 522 interchange, northbound I-405 will be reconstructed on a new alignment to the east of the existing roadway. Between MP 26.30 and 27.06, I-405 will be widened to accommodate the SR 527 interchange area improvements, including the new direct access ramps. The Project will install tolling equipment and toll gantries at all ETL access points, including the direct access ramps. The toll system includes monotube toll gantries, similar to an overhead sign structure, and roadside cabinets that connect to the roadway intelligent transportation system. The Project will reconstruct three toll gantries along I-405 and add eight toll gantries at the new direct access ramps.

2.3 INTERCHANGE AND DIRECT ACCESS RAMPS

The Project includes improvements and direct access ramps at both the SR 522 and SR 527 interchanges. The SR 522 interchange will be reconfigured with direct access ramps and three new signalized intersections at the following locations.

- Southbound I-405 off-ramp to SR 522.
- Entrance to the new bus stop and turnaround loop at the I-405/SR 522 interchange.
- SR 522 ramps to and from northbound I-405.

The new ramp from northbound I-405 to eastbound SR 522 will not be signalized. The existing ramp from westbound SR 522 to southbound I-405 will be maintained, and no signals will be added. Northbound I-405 will be realigned to the east to make room for the new direct access ramps and the additional ETL.

At the SR 527 interchange, a new direct access ramp will be constructed with a connection to the local streets system at 17th Avenue SE. The existing general purpose ramps between I-405 and SR 527 will be reconfigured to accommodate the I-405 widening for the new direct access ramps.

2.4 TRANSIT FACILITIES

The Project improvements include transit facilities at both the SR 522 and SR 527 interchanges. At northwest quadrant of the SR 522 interchange, the Project will construct a new bus stop and turnaround loop, pick-up and drop-off facilities, and nonmotorized connection in the northwest quadrant.

At the SR 527 interchange, the Project will reconfigure the Canyon Park Park and Ride and construct transit stations at both the park and ride and along the new direct access ramps. Constructing the connection between 17th Avenue SE and the new direct access ramps will

require reconfiguring and shifting the existing park and ride to the north to maintain approximately the same number of parking stalls.

All of the proposed transit stations include station platforms, signage, artwork, lighting, fare machines, and site furnishing such as shelters, lean rails, benches, bollards, bicycle parking, and trash receptacles.

2.5 BRIDGE DEMOLITION AND CONSTRUCTION

The Project includes both bridge construction and bridge demolition. All of the bridge work will be focused near the SR 522 and the SR 527 interchanges and will include bridges over the Sammamish River at a river mile (RM) 4.6 and roadway overcrossings. There will be no widening or demolition of the I-405 bridges or SR 522 bridges over North Creek. Typical equipment used for construction of the new bridges and demolition work includes backhoes, excavators, front loaders, pavement grinders, jack hammers, trucks, cranes, drilling rigs and augers, concrete pumping equipment, and slurry processing equipment. The Project will utilize the existing staging area and WSDOT right of way to the extent possible. For material and equipment staging, the contractor may choose to use a portion of the King County open parcel located on the left bank of the Sammamish River because the parcel consists of an existing access road. Final construction means and methods will be determined by the design-build contractor. Stormwater runoff from the existing bridges is currently collected in a conveyance system and treated. Stormwater runoff from the new bridges will also be collected in a conveyance system and be routed to a new water quality treatment facility before discharging into the Sammamish River.

2.5.1 Existing Bridge Demolition

At the SR 522 interchange, the Project will demolish the existing two bridges for the northbound I-405 ramps to SR 522, both with spans over the Sammamish River. 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). 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 to the greatest extent possible. Demolition of superstructures will likely be contained by a barge or temporary work 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. The barge will be trucked in to the demolition site and will be placed near the existing bridges.

If temporary work bridges are used for containment, two work bridges will be built approximately 9.5 feet below the existing bridges that will span across the Sammamish River, and no structures will be placed within the ordinary high water mark (OHWM). The existing bridges are approximately 35 to 40 feet above the OHWM of the Sammamish River. WSDOT anticipates using steel plate girders for temporary work bridges, which could easily span up to 150 feet eliminating the need to place support piers in the river. The temporary work bridges will create approximately 8,000 square feet (0.18 acre) of additional over-water shading during the demolition period. These bridges are estimated to remain in place for up to 16 weeks until the demolition is complete. This includes time to erect the temporary work bridges, demolition of the existing structures, and removal of the bridges. Once the demolition of the bridge superstructure

is complete, the Project will demolish the piers to two feet below mudline/natural stream bottom. Each of the existing bridges includes two piers within the Sammamish River OHWM (Figure 3).

Demolition of the piers within the OHWM will require each column to be isolated with a cofferdam during the approved in-water work window and will be removed to two feet below the mudline. It is estimated that each pier removal will take approximately one week per pier column, 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 in the substrate in a vertical position and will be driven using vibratory equipment mounted on a crane positioned on the bank or on the barge. Overall, it is estimated that the removal of all the piers in the Sammamish River will take up to four weeks. For each pier removal, up to eight sheet piles will be installed for a single cofferdam, and up to 860 square feet of the work area will be isolated. It is estimated that a cofferdam installation will take approximately two days.

2.5.2 New Bridge Construction over the Sammamish River

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. 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. The new bridges will be constructed in accordance with permit conditions and WSDOT standard specifications All three bridges will include spans over the Sammamish River but will be required to have bridge piers placed outside of the OHWM.

The two 45-foot-wide existing bridges at the Sammamish River will be replaced with three 65- to 80-foot-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. Appendix E shows the plan and elevations of the proposed bridges at the Sammamish River. New lighting fixtures will be installed on the two ramp bridges over the Sammamish River. For the new light fixtures, individual “cobra head” or similar lamps will be used to limit ambient lighting to the river. Lights will be directed away from the Sammamish River to the extent possible. If nighttime work is needed for the Project, temporary lights will be directed away from the river to the greatest extent possible, with the intent to prevent light from shining on surface waters.

2.5.3 New Overcrossing Construction near SR 527

At the SR 527 interchange area, the Project will construct three new overcrossings and widen one overcrossing at 228th Street SE. The new overcrossings will include a new overcrossing at I-405 to connect 17th Avenue SE to the direct access ramps and two pedestrian overcrossings that connect to the new direct access ramps. The pedestrian overcrossing at southbound I-405 will connect to the existing pedestrian overcrossing on the west and the new direct access ramps on the east. Over northbound I-405, the second pedestrian overcrossing will connect to the direct access ramps on the west and the Canyon Park Park and Ride on the east. The northbound I-405 overcrossing at 228th Street SE will be widened to accommodate the additional ETL. No in-water work will be required for construction of these new overcrossings.

Figure 3. Northbound I-405 to Eastbound SR 522 Ramp with Two Piers Proposed for Removal in the Sammamish River

2.6 INTERSECTION RECONFIGURATION

In addition to the new intersections at the SR 522 interchange, the Project will reconfigure the local streets and associated intersections at the SR 527 interchange along 17th Avenue SE, 220th Street SE, and SR 527. The signalized intersections at SR 527/220th Street SE and at 17th Avenue SE/220th Street SE will be improved with widening along SR 527, 220th Street SE, and 17th Avenue SE to create additional turn lanes. The Project will extend 17th Avenue SE over northbound I-405 to connect to the new direct access ramps with a signal at the ramp terminal. At this location, the entrance to the Canyon Park Park and Ride will be reconstructed with a roundabout. New bike and pedestrian improvements will also be constructed along 17th Avenue SE and 220th Street SE.

2.7 FISH BARRIER REMOVAL

The Project is located within the tribal treaty rights for usual and accustomed fishing areas of the Muckleshoot Indian Tribe (MIT) and the Yakama Nation; however, in this area the Yakama Nation defers to the Muckleshoot Indian Tribe for consultation on fishing areas. The Project will remove fish barriers on Par Creek, Stream 25.0L, Stream 66, North Fork Perry Creek, and Queensborough Creek to comply with a federal permanent injunction (United States et al. vs. Washington et al., No. C70-9213, Subproceeding No. 01-1, dated March 29, 2013). These crossings have been identified as fish barriers by Washington Department of Fish and Wildlife (WDFW). WSDOT is still coordinating with WDFW and the Muckleshoot Indian Tribe to finalize the list of fish barriers that will be removed as part of the Project; however, the fish barriers that are being discussed are located on streams that are relatively small and do not have

documented occurrences of ESA listed fish species and they lack suitable habitat. Existing barriers will be replaced with restored stream connections.

The proposed fish barrier corrections will be designed to meet the requirements of the federal injunction utilizing the stream simulation or confined bridge methodology design criteria outlined in the 2013 WDFW Water Crossing Design Guidelines. Dimensions and materials of the proposed fish barrier corrections are described in Table 2. Typical work for restoring stream connection includes excavation, removal of the existing fish barrier, installation of the fish barrier replacement, and backfilling. 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, as approved by applicable local, state, and federal permits. Each restored stream connection will be constructed over one in-water work window in any construction year. Table 2 summarizes previously-known fish barrier conditions.

The proposed restored stream connections will provide improved access to approximately 24,812 linear feet (4.7 miles) of habitat for all the streams listed below (Table 2). Only two of the streams have listed fish present, the North Fork of Perry Creek and Queensborough Creek. At the Queensborough Creek crossing at MP 26.87, the proposed culvert will be shortened by 63 feet, and two fish barrier corrections will result in a total gain of approximately 6,663 feet of upstream habitat. At the North Fork Perry Creek, the length of the proposed culvert will be reduced by approximately 35 feet and will lead to improved access to approximately 8,281 feet of the upstream channel. Correcting existing fish barriers by restoring stream connections and realigning the stream channel will provide additional access to upstream habitat for listed fish species.

Table 2. Summary of Proposed Fish Barrier Correction Activities in the Project Corridor

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)	Aquatic Habitat Restored or Improved (feet)	Upstream Habitat Gain (feet)[a]
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	-	60	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	505	892
Stream 66	993106	30-inch CST pipe at MP 25.35	None documented	WS Drop	New culvert at MP 25.35. Assume 8'x8' concrete box culvert	No existing channel will be filled by the proposed construction	500/0.01	-	-	482
North Fork of 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'x8' 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)	Aquatic Habitat Restored or Improved (feet)	Upstream Habitat Gain (feet)[a]
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[b]

[a] Upstream habitat gain determined by WDFW (WDFW 2019b).

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

Replacing the existing fish barriers will require in-water work on the stream where the fish barrier is located. Any work below the OHWM will be conducted in the summer low-flow period during the in-water work windows designated by WDFW and any associated fish exclusion will be conducted in accordance with WSDOT fish exclusion protocols current at the time of construction (Appendix C).

A temporary stream bypass may be required to allow for dewatering of the work area during construction of the fish barrier replacement and associated upstream and downstream reaches. If required, temporary stream diversion or dewatering will occur during the driest time of the year when fish are least likely to be present and will be performed in compliance with applicable permit conditions and WSDOT standard specifications. Temporary stream diversion methods will be determined by the contractor; however selected methods will comply with WSDOT specification requirements for temporary diversions. The contractor will follow Section 401 Water Quality Certification conditions. The contractor will comply with all applicable state and local water quality standards and follow the most stringent standards. In addition, the contractor will be required to follow the minimization measures listed in Section 2.12.

2.8 VEGETATION REMOVAL

Project construction will mostly occur within WSDOT right of way as well as along SR 527, 17th Avenue SE, and 220th Street SE. Construction areas will be cleared of vegetation to provide adequate work space. In addition, all staging areas are anticipated to be located within WSDOT right-of-way, and no clearing and grubbing is expected. If the contractor needs additional staging areas, it will be their responsibility to assess additional impacts and obtain necessary permits. Vegetation clearing will include the removal of branches and tree trunks but will generally leave the soil intact. Grubbing will include the removal of all vegetative matter (roots and debris) from the load-bearing surface of the soil. Retained vegetation will be clearly marked for protection during clearing and use of the area.

A temporary high-visibility silt fence will be installed around construction areas to prevent machinery, equipment, and construction activities from intruding into adjacent wetlands, streams, buffers, and other sensitive areas. Some trees will be removed along the Project corridor, and vegetation removal in the sensitive areas is described in the next sections. WSDOT will comply with all local, state, and federal requirements for planting and mitigation.

2.8.1 Upland Vegetation

The proposed Project is expected to remove up to 24 acres of trees in the action area. Most of these trees are located along I-405, SR 527, or 17th Avenue SE. Trees found along 17th Avenue SE and interchanges at NE 160th Street, SR 522, and SR 527 are mostly ornamental trees that have been planted. Upland vegetation in the Project area typical consists of roadside vegetation, maintained landscape, or young deciduous forests. These vegetated areas do not serve as suitable habitats for any of the listed species that may occur within the action area. Vegetation temporarily removed for construction will be replanted with native species appropriate to the area, in accordance with the WSDOT Roadside Policy Manual.

2.8.2 Riparian Vegetation

Some trees will be removed along the Sammamish River at the new bridge locations; however, dominant riparian vegetation at the proposed bridges mostly consists of Himalayan blackberry (*Rubus armeniacus*) with scattered young deciduous trees along the Sammamish River. For the fish barrier replacement work and widening of the roadway, the Project will result in the permanent removal of approximately 1 acre of riparian habitat and the temporary disturbance of approximately 2 acres of riparian habitat for the streams where existing barrier replacements are known. This number is likely to increase as additional streams are evaluated for fish bearing potential and barrier status; however, none of the additional streams under review have listed species present. For the North Fork Perry Creek and Queensborough Creek, the Project will permanently affect approximately 0.2 acre of riparian habitat and temporarily disturb approximately 0.4 acre of riparian habitat. Early successional hardwood or mixed stands of deciduous trees, such as black cottonwood, red alder, and bigleaf maple are common in forested areas adjacent to streams along I-405. Vegetation temporarily removed for construction will be replanted with native species appropriate to the area, in accordance with the WSDOT Roadside Policy Manual.

2.8.3 Wetland Vegetation

The Project will result in unavoidable permanent impacts to 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.

2.9 MITIGATION

Permanent impacts to wetlands and wetland buffers are proposed to be mitigated both on-site and off-site. WSDOT plans to provide compensatory wetland mitigation by purchasing credits from the Keller Farm Mitigation Bank, and on-site mitigation is currently proposed along Par Creek. Any on-site and off-site compensatory mitigation to replace lost and/or degraded wetland/buffer, riparian, and instream habitat functions and values proposed for the Project will occur within WRIA 8. The proposed on-site mitigation is anticipated to occur concurrently with Project construction. The Project will comply with all conditions from the Section 404 permit and HPA issued for the Project and will satisfy requirements from critical area ordinances and regulations administered by those cities and counties with jurisdiction. The Project's compensatory obligations will satisfy federal, state, and local requirements.

2.10 NEW IMPERVIOUS SURFACE AND STORMWATER TREATMENT

The Project includes extensive widening of the paved roadway and construction of new pollution-generating impervious surfaces (PGIS). Facilities to manage stormwater runoff for water quality and water quantity will be provided in accordance with the latest Highway Runoff Manual along the Project corridor (WSDOT 2014). All of the facilities in threshold discharge areas (TDAs) G2, G4, I1, I2, I3, I4, J1, J2, and NW02 will provide enhanced treatment. The Project will maintain basic treatment provided by the existing facilities in the basin. The Project will keep 11 existing detention facilities and remove two existing vaults. Eleven detention

facilities are proposed for the Project. TDA G2, G4, I1, J2, and NW02 directly discharge to waters with ESA-listed fish present.

This section of I-405 has 128 acres of existing PGIS and 44 acres of that PGIS receives stormwater treatment. The Project will construct approximately 24 acres of new PGIS across 13 TDAs, and 100 percent of the new PGIS will be treated. In addition, 20 acres of the existing PGIS will be retrofitted to provide enhanced stormwater treatment. Once the Project is complete, approximately 89 acres of PGIS will be treated, which include 44 acres of PGIS that are currently treated. The largest area of increase will be around the Sammamish River, where bridge crossings will be wider and signalized interchanges on SR 522 will be added. Table 3 provides a breakdown of new PGIS proposed in each TDA. The design-build contractor may elect to implement different types of stormwater treatment facility, but any variation from the proposed facilities will comply with the treatment levels currently proposed.

Table 3. Summary of Proposed New Pollution-Generating Impervious Surfaces

Basin	Receiving Water Body	TDA	Proposed New PGIS in TDA (acres)	Proposed Treatment (acres)	Type of Facility
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/MF
	North Creek	NW 03	0.11	0	No additional treatment proposed
Total			24	89	

TDA = threshold discharge area; PGIS = pollution-generating impervious surfaces; CABS = compost-amended vegetated bioswale; MFD = media filter drain; CSW=constructed stormwater wetland

2.11 NEW STORMWATER OUTFALLS

The proposed Project will introduce three new stormwater outfalls: one at the Sammamish River and two at North Fork Perry Creek. At the Sammamish River, the new outfall will be located on the right bank of the river under the new ramp from northbound I-405 to eastbound SR 522. Stormwater runoff generated from northbound I-405 and SR 522 at the interchange will be routed through compost-amended vegetated bioswales (CABS) or other enhanced stormwater treatment BMPs prior to discharging into the Sammamish River. No flow control is required for discharging into the Sammamish River as the river is exempt from flow control requirements. The estimated pipe size of the new outfall at the Sammamish River is between 24 and 30 inches wide. At the outfall location above the OHWM, the bank will be stabilized with riprap to prevent bank erosion. Armoring of the bank will be designed in accordance with the latest Highway Runoff Manual (WSDOT 2014). No in-water work is anticipated, and no trees will be removed for installation of the outfall at the Sammamish River.

At North Fork Perry Creek, one outfall will be located on west of I-405, on the left bank of the realigned channel upstream of the proposed culvert. Stormwater runoff generated from southbound I-405 will go through a CABS and a detention facility or other enhanced stormwater treatment BMPs prior to discharging into North Fork Perry Creek. The second outfall will be located on east of I-405, on the right bank of the realigned stream channel, downstream of the proposed culvert. Similar to the west side, stormwater runoff generated from northbound I-405 will go through a series of treatment and detention facilities, including stormwater ponds and CABS, prior to discharging into North Fork Perry Creek. The estimated pipe size for both outfalls at North Fork Perry Creek is 18 to 24 inches wide.

Both outfalls will be located along the realigned channel where banks will be constructed. For bank stabilization, energy dissipating riprap pads will be installed around the outfalls. Armoring of the banks will be designed in accordance with the latest Highway Runoff Manual (WSDOT 2014). No in-water work will occur for installation of the outfalls along North Fork Perry Creek as both outfalls will be constructed on the new channel. Some vegetation removal may be required for construction of the channel; however, vegetation will likely consist of salmonberry, red-osier dogwood, and Himalayan blackberry. Figure 2 in Section 2.1 of this report shows the location of existing and proposed stormwater treatment facilities for the proposed Project, and Appendix D shows the location of stormwater outfalls and TDAs.

2.12 MINIMIZATION MEASURES

BMPs will be used during all construction activities to eliminate or minimize potential environmental effects. BMP measures include erosion and sediment control, structural erosion control, sediment retention, water quality/quantity, and stormwater treatment during Project construction and operation. These BMPs will be included in the Temporary Erosion and Sediment Control (TESC) plan, Spill Prevention, Control, and Countermeasures (SPCC) plan, Stormwater Pollution Prevention (SWPP) plan, and stormwater report for the Project. Many of the BMPs listed below are standard and will generally apply to many Project construction activities; however, actual site conditions may require additional measures or use other methods, as necessary, in the field. Changes to pre-approved BMPs will be approved by the WSDOT Project Engineer before being implemented. Changes in BMP types or methods are not likely to change the effects to species or critical habitat. However, if any change does result in a new

effect to listed species not previously addressed, WSDOT will reinitiate consultation with the Services.

The proposed Project will further avoid and/or minimize effects to natural resources in the Project area through the following measures:

General Construction Minimization Measures

1. Construction impacts will be confined to the minimum area necessary to complete the Project.

2. WSDOT Construction will clearly flag the boundaries of clearing limits to prevent disturbance outside of the limits. The contractor shall install high visibility fencing in accordance with WSDOT Standard Specifications.

3. All silt fence, high visibility fence, and BMPs will be removed upon completion of the Project.

4. Site work will be limited to daylight hours to the extent practicable and comply with local, state, and federal permit restrictions.

Geotechnical Investigations Minimization Measures

5. For Geotechnical Drilling: No geared mechanisms (e.g., tires, tracks) will enter the wetted perimeter of a waterbody. Truck mounted and tracked drilling equipment will work from a location outside of the wetted perimeter unless working off a temporary barge. The temporary barge will not ground on the bed of State waters.

Staging Area/Aquatic Buffer Minimization Measures

6. No contractor staging areas will be allowed within 200 feet of potentially suitable wetland, stream, estuarine, river or marine drainage as identified by the Project biologist, unless site specific review completed by the Project biologist indicates that no impacts to the sensitive resource areas will occur due to topography or other factors.

7. Temporary material storage piles consisting of erosive materials will be placed outside the 100-year floodplain during the rainy season (October 1 through June 1) except for emergency projects, or unless site specific review completed by the Project biologist indicates that topography or other factors preclude runoff from entering water bodies containing listed fish species or their prey. Such temporary storage piles will be stabilized with plastic sheeting, straw bales, or other BMPs, to prevent sediment delivery to these water bodies. Material to be used within 12 hours of deposition will not be considered a temporary material storage pile.

8. All excavated materials will be removed to an upland location where they cannot enter the water body.

Material Containment Minimization Measures over Waterbody

9. Anthropogenic debris from bridge demolition will be directed toward storage areas on land or barges and support vessels. Bridge demolition will include sectioning the structure to the extent possible to provide for safer disposal and to minimize debris falling into surface waters.

Vegetation Removal/Clearing and Grading Minimization Measures

10. Vegetation will only be grubbed from areas undergoing permanent alteration. No grubbing will occur in areas slated for temporary impacts.

11. Disturbance to riparian vegetation from the operation of heavy equipment will be minimized as practicable by straddling it with heavy equipment or by pruning it without damaging the roots. Existing riparian vegetation outside of the work area will not be removed or disturbed.

12. WSDOT will prepare and implement a revegetation plan and minimize the amount of vegetation clearing to retain as many trees as practicable to minimize impacts.

Revegetation and Slope Stability Minimization Measures

13. Temporarily disturbed areas will be restored to pre-work conditions to the extent possible, including protecting existing root systems and allowing re-sprouting of herbaceous and woody plants. Native trees and shrubs will be used that are endemic to the Project vicinity or region of the State where the activity is occurring.

14. Where practicable for soil stability, native vegetation will be planted in areas disturbed by construction activities.

15. All exposed areas will be mulched and seeded with an approved native or noninvasive herbaceous seed mix following construction and/or planted with native woody vegetation and trees (if appropriate) during the first available planting season.

Pile Installation Minimization Measures

16. No permanent or temporary piers will be placed below the OHWM.

Lighting Minimization Measures

17. Temporary lights for night work will be directed away from waters with listed fish species to the greatest extent possible, with the intent to prevent light from shining on surface waters.

18. To limit potential effects to fish behavior, in the area within 300 feet of the Sammamish River mainstem, all temporary Project lighting will be minimized between sunset and sunrise from November 1 to January 15, and from March 15 to May 15, and lighting will be directed toward work areas and away from the Sammamish River.

19. When permanent lighting is needed on a road segment along walkways adjacent to surface waters with listed fish species, individual “cobra head” or similar lamps will be used when possible, to limit ambient lighting to the stream. Lights will be directed onto the walkway, away from waters with listed fish species to the extent possible.

20. If nighttime work is needed for the Project, temporary lights will be directed away from the river to the greatest extent possible, with the intent to prevent light from shining on surface waters.

Over-water Minimization Measures

21. Disturbance of the streambed and banks shall be limited to that necessary to dismantle the existing bridge, construct new outfalls, and construct restored stream connections.

22. Streambank shaping shall be limited to the minimum necessary.

In-water Work Minimization Measures

23. Seasonal restrictions applied to work conducted within or below the OHWM will follow requirements within the HPA issued by the Washington Department of Fish and Wildlife, and Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC). In-water work duration will be minimized as practicable.

24. Construction equipment will not enter any water body without authorization from the Washington Department of Fish and Wildlife, USFWS, and the NMFS. Equipment will be operated as far from the water's edge as possible.

25. Bridge construction will take place from the adjacent streambanks, existing bridges, barges, or temporary work bridges. Some work may be allowed within a dewatered channel or on a dry gravel bar with WDFW, NMFS, and USFWS approval, but no equipment or vehicle staging will be allowed in these areas.

26. Where practicable, excavation activities shall be accomplished in the dry. If not, either the in-water work area will be isolated from the rest of the water body and surrounding riparian areas, or flows will be diverted around the area of construction using appropriate features. If isolation takes place, all surface water flowing towards the excavation shall be diverted through use of cofferdams and/or berms. Cofferdams and berms will be constructed of sandbags, clean rock, steel sheeting, or other non-erodible material. If diversion is necessary, stream flow will be diverted around culvert replacement sites through a temporary culvert, or a trench lined with plastic, rocks, or other suitable material to prevent erosion.

27. No excavated material will be placed in the existing stream channels. Excavated material will be removed to a location that will prevent its reentry into waters of the State.

28. Streams shall not be used as transportation routes for heavy equipment. Crossings shall be limited to one point and erosion control measures must be used where stream banks are disturbed. Crossings shall be constructed of clean rock and shall be sufficiently designed to convey flow without any impairment.

Bank Protection Minimization Measures

29. Placement of riprap and other materials for bank and/or outfall protection within the OHWM will be minimized to the extent practicable during final design.

30. All materials, such as riprap or gravel, placed within the water for culvert replacement work will be washed and free of rock fines, silt, soil, or other extraneous material. An exception to the presence of fines is permitted if they are required as part of channel bed reconstruction.

Work Area Isolation and Fish Handling Minimization Measures

31. Listed fish species, including their forage fish, will be removed from the work area prior to any in-water work activities after approval by the Services, unless removal would affect the individuals more than leaving them on-site. Fish exclusion activities will follow the most recent WSDOT protocol that has been approved by the NMFS and USFWS (Appendix C).

32. All intake pumps within fish-bearing streams will have a fish screen installed, operated and maintained. Screening techniques must utilize the specifications in the Hydraulic Project Approval (HPA) and be in compliance with RCW 77.55.010, RCW 77.57.040 and RCW 77.57.070 or the specifications in the NMFS Anadromous Salmonid Passage Facility Design manual (NOAA Fisheries 2011) and NMFS Fish Screening Criteria for Anadromous Salmonids (NOAA Fisheries 1997), whichever is more restrictive.

Pollutant Protection Minimization Measures

33. The contractor will use BMPs, as stated in their SPCC Plan, to ensure that no foreign material such as oil or fuel from construction equipment will enter any wetlands, flowing or standing water

34. All equipment will be fueled and maintained more than 200 feet from the nearest wetland, ditches, flowing or standing water, unless site specific review completed by the Project biologist indicates that no impacts to the resource areas will result due to topography or other factors. Exceptions to this requirement are allowed for large cranes, pile drivers, and drill rigs if they cannot be easily moved.

35. Equipment will be checked daily for leaks and will be well maintained to prevent lubricants and any other deleterious materials from entering waters of the State. Prior to entering the water or below the OHWM, all equipment will be free of any external petroleum products, hydraulic fluid, coolants, and other deleterious materials. Wash water will not be discharged to any water body without pre-treatment.

36. All equipment entering waters that may be used by listed fish species will use vegetable oil or other biodegradable acceptable hydraulic fluid substitute.

Stormwater Quality and Quantity Minimization Measures

37. WSDOT will ensure that projects within 200 feet of surface water will install and maintain BMPs as stated in the Contract to ensure that no foreign material, such as pavement slurry from asphalt grinding equipment, is sidecast, and to control and prevent sediments from entering aquatic systems.

38. The Contractor shall comply with Washington Department of Ecology's (Ecology) State Water Quality Standards (WAC 173-201) or permit modifications. Permit modifications are limited to an extended temporary area of mixing granted by Ecology in a 401 Water Quality Certification.

The mixing zone of the Sammamish River should extend 300 feet downstream from the pier removal locations. For the fish barrier replacement work, mixing zones should extend 200 feet downstream from each crossing location.

39. Stormwater will be infiltrated and/or dispersed when possible.

40. The contractor will designate at least one employee as the Erosion and Sediment Control (ESC) lead. The ESC lead will be responsible for the installation and monitoring of erosion control measures and maintaining spill containment and control equipment. The ESC lead will also be responsible for ensuring compliance with all local, state, and federal erosion and sediment control requirements.

41. Erosion control devices (e.g., silt fence) will be installed as needed to protect surface waters and other critical areas. Actual locations will be specified in the field, based upon site conditions.

42. Silt fences will be inspected immediately after each rainfall, and at least daily during prolonged rainfall. Sediment will be removed as it collects behind the silt fences and prior to their final removal. All silt fencing and staking will be removed upon Project completion.

43. Material that may be temporarily stored for use in Project activities shall be covered with plastic or other impervious material to prevent sediments from being washed from the storage area to surface waters.

44. All temporary and permanent erosion and sedimentation control measures will be inspected on a regular basis, maintained, and repaired to ensure continued performance of their intended function.

45. A TESC Plan and a Source Control Plan will be developed and implemented for all Projects requiring clearing, vegetation removal, grading, ditching, filling, embankment compaction, or excavation. The BMPs in the plans will be used to control sediments from all vegetation removal or ground disturbing activities.

2.13 PROJECT TIMING

Construction is expected to last three years anticipated between 2021 and 2024. All in-water work will be conducted by the design-build contractor within approved in-water work windows. In-water construction is expected to occur throughout that entire in-water work window for the 3-year construction period. In-water construction activities are described in Sections 2.5.1, existing bridge demolition; 2.5.2, new bridge construction over the Sammamish River; and 2.7, fish barrier removal. For bridge construction, activities associated with bridge demolition would occur before new bridges are built.

3.0 PROJECT AREA

The Project area includes the immediate vicinity of the proposed construction. The Project area extends between MP 21.79 and MP 27.06 along I-405, and 1,100 feet east and 1,900 feet west of the I-405/SR 522 interchange on SR 522. The Project area also includes the portion of the Sammamish River channel below the existing I-405/SR 522 interchange for the pier removal work and upstream and downstream portions of Par Creek, Stream 25.0L, Stream 66, North Fork Perry Creek, Queensborough Creek, and other fish-bearing waters where fish barriers will be replaced.

4.0 ACTION AREA

The action area is defined as all areas that are potentially affected, directly or indirectly, by the Project and not merely the immediate area involved in the Project. The action area is addressed as the three-dimensional extent of all chemical, physical, and biological effects of the action on the environment. The extent of the action area is shown in Figure 4.

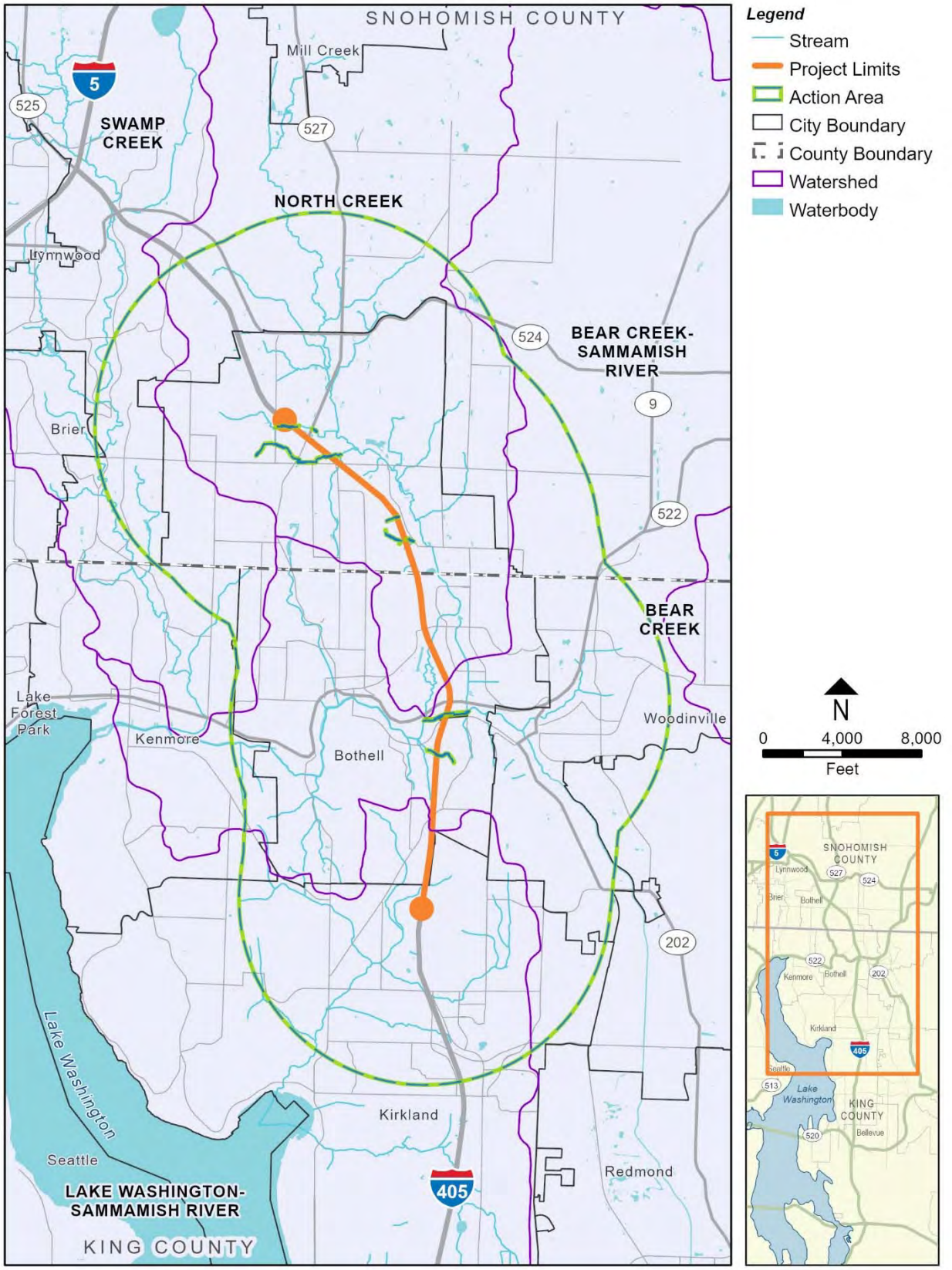
For this biological assessment, the action area encompasses two zones of effect: the terrestrial portion of the action area and the aquatic portion. The terrestrial portion, or the extent of terrestrial impacts, is defined by the following:

- Aerial noise produced by heavy equipment during transportation and construction (direct effect).
- Habitat disturbance at the construction site (direct effect).

The aquatic portion, or the extent of aquatic impacts, is defined by the following:

- In-water work in the Sammamish River and streams where restored stream connections are proposed (direct effects).
- Localized and downstream turbidity produced by short-term pulses of construction-related sediment (direct effect).
- Underwater noise associated with construction (direct effect).

Figure 4. Action Area Map



4.1 TERRESTRIAL PORTION OF ACTION AREA

Noise generated from construction activities, particularly the use of an impact pile driver in the upland area, may affect terrestrial species. Using the rules for decibel addition (WSDOT 2019a), the combined noise level of the three loudest pieces of equipment was calculated. The three loudest pieces of equipment and their sound levels are as follows:

- The loudest piece of primary equipment is the impact pile driver, which, at a distance of 50 feet, is estimated to produce sound levels of 110 A-weighted decibels (dBA).
- The second piece of primary construction equipment is the vibratory pile driver, which at 50 feet is estimated to produce sound levels of 101 dBA.
- The third piece of primary construction equipment is the shears (on backhoe), which at 50 feet is estimated to be 96 dBA.

Using the rules for decibel addition (WSDOT 2019a), the noise level for this construction activity is expected not to exceed 111 dBA. Based on the population density of Bothell, the existing background (ambient) noise level is estimated to be 65 dBA (WSDOT 2019a). The speed limit in the Project area on I-405 is 60 miles per hours (mph). The 2017 Annual Traffic Report lists the annual daily traffic (ADT) on I-405 between 210,000 and 213,000 vehicles per day. Therefore, vehicles per hour can be estimated as 10 percent of 213,000 or approximately 21,300 vehicles per hour. A roadway with 21,300 vehicles per hour at 60 mph traffic speed has a traffic noise level of approximately 79.8 dBA (WSDOT 2019b). Hard site conditions are assumed to be present along the majority of the Project corridor.

Based on the WSDOT guidance (2019a), base 10-Log equations are used to calculate noise levels at a specific distance from the source to determine the distance that construction noise will travel before it attenuates to the traffic noise level and the distance at which construction or traffic noise will attenuate to background noise levels.

Using the equations, traffic noise is not expected to be distinguishable from the background noise level at approximately 906 feet, and construction noise levels attenuate to the background noise levels at approximately 1.9 miles. As a result, the extent of Project related noise is estimated at approximately 1.9 miles. This calculation does not factor in topographical relief, which will further limit the extent of noise travel.

4.2 AQUATIC PORTION OF ACTION AREA

During construction, pile removal in the Sammamish River may result in increased sound pressure levels as well as downstream stormwater dilution, water quality, and turbidity impacts in the Project area. The bottom substrates of the Sammamish River in the Project vicinity consist of silt and clay. To comply with Ecology's 401 Water Quality Certification, Chapters 173-201A-200 and 210 of the Washington Administration Code (WAC) were consulted to determine the extent of potential effects of sedimentation and associated turbidity to the Sammamish River in the Project area. Based on the flow characteristics of water bodies in the Project area, the Sammamish River is assumed to have a flow greater than 100 cubic feet per second at the time of the turbidity release, as a result, the area affected by turbidity or water quality degradation in the Sammamish River is estimated to be up to 300 feet downstream of each pier to be removed. For

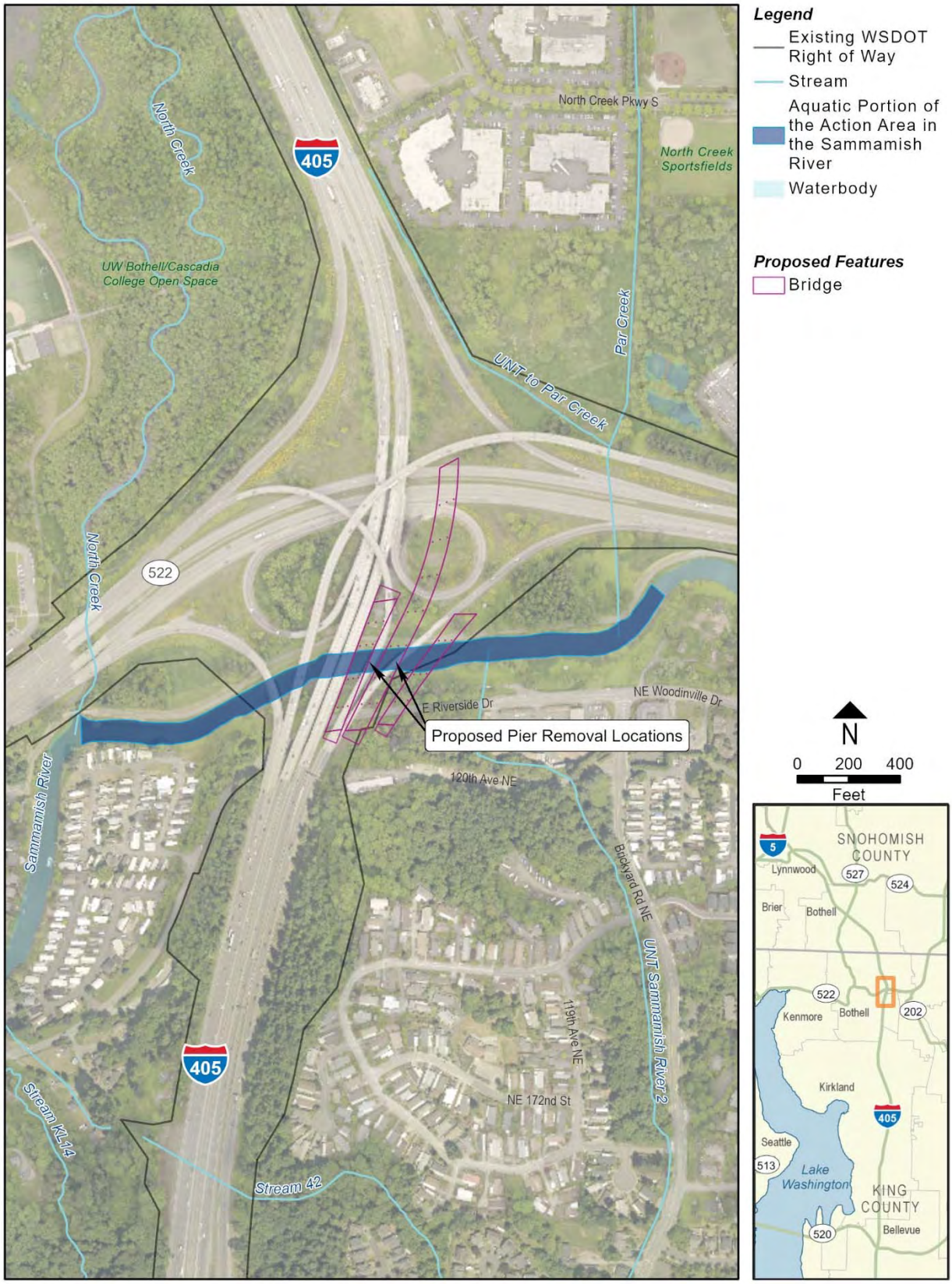
the fish barrier replacement work, in-water work would occur at each stream, and the area affected by turbidity or water quality degradation is estimated to be 200 feet downstream from each crossing location. The action area also includes upstream habitat gain after fish barriers are replaced with restored stream connections. Table 5 includes the upstream habitat gain for each stream after the proposed stream connections are restored.

For the pile removal activity in the Sammamish River, sheet piles, aqua dams, or other work area exclusion techniques will be employed to isolate the in-stream work area. Sheet pile installation is assumed to be the most disruptive method, therefore the noise associated with this technique is used to conservatively evaluate potential effects. Sheet piles would likely be driven within the duration of a week using an excavator, or vibratory equipment mounted atop a crane positioned on the streambank. Underwater noise estimates for vibratory installation of sheet piling are not available; however, Seattle Department of Transportation estimates that noise generated from vibratory installation of sheet piles is generally similar to noise levels generated by 48-inch-wide steel sheet piles, which is estimated to be 165 decibels root mean square (dBRMS) pressure level (SDOT 2012). This level was applied to possible vibratory installation of sheet piling.

Although ambient underwater noise was not measured at the Sammamish River, ambient levels from other sites can be used to estimate existing conditions at the Project site. Ambient noise levels in deep freshwater lakes or deep slow-moving rivers are approximately 120 dBRMS (WSDOT 2019a). In shallow (1 foot deep or less), fast-moving rivers, the ambient noise levels are louder due to the water moving over rocks and boulders and the wave action at the surface. Ambient levels are estimated to be 140 dBRMS in these systems (WSDOT 2019a). Based on this information, an estimate of 120 dBRMS was used as the baseline underwater noise level.

To define the extent of Project-related construction noise in the aquatic environment, the practical spreading loss calculation was used. This formula estimates the distance at which underwater sound pressure levels created during vibratory installation (using 165dBRMS) would attenuate to background levels (120 dBRMS). This model assumes that sound energy decreases at a rate of 4.5 dB per doubling distance. It is also assumed that noise would stop when it reaches the nearest land mass. Based on the practical spreading model ($R1 = R2 * 10(165-120)/15)$), noises would attenuate to baseline levels approximately 10,000 meters (32,800 feet) from sheet pile vibratory installation. However, there is a bend in the channel approximately 1,200 feet downstream and 900 feet upstream of the proposed sheet pile installation location. Based on the location of stream bends upstream and downstream of the coffer damming activity, pressure waves are expected to diminish rapidly when they intersect with land, and the extent of the Project related underwater noise area will be confined to the 2,100-foot reach of the stream between the two bends (Figure 5). Up to 5 acres of the Sammamish River may be exposed to underwater noise above background levels from vibratory pile driving or removal.

Figure 5. Extent of Underwater Noise Effects in the Sammamish River



5.0 PROJECT VICINITY – EXISTING CONDITIONS

5.1 PROJECT SETTING

I-405 is a 30-mile corridor that runs between Tukwila and Lynnwood, and it is the region's dominant north-south travel corridor east of Interstate 5. The Project is located between MP 21.79 and MP 27.06 within the city limits or Urban Growth Area boundaries of the cities of Kirkland and Bothell, Washington (Figure 1). I-405 varies from six to ten lanes along the Project corridor, and traffic volumes range from 210,000 to 213,000 vehicles daily according to WSDOT's 2017 annual traffic data (WSDOT 2019b).

5.2 WATER RESOURCES

The Project area contains three basins within the Lake Washington/Cedar/Sammamish Watershed (WRIA 8), in hydraulic unit code 171100120400 (Lake Washington-Sammamish River). From south to north, the basins in the Project area include Juanita Creek, the Sammamish River, and North Creek. Juanita Creek and the Sammamish River drain into Lake Washington, and North Creek drains into the Sammamish River. More detailed descriptions of each drainage basin appear in Section 6.0.

5.3 VEGETATION

Besides impervious surface areas, vegetated land cover in the action area includes forests, shrubs and grasses, and roadside vegetation.

In general, the forested areas in the action area are mostly located outside of WSDOT right of way and include stands where Douglas-fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*) are dominant. Mixed stands of deciduous trees, such as black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), red alder (*Alnus rubra*), and bigleaf maple (*Acer macrophyllum*) are common in forested areas adjacent to streams within the action area. Plant species common in the understory include vine maple (*Acer circinatum*), Himalayan blackberry, salmonberry (*Rubus spectabilis*), willows (*Salix* spp.), and sword fern (*Polystichum munitum*).

The shrub and grasses land-cover type includes vegetated areas dominated by woody plants less than 20 feet tall (distinguishable from a tree by their multiple stems and lower height), grasses and grass-like plants, or both. Common plant species observed in this land cover type include Himalayan blackberry, Scot's broom (*Cytisus scoparius*), vine maple, salmonberry, willows, and snowberry (*Symphoricarpos albus*), as well as various grass species.

Roadside vegetation consists of vegetation along I-405, including roadway medians and shoulders that are regularly maintained for safety purposes, and landscaped areas consisting primarily of plants grown for ornamental value for residential, commercial, and industrial developments. Plant species observed in this land-cover type include Himalayan blackberry, Scot's broom, snowberry, Oregon grape (*Mahonia nervosa*), and grass species. Maintained vegetation typically provides little to no value as wildlife habitat.

5.4 WETLANDS

There are 51 wetlands identified along the Project corridor, and approximately 5 acres of the wetlands are within the existing WSDOT right of way. Of 51 wetlands, 30 depressional wetlands, 20 slope wetlands, and one riverine wetland occur within the Project area. Three wetland categories (Category II, III, and IV) are present within the Project area.

6.0 ENVIRONMENTAL BASELINE

WSDOT documents the existing environmental baseline by providing information about individual habitat features that may support listed species in the action area. The analysis determines how the Project may directly impact the habitat features in the action area, and changes to the environmental baseline condition following construction.

Three different habitat features occur within the action area; terrestrial, aquatic, and wetlands. Terrestrial habitat includes upland habitat such as forests, shrubs and grasses, and maintained vegetation. Aquatic habitat includes streams, rivers, and their associated riparian habitat. Wetland habitat includes emergent, scrub-shrub, and forested wetlands. The following subsections describe each habitat feature identified in the action area as well as existing stormwater baseline conditions.

Land uses within the action area mostly consist of medium- and high-density residential developments, commercial, and industrial uses. In general, upland habitats, rivers and streams in the action area have been altered from their historical states to accommodate residential, commercial, and industrial developments over time. These alterations include deforestation, fragmentation, bank armoring, channelization, and removal of riparian vegetation. These alterations have also resulted in loss of the historic floodplains associated with most of these streams. Most of the action area is located within the city limits or Urban Growth Area boundaries of the cities of Kirkland and Bothell, Washington, and existing developments heavily encroach on degraded riparian zones.

6.1 TERRESTRIAL

As described in Section 5.3, upland habitat in the action area includes forests, shrubs and grasses, and maintained vegetation. However, most of the action area consists of developed urban land including residential and commercial developments, and forests and shrub and grasses land cover have been fragmented by recent development. Connectivity between and within these habitats has also been reduced, and functions provided by these habitats are somewhat limited.

6.2 AQUATIC

Streams in the action area are all part of the Lake Washington hydrologic system and are typically characterized as low-gradient systems that originate in gently sloping upper basins and flow through narrow valleys. Stream flows in the action area are mostly fed by local rainfall and groundwater. With the exception of the Upper Sammamish River watershed, most streams in the action area do not extend into the Cascades. Thirteen streams are identified within the action area, which are characterized by each basin in the following subsections, and multiple drainages are still under review. Juanita Creek basin is included in this section because Juanita Creek flows through the Project area; however, there will be no in-water work or any vegetation removal activities associated with Juanita Creek as a result of the Project. The only Project activity that will occur in the vicinity of Juanita Creek is restriping of the existing pavement.

Fish habitat was assessed during field visits and using publicly available information sources. Fish habitat components included bedform, stream bank stability, secondary channel habitat, substrate, vegetation cover, riparian buffer, and large woody debris (LWD). LWD is defined as downed wood that intercepts bankfull flow. To be counted as LWD, a piece of wood must be of a length greater than or equal to 7.6 m or greater than twice the bankfull width of the stream reach being surveyed.

6.2.1 Juanita Creek Basin

The Juanita Creek basin covers approximately 4,000 acres. Juanita Creek originates east of I-405, immediately north of NE 124th Street, and then flows to the west and south for approximately 5 miles prior to entering the northeast end of Lake Washington (King County 2018a). Within the Juanita Creek basin, Juanita Creek is the only stream located in the aquatic portion of the action area; however as mentioned above, there are no in-water work or alteration to riparian habitat proposed at Juanita Creek. WSDOT does not anticipate any stream or riparian impacts in this basin.

Juanita Creek is identified on the Washington State Department of Ecology's 303(d) list for dissolved oxygen and bacteria (Ecology 2019). According to the City of Kirkland watershed report card (Kirkland 2019), the average temperature for Juanita Creek remains below 60°F throughout the year; however, low concentrations of dissolved oxygen have been recorded during summer months, and 24 pesticides were detected in Juanita Creek. The channel has been armored in most segments of the stream, and approximately 48 percent of the surface area within the basin is covered with impervious surfaces (Kirkland 2019). Channel complexity, floodplain connectivity, and riparian condition and function are heavily degraded due to bank armoring.

6.2.1.1 Juanita Creek

Juanita Creek crosses I-405 at MP 21.94. Within the WSDOT right of way, there is no open channel, and the area downstream of I-405 has two complete fish barriers owned by WSDOT and the City of Kirkland (WDFW 2019b). This WSDOT fish barrier will be evaluated as a separate project. Upstream of the I-405 crossing, Juanita Creek flows through a mixed forest area that contains red alder along the channel and bigleaf maple, western red cedar, and Douglas-fir on top of the ravine. Juanita Creek flows into a 48-inch-wide culvert that has a debris cage at both ends. The stream channel upstream of the culvert is 5 to 7 feet wide and 1 foot deep. Substrates include primarily gravels and sand.

Downstream of I-405, the stream channel of Juanita Creek is approximately 5 feet wide and 3 to 4 feet high. The riparian vegetation along the stream is dominated by Himalayan blackberry with some red alder and Western red cedar. Dominant substrates in this reach are fines and silt. Juanita Creek then flows through another 54-inch culvert under an unmaintained access road at the end of NE 145th Street. Downstream of the culvert, an active beaver dam was present approximately 400 feet downstream of the I-405 crossing (Figure 6).

Figure 6. Beaver Dam at Juanita Creek

6.2.2 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 5 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, LWD accumulations, and sufficient number of pools.

King County collected water, sediment, and benthic community samples in the Sammamish River from 2001 to 2003 (King County 2005a). 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 2005a). 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 2005a).

The Sammamish River has no fish barriers within the action area or farther downstream of the action area (WDFW 2019b). 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 heavily degraded due to channelization of the river and dredging activities. Within the action area, the Sammamish River and four tributaries to the Sammamish River are present in the Sammamish River basin. The following sections include a description of each stream.

6.2.2.1 Sammamish River

The Sammamish River crosses I-405 at MP 23.60 on the south side of the I-405/SR 522 interchange (Figure 2; Figure 7). 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 2002a).

Figure 7. Sammamish River Below I-405, Facing South from Right Bank

6.2.2.2 Stream KL14

Stream KL14 is a tributary to the Sammamish River that originates west of southbound I-405 at MP 22.75 (Figure 2, Figure 8). It flows south to north in a steep ravine on the west side of I-405 in relatively undeveloped area. Stream KL14 receives flow from surface water runoff, a series of wetlands located along the stream, and culverts east of I-405. At least five culverts convey water across I-405 to Stream KL14.

Stream KL14 along southbound I-405 starts from a 48-inch corrugated metal culvert and is approximately 2 feet wide and 2 feet deep. The stream banks are steeply sloped until it flows into a wetland, approximately 150 feet downstream of the I-405 crossing (Figure 8). Riparian vegetation observed along the stream channel consists of Himalayan blackberry, reed canarygrass, and Pacific willow (*Salix lucida*). Substrates observed in Stream KL14 are fines with some sand. No LWD or pool habitat is present within the WSDOT right of way. Stream KL14 continues to flow north for approximately 2,000 feet through a forested area, crosses East Riverside Drive via a 48-inch corrugated metal culvert, and then flows through another 24-inch culvert, north of East Riverside Drive. The stream then discharges into the Sammamish River approximately 200 feet north. A series of these culverts likely prevents fish from migrating upstream. WDFW has completed an assessment of this stream and reported that this channel is a non-fish-bearing stream. It is fed by stormwater, and there is no potential fish habitat present upstream (WDFW 2019b). No fish are documented to be present in Stream KL14 (WDFW 2019b, 2019c).

Figure 8. Stream KL14 in a Wetland, Facing North

6.2.2.3 Stream 42

Stream 42 is a tributary to the Sammamish River that originates in the area southeast of the I-405/SR 522 interchange at MP 23.20, near Brickyard Road (Figure 2, Figure 9). Substrate of the channel is mostly fines. At least five pieces of LWD were observed within 300 feet upstream of the I-405 crossing. Stream 42 flows from south to north in a steep ravine that is dominated by western red cedar and bigleaf maple. Along the bank, salmonberry, vine maple, and sword ferns are present. The banks are highly incised, and bank erosion was observed along both sides of the banks.

Stream 42 crosses the I-405 via a 30-inch corrugated metal pipe (Site ID 99543). Downstream of the I-405 crossing, the stream flows through a forested area dominated by red alder, behind a private property. Two 24-inch-wide standpipes are located just downstream of the culvert, and these standpipes connect to a 12-inch pipe that drains to the channel approximately 15 feet downstream. The channel continues to flow for another 120 feet, and then it goes through a concrete-lined channel that is 7 inches wide and 8 inches deep behind the private property (Figure 9). Stream 42 then drops off for approximately 7 to 8 feet, continues to flow through the private property, and goes into a pipe under the private driveway. The channel appears to be piped all the way to the Sammamish River. Substrate of Stream 42 in this reach is mostly fines, and no gravels were observed. WDFW has assessed Stream 42 and determined it is not a fish-bearing stream because it does not meet physical criteria for potential fish use.

Figure 9. Concrete Structure at Stream 42, Facing Northwest

6.2.2.4 Par Creek

Par Creek is a tributary to the Sammamish River that originates in Bothell's North Creek Business Park south of NE 195th Street (Figure 2, Figure 10). Par Creek flows north to south, crosses SR 522 via a 60-inch concrete culvert, and enters the Sammamish River just east of the I-405/SR 522 interchange. Par Creek has been heavily altered by commercial development, and it runs through a low-gradient, canal-like channel in a grassy field on north side of SR 522. According to the City of Bothell's Stream Health Assessment Report (Bothell 2017), Par Creek was dredged and modified into a trapezoidal shape when the North Creek Business Park was built in the 1980s. The channel is heavily incised, and signs of erosion were observed along the channel. Par Creek is approximately 7 to 8 feet wide and 8 to 9 feet deep. Substrates consist of 95 percent fines with a few gravels. Observed riparian vegetation mostly consists of Himalayan blackberry and reed canarygrass with some ornamental maple and poplar trees at North Creek Parkway South. Within the WSDOT right of way, a few Douglas-fir and bigleaf maple trees are present on the left bank. Figure 10 shows the typical riparian and bank conditions of Par Creek.

Figure 10. Par Creek, Facing South from North Creek Parkway

Par Creek crosses SR 522 at MP 11.31 via a 60-inch culvert. It continues to flow south for approximately 300 feet and discharges into the Sammamish River after flowing through two 60-inch culverts. One culvert is located approximately 160 feet south of the SR 522 crossing, but this crossing is no longer used. Then the stream flows in an open channel for approximately 60 to 70 feet, crosses the Sammamish River Trail, and empties into the Sammamish River. Both banks in this reach are mostly covered with Himalayan blackberry. The channel is approximately 10 feet wide and 8 to 9 feet deep. Substrate is mostly fines in this reach. No LWD was observed along the channel within the action area. According to the WDFW assessment, the SR 522 crossing (Site ID 993083) is a partial fish barrier (WDFW 2019b).

An unnamed tributary (UNT) to Par Creek flows north to south parallel to the on-ramp from westbound SR 522 to northbound I-405. The headwaters of UNT to Par Creek begin at the south end of a wetland that is located between North Creek and UNT to Par Creek. The stream flows for approximately 1,500 feet parallel to the SR 522 to I-405 on-ramp at I-405 MP 23.95 to the stream's convergence with Par Creek at SR 522 MP 11.20. UNT to Par Creek is approximately 5 to 6 feet wide and 2 to 3 feet deep, and it appears to be constructed as the channel has a uniform shape. The channel contains mostly silt and lacks gravel substrate.

The City of Bothell has been monitoring the health of Par Creek. Par Creek does not support habitat for salmonids due to low dissolved oxygen and high summer temperatures. According to the City of Bothell's stream health assessment report, dissolved oxygen levels in Par Creek were recorded to be below the lethal level to salmonids for six months of a year. These levels were often observed in late spring into the early part of fall (Bothell 2017). During September and October 2011, dissolved oxygen levels in lower reaches of Par Creek were below the lethal level for salmonids (Bothell 2011). Temperature in Par Creek is also recorded to exceed Ecology's

standard for temperature, and annual pH of Par Creek has been recorded to be below Ecology's standard (pH 6.5) since 2010 (Bothell 2017).

6.2.2.5 Stream 25.0L

Stream 25.0L (Figure 11) is a tributary to Par Creek at MP 25.00. It originates in the North Creek Forest, just west of I-405. It flows west to east in a mature forested ravine outside of WSDOT right of way. The stream travels through a steep ravine with 18 percent gradient (WDFW 2019b). Within WSDOT right of way, the stream flows through a wetland that is dominated by reed canarygrass for approximately 50 feet. The stream channel is approximately 20 inches wide and 8 to 10 inches deep. Observed substrates consist of fines and gravels. No defined bed and bank are observed after the channel enters the wetland within the right of way. All the surface runoff drains into a catch basin located at MP 25.55. On the east side of I-405, there is a 36-inch-wide corrugated metal pipe with a small open channel that is approximately 2 to 3 feet wide. This channel is completely vegetated and runs south for approximately 180 feet until it enters into a City of Bothell stormwater conveyance system. Figure 11 shows the channel conditions downstream of the I-405 crossing. According to the City of Bothell's stormwater GIS data, the drainage flows through a series of conveyance pipes, bypasses North Creek, and discharges into a detention pond just north of NE 195th Street that feeds into Par Creek.

Figure 11. Stream 25.0L, Downstream of the I-405 Crossing, Facing South

WDFW assessed this stream crossing at northbound I-405 (Site ID 993104) and determined that the crossing is a complete barrier to anadromous fish (WDFW 2019b). WDFW also evaluated potential fish habitat and determined that the upstream portion of the stream only provides potential habitat for resident trout due to the steep gradient (WDFW 2019b). According to WDFW's report, there is an underground diesel fuel storage tank near the piped stream on the

east side of I-405, and approximately 15,000 gallons of diesel leaked into the surrounding environment in August 2008 (Loch, cited in WDFW 2019b).

6.2.3 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 2018b). The City of Bothell has also assessed land cover types for some drainage basins of tributaries of North Creek basin per the City's surface water management areas. Table 4 shows the summary of the City's assessment (Bothell 2017).

Table 4. Summary of Bothell's Surface Water Management Areas in the North Creek Basin

Stream Water Management Area	Total Basin (acre)	Total Basin in City (acre)	Wetlands in Basin	Road Length (mi/sq mi)	Impervious
Par Creek	749	719	4%	13.1	42%
Queensborough	1,089	1,080	6%	36.4	37%
Canyon Park	723	706	9%	27	36%
Fitzgerald	871	183	11%	21.1	21%

Source: Bothell 2017

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 2019b). North Creek is reported to have slightly better habitat conditions than the Sammamish River but is still considered degraded (King County 2002a). 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).

Within the action area, North Creek and four tributaries to North Creek are present. Tributaries to North Creek include Stream 66, Perry Creek and its tributaries (North and South Forks of Perry Creek), and Queensborough Creek, which are described below.

6.2.3.1 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. Figure 12 shows typical conditions of North Creek, upstream of the I-405 crossing.

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 canarygrass 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.

Figure 12. North Creek, Facing South Along Northbound I-405

6.2.3.2 Stream 66

Stream 66 is a tributary to North Creek located at MP 25.35 (Figure 2, Figure 13). This stream crosses southbound I-405 via a 30-inch culvert under I-405 and then eventually enters North Creek approximately 700 feet east from I-405. Stream 66 originates from upland areas in North Creek Forest located west of I-405 and travels through steep ravines with gradients between 27 and 40 percent (WDFW 2019b).

The channel on west side of I-405 is approximately 4 to 5 feet wide and 3 to 6 feet deep. Quarry spalls are present at the culvert inlet. An above-ground 16-inch plastic pipe is also present, running east and west in North Creek Forest and discharging stormwater runoff at the quarry spalls. Riparian vegetation observed along the stream channel includes bigleaf maple, vine maple, Himalayan blackberry, and sword fern. On east side of I-405, the channel is approximately 2 to 3 feet wide and 2 feet deep. Red alder, Himalayan blackberry, and planted red-osier dogwood are the dominant vegetation along the channel (Figure 13). Substrates observed in Stream 66 are mostly fines and gravels. A few LWD is present along the stream channel on both sides of I-405.

Figure 13. Stream 66, Downstream of the I-405 Crossing, West of 27th Avenue SE, Facing Southeast

Stream 66 runs through a forested area for approximately 350 feet southeast and enters the City of Bothell's stormwater system at 27th Avenue SE, which consists of a series of 30-inch-diameter, corrugated metal pipes running for 1,100 feet along 27th Avenue NE and 240th Street SE to North Creek.

WDFW assessed the stream crossing at northbound I-405 (Site ID 993106) and determined that the culvert is a complete barrier to anadromous fish (WDFW 2019b). Based on the field observations, the series of pipes along 27th Avenue NE and 240th Street SE is also a barrier to anadromous fish.

6.2.3.3 Perry Creek

Perry Creek is a tributary to North Creek located at MP 26.38 (Figure 2, Figure 14). 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 (Site ID 993129) and determined that the culvert is a partial blockage to fish (WDFW 2019b). 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).

Figure 14. Perry Creek, Upstream of the 20th Avenue SE Crossing, Facing West

6.2.3.4 North Fork Perry Creek

North Fork Perry Creek is a low-gradient stream that originates west of the I-405/SR 527 interchange, just north of 228th Street SE (Figure 2, Figure 15). 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 (Site ID 08.0070 A 0.25) is a partial fish barrier due to the presence of baffles that are approximately 1 foot high inside of the concrete culvert (WDFW2019b).

Figure 15. North Fork Perry Creek, Downstream of the I-405 Crossing

6.2.3.5 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 (Figure 2, Figure 16). 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 2019b), the 228th Street SE crossing (Site ID 102 N128) is not a fish barrier.

Figure 16. South Fork Perry Creek, Facing Downstream from 228th Street SE

6.2.3.6 Queensborough Creek

Queensborough Creek is a tributary to North Creek that crosses I-405 at MP 26.87 (Figure 2, Figure 17). According to the City of Bothell (2004), 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 (Site ID 993109) and SR 527 (Site ID 993084) are currently complete fish barriers according to the WDFW assessments (WDFW 2019b).

Figure 17. Queensborough Creek, Downstream of the SR 527 Crossing, Facing Southeast

6.2.4 Summary of U.S. Fish and Wildlife Service Matrix of Pathways and Indicators

Table 5 provides an overview of baseline stream conditions in the action area and in the Lake Washington/Cedar/Sammamish Watershed. This table is based on the USFWS Matrices of Pathways and Indicators. A brief description of each pathway documented or observed in the field is included in the previous sections.

Table 5. U.S. Fish and Wildlife Service Checklist

Pathways Indicators	Environmental Baseline		Effects of Project Action	
	Action Area Scale	Watershed Scale	Action Area Scale	Watershed Scale
Water Quality				
Temperature	NPF	NPF	Maintain	Maintain
Sediment	NPF	NPF	Maintain	Maintain
Chemical contamination/nutrients	NPF	NPF	Restore	Maintain
Habitat Access				
Physical barriers	PF	PF	Restore	Maintain
Habitat Elements				
Substrate/substrate embeddedness	NPF	NPF	Maintain	Maintain
Large woody debris	NPF	NPF	Maintain	Maintain
Pool frequency and quality	NPF	NPF	Maintain	Maintain
Large pools	NPF	NPF	Maintain	Maintain
Off-channel habitat	NPF	NPF	Maintain	Maintain
Refugia	NPF	NPF	Maintain	Maintain
Channel Conditions and Dynamics				
Wetted width/depth ratio	PF	PF	Maintain	Maintain
Streambank Condition	PF	PF	Maintain	Maintain
Floodplain connectivity	NPF/FUR	NPF/FUR	Maintain	Maintain
Flow/Hydrology				
Change in peak/base flows	NPF/FUR	NPF/FUR	Maintain	Maintain
Increase in drainage network	NPF/FUR	NPF/FUR	Maintain	Maintain
Watershed Conditions				
Road density and location	NPF/FUR	NPF/FUR	Maintain	Maintain
Disturbance history	NPF/FUR	NPF/FUR	Maintain	Maintain
Riparian reserves/ conservation areas	NPF/FUR	NPF/FUR	Maintain	Maintain
Disturbance regime	NPF/FUR	NPF/FUR	Maintain	Maintain
Integration of species and habitat conditions	NPF/FUR	NPF/FUR	Maintain	Maintain

FA = Functioning Appropriately; FUR = Functioning at Unacceptable Risk, NPF = Not Properly Functioning; PF = Properly Functioning

6.3 WETLANDS

There are 52 wetlands delineated along the Project corridor; the wetlands total approximately 5 acres within the existing WSDOT right of way. Based on the field investigations conducted for wetland delineations, none of the wetlands adjacent to the Project corridor likely provide habitat for the listed species, as they are located adjacent to the highway or developed areas, dominated by invasive species, and lack structural complexity to support habitat for listed species. Common species observed in the wetlands along the Project corridor include red alder, vine maple, salmonberry, reed canarygrass, and Himalayan blackberry.

6.4 STORMWATER BASELINE

I-405 within the Project action area has been divided into 13 TDAs (Figure 18 and Figure 19), which drain to 11 streams. Currently, I-405 runoff is routed through vaults and ponds as well as compost-amended biofiltration swales, media filter drains, and a constructed stormwater wetland. Approximately 128 acres of PGIS is present in the current roadway configuration, and 44 acres is currently treated (Table 6). There are 13 detention facilities located throughout the Project corridor. Figure 2 in Section 2.1 shows the proposed stormwater facilities throughout the Project corridor.

Table 6. Summary of Existing Pollution-Generating Impervious Surfaces and Treatment

Basin	Receiving Waterbody	TDA	Potential Listed Species Present at Outfall	Existing PGIS in TDA (acres)	Type of Facility	Existing Treatment (acres)
Sammamish River	Stream KL14	F2	Not Present	4.11	n/a	0
	Stream 42	F3	Not Present	1.40	n/a	0
	Sammamish River	G2	Puget Sound Chinook	52.82	CABS	10.65
			Puget Sound Steelhead		MFD	3.02
			Bull Trout		Wet Vault	3.30
	North Creek	G4	Puget Sound Chinook	1.49	MFD	0.29
			Puget Sound Steelhead			
North Creek	North Creek	I1	Puget Sound Chinook	20.84	MFD	3.52
			Puget Sound Steelhead			
	Stream 66	I2	Not Present	3.76	MFD	0.55
	Stream 25.0L	I3	Not Present	2.61	MFD	0.91
	Stream 70	I4	Not Present	4.51	MFD	1.26
	Stream C-77	J1	Not Present	4.08	MFD	1.21
					CSW	0.89
	North Fork Perry Creek	J2	Puget Sound Chinook Puget Sound steelhead	13.19	Bio-Swale	4.42
					Wet vault	4.45
	North Creek	NW01	Puget Sound Chinook	1.92	n/a	0
			Puget Sound Steelhead			
	Queensborough Creek	NW02	Puget Sound Chinook	17.25	Wet pond	9.35
			Puget Sound Steelhead		MFD	0.37
	North Creek	NW03	Puget Sound Chinook Puget Sound Steelhead	0.39	n/a	0
Total				128	n/a	44

CABS = compost-amended vegetated bioswale; CSW=constructed stormwater wetland; MFD = media filter drain; n/a = not applicable; PGIS = pollution-generating impervious surfaces; TDA = threshold discharge area

Figure 18. Threshold Discharge Area Boundaries on the South End of the Project Area

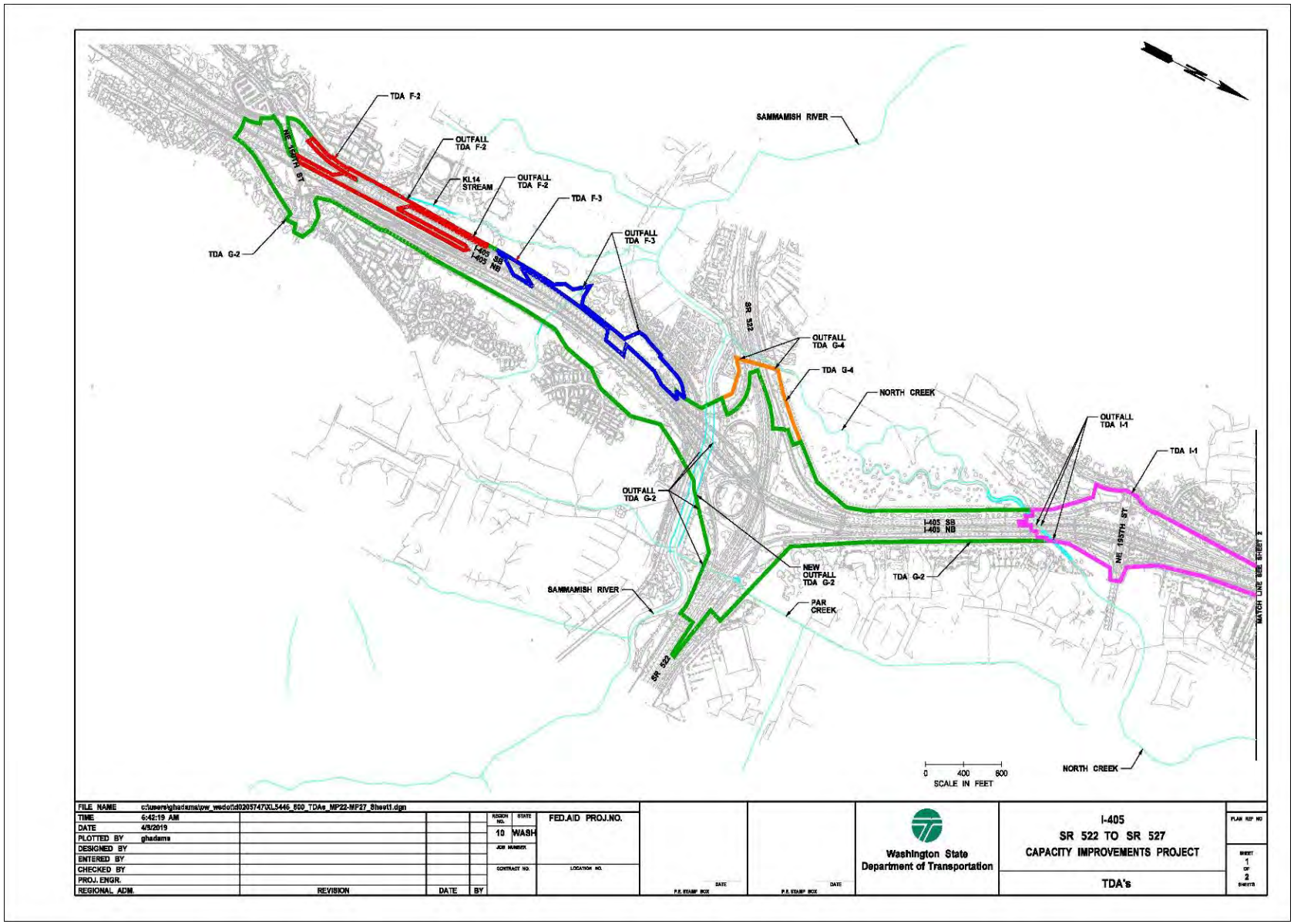
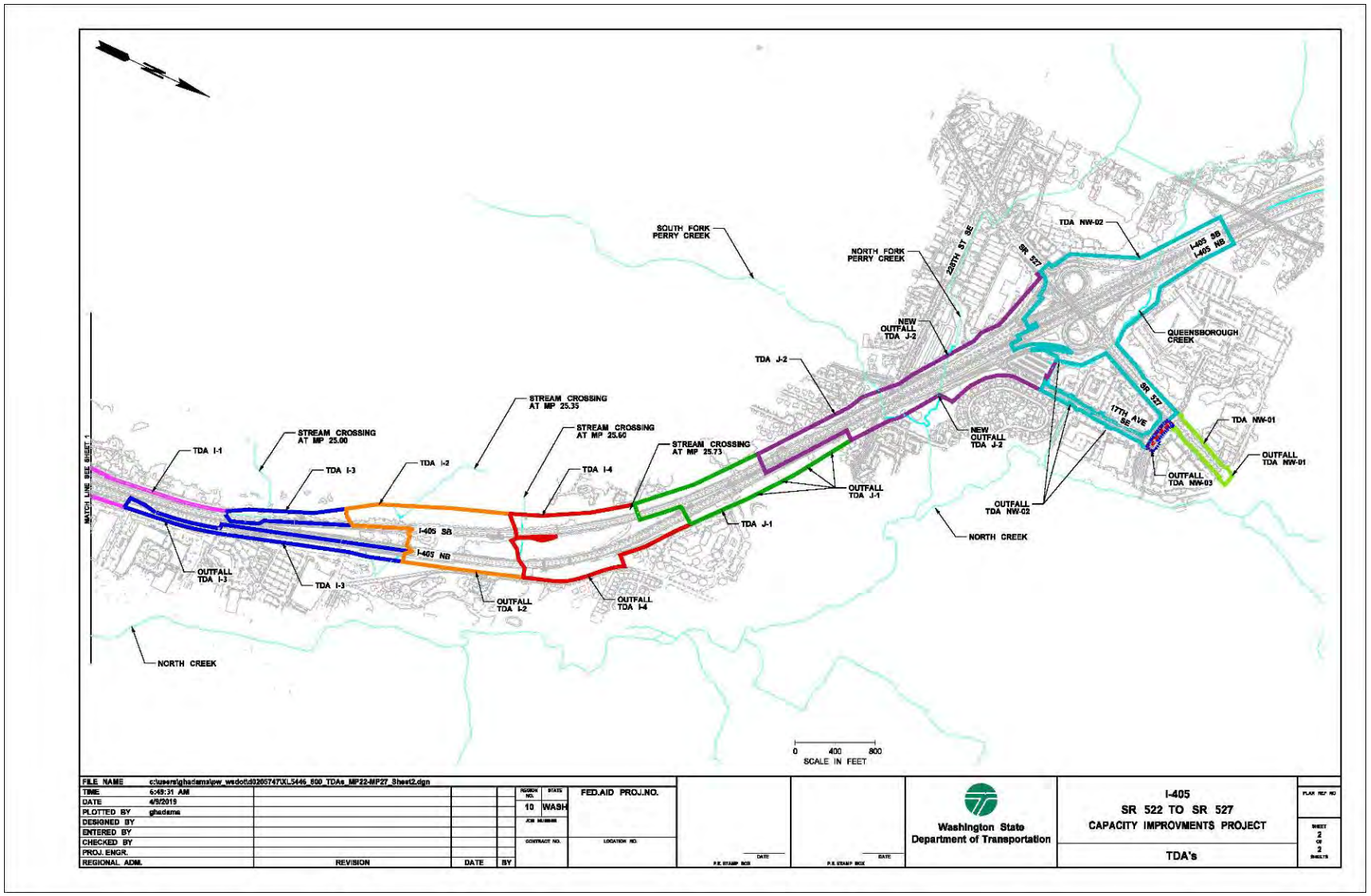


Figure 19. Threshold Discharge Area Boundaries on the North End of the Project Area



7.0 SPECIES OCCURRENCE

The species addressed in this biological assessment (Table 7) were identified based on a review of the following sources:

- Information for Planning and Consultation (IPaC) Resource List obtained from the USFWS website on July 12, 2019 (Appendix A)
- Species list obtained from the NOAA Fisheries website on February 12, 2019 (Appendix A)
- WDFW Priority Habitats and Species data, accessed February 12, 2019
- WDFW SalmonScape, accessed February 12, 2019
- Washington Department of Natural Resources Natural Heritage Program county lists for vascular and nonvascular species and GIS data for rare plants and high-quality ecosystems, obtained February 12, 2019

Table 7. Listed Species and Critical Habitat Addressed in this Biological Assessment

Species	Federal Status	Critical Habitat	Potential Sites Where ESA-Listed Species Could Occur
Puget Sound ESU Chinook salmon *(Oncorhynchus tshawytscha)*	Threatened	Designated, but none in the action area	Juanita Creek, Sammamish River, North Creek, North Fork/South Fork Perry Creek, and Queensborough Creek
Puget Sound DPS steelhead *(Oncorhynchus mykiss)*	Threatened	Designated, but none in the action area	Juanita Creek, Sammamish River, North Creek, North Fork/South Fork Perry Creek, and Queensborough Creek
Coastal/Puget Sound DPS bull trout *(Salvelinus confluentus)*	Threatened	Designated, but none in the action area	Sammamish River
Yellow-billed cuckoo (*Coccyzus americanus*)	Threatened	Not proposed in Washington	University of Washington Bothell / Cascadia College Mitigation Site

DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit

7.1 TERRESTRIAL SPECIES

7.1.1 Yellow-Billed Cuckoo

The western yellow-billed cuckoo has experienced a major decline in its population size and breeding range during the past century and is now extirpated throughout most of its historical range except for small and widely dispersed nesting populations in northern California and southern Idaho (Wiles and Kalasz 2017). Yellow-billed cuckoos are considered rare in Washington, with 20 sightings since the 1950s. There has been no observed breeding in Washington since the 1950s. Of the 20 sightings, only four records occurred in western Washington, and these sightings indicate that they are likely non-breeding vagrants or migrants (Wiles and Kalasz 2017).

Western yellow-billed cuckoos breed in large blocks of riparian habitat with dense willow and cottonwood stands in river floodplains (USFWS 2013). In western Washington, moister habitats were once occupied as breeding habitat; however, most remaining breeding populations occur in arid regions (Wiles and Kalasz 2017). Patch size of a suitable breeding habitat for the cuckoo populations ranges from 100 to 200 acres with 660 feet wide, and a patch size of 50 to 100 acres with 330 to 660 feet wide is considered marginal (Wiles and Kalasz 2017).

Although they are rare, yellow-billed cuckoos are known to occasionally occur in Washington. Yellow-billed cuckoos migrate annually and arrive in Washington between mid-May and mid-June. Fall departures are reported to occur between September and October. During migration, yellow-billed cuckoos utilize different types of habitat, including thick scrub, open woodlands, tropical deciduous forest secondary forest, forest edge, and mangroves (Hughes 2015, as cited in Wiles and Kalasz 2017). Within the action area, the mitigation site for the University of Washington Bothell/Cascadia College campus could provide potential habitat for yellow-billed cuckoos. The mitigation site is approximately 60 acres in size and 800 feet wide, and because there is no documented occurrence of yellow-billed cuckoos within the action area (WDFW 2019a), the site could provide habitat for migrating cuckoos. No critical habitat for the yellow-billed cuckoo has been proposed in Washington. As a result, although their presence is unlikely, yellow-billed cuckoo may potentially transit or rest in the action area during their migratory season.

7.2 AQUATIC SPECIES

Three ESA-listed species (Puget Sound Chinook salmon, Puget Sound steelhead, and Coastal/Puget Sound bull trout) are known to occur in seven streams within the action area. Table 8 lists these streams and summarizes the expected Project activities in the their vicinity. Detailed information on the three aquatic species is provided in the following subsections.

Table 8. Occurrence of Listed Aquatic Species Within the Action Area

Streams where ESA-Listed Aquatic Species Occur	Expected Project Activities in the Vicinity
Juanita Creek	Restriping the existing lanes
Sammamish River	Existing bridge demolition (in-water work) including temporary work bridge or barge, fish removal/exclusion, stream bypass/dewatering, new bridge construction (over-water work), and construction of new outfall on the right bank
North Creek	Road paving and pavement removal
North Fork Perry Creek	Road paving, pavement removal, fish removal/exclusion, stream bypass, dewatering, culvert excavation and removal, culvert installation and backfilling, and construction of two new outfalls
South Fork Perry Creek	No work is anticipated at South Fork Perry Creek because I-405 is bridged above 228th Street SE at the stream crossing.
Queensborough Creek	Road paving, pavement removal, fish removal/exclusion, stream bypass, dewatering, culvert excavation and removal, and culvert installation and backfilling

7.2.1 Puget Sound Chinook Salmon

The Puget Sound Evolutionarily Significant Unit (ESU) of Chinook salmon was listed as threatened under the ESA on March 24, 1999 (64 FR 10 14308), and its threatened status was reaffirmed on June 28, 2005 (70 FR 37160). NOAA Fisheries issued results of its 5-year review on August 15, 2011, and concluded that this species should remain listed as threatened (76 FR 50448).

Within the Cedar-Sammamish watershed, there are two distinct populations, or stocks, as classified by the Puget Sound Technical Review Team (PSTRT 2001): the Cedar River and the Sammamish River stocks. The latter includes what is now designated by the WRIA Technical Committee as the North Lake Washington Population and the Issaquah Population (King County 2005b). In this assessment, specific detail has been focused on the North Lake Washington and the Issaquah Populations as they are the populations represented in the action area. Additional species life history information is contained within Appendix F.

7.2.1.1 Species Use of the Action Area

Adult North Lake Washington Chinook salmon populations return to the watershed primarily between June and September. Adults typically enter the Sammamish River in late August or early September (Jeanes and Morello 2016). They spawn between September and November in tributaries to northern Lake Washington and the Sammamish River, including North Creek (King County 2005b). The Issaquah population spawns in the Lake Sammamish tributaries, including the Issaquah Creek system and Lewis and Laughing Jacobs Creek. After emerging from the gravel between January and April, juveniles migrate into Lake Washington or the Sammamish River between February and June (King County 2005b). Although some use the shallow littoral areas in Lake Washington or creek mouths for extended periods (Tabor et al. 2003), most juveniles move into deeper water by as early as May or June and out-migrate through the Ship Canal and Hiram M. Chittenden Locks. They enter saltwater between May and July (Lisi 2018) and continue rearing in the Puget Sound marine nearshore before migrating to the Pacific Ocean.

Within the action area, Chinook salmon use is documented in Juanita Creek, the Sammamish River, and North Creek (WDFW 2019c; NOAA Fisheries 2008). Chinook salmon are also presumed to be present within the action area in Perry Creek, including the North and South Forks, and Queensborough Creek, because there are no complete barriers located between North Creek and the proposed restored stream connection locations at North Fork Perry Creek and Queensborough Creek (WDFW 2019b).

<u>Juanita Creek</u>

Historically, Juanita Creek supported a small population of Chinook salmon throughout the basin (King County 2018a). Currently Chinook salmon are documented to be present just north of NE 140th Street, approximately 3,000 feet downstream of the I-405 crossing (WDFW 2019c, 2019d). However, there are two complete fish barriers: one located immediately downstream of the I-405 crossing and another one approximately 5,500 feet downstream just west of 108th Avenue NE (WDFW 2019c), indicating that there is extremely low possibility of Chinook being present within 300 feet of the I-405 crossing.

According to the WDFW Spawning Ground Database (WDFW 2019e), Chinook salmon sightings have not been documented during stream surveys conducted since 1990. Neither The Watershed Company (1998) nor Kerwin (2001) reported Chinook salmon use of Juanita Creek. Furthermore, spawning surveys did not identify any Chinook salmon adults spawning in Juanita Creek (King County 2002b). According to the King County's Salmon Watcher's program, no Chinook salmon were observed at the mouth of Juanita Creek between 2005 and 2015 (King County 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, and 2016). However, because of the WDFW documentation of Chinook salmon presence in Juanita Creek, it is assumed that there is the potential for re-occurrence in the action area. Chinook salmon life history stages potentially using Juanita Creek could include adults and juveniles.

Sammamish River and Tributaries

The Sammamish River primarily supports Chinook salmon migration, as spawning and most rearing occurs in upstream tributaries, including Bear Creek, Swamp Creek, Little Bear Creek, North Creek, and Issaquah Creek (WDFW 2019c, 2019d). Life history stages of Chinook salmon that could occur in the Sammamish River in the action area include migrating adults and juveniles. The Sammamish River is considered an important migration corridor for Chinook salmon (NOAA Fisheries 2008); however, high recorded temperatures and low dissolved oxygen during summer and early fall can pose thermal stress to Chinook salmon.

No Chinook salmon are documented to occur in Stream KL14, Stream 42, Stream 25.0L, and Par Creek (WDFW 2019a, 2019b). Based on the field observations, Stream KL14 and Stream 42 are small and shallow, lacking suitable habitat for Chinook salmon. For both streams, culverts located downstream of the Project area, near East Riverside Drive, likely block Chinook salmon access to the upstream reach where the Project is located. In Par Creek, poor water quality conditions prevent salmonids from using its system. Field observations at Stream 25.0L also indicate that suitable habitat is not present within the action area. Connectivity between North Creek and these streams (Par Creek and Stream 25.0L) is absent because they all connect to the City of Bothell's stormwater system downstream of the I-405 crossings.

North Creek and Tributaries

Chinook salmon are known to occur in North Creek within the action area (WDFW 2019c, 2019d; King County 2016; Kerwin 2001; Steward and Associates 2004). The mainstem channel serves as a migratory corridor for adult and juvenile Chinook salmon and provides spawning and rearing habitat. Tributaries of North Creek, including Perry Creek and Queensborough Creek, likely provide habitat for juvenile salmonids because there are no complete downstream migration barriers identified between North Creek and the Project area.

Chinook salmon presence in Perry Creek and Queensborough Creek is a conservative assumption because no existing data support their presence in these waterways. Juvenile Chinook salmon are only present in freshwater for a short period (typically less than 3 months) (Healy 1991). Therefore, Chinook salmon are less likely to be in these tributary streams than other salmonids with a longer freshwater residency, such as rainbow trout or coho (Wydoski and Whitney 2003).

Chinook salmon are not documented to be present in Stream 66 (WDFW 2019c, 2019d). Field observations at these streams also indicate that suitable habitat is not present within the action area. Connectivity between North Creek and these streams is absent because they all connect to the City of Bothell's stormwater system downstream of the I-405 crossings.

7.2.1.2 Puget Sound Chinook Salmon Critical Habitat

No critical habitat for Chinook salmon is designated within the action area. NOAA Fisheries published the final rule designating critical habitat for Puget Sound Chinook salmon in September 2005 (70 FR 52630). The rule identifies Lake Washington; however, the rule excludes all tributaries of Lake Washington and the entire Lake Sammamish and Sammamish River watersheds from the final critical habitat designations.

7.2.2 Puget Sound Steelhead

The Puget Sound distinct population segment (DPS) of steelhead was listed as threatened on May 11, 2007 (72 FR 26722). NOAA Fisheries issued results of a 5-year review for Puget Sound steelhead on August 15, 2011, and concluded that this species should remain listed as threatened (76 FR 50448).

Puget Sound steelhead exhibit two life history types (winter-run and summer-run) that are defined based on the timing of adult returns to their natal spawning streams and by their degree of sexual development at the time they enter freshwater (NOAA Fisheries 2005). The Puget Sound DPS, including the large Skagit and Snohomish River populations, is primarily composed of winter steelhead stocks, but also includes several small stocks of summer steelhead occupying limited habitat. Winter run, or ocean-maturing, steelhead enter freshwater between November and April at an advanced stage of maturation and spawn shortly thereafter, usually from March through June. Summer run, or stream- maturing, steelhead enter freshwater in a sexually immature condition, usually between May and October. These summer run steelhead remain in freshwater for several months before reaching maturity and spawning between January and April.

7.2.2.1 Species Use of the Action Area

In the action area, winter steelhead are documented to be present in the Sammamish River and North Creek (WDFW 2019c; Kerwin 2001; Steward and Associates 2004). Although their presence has not been documented, steelhead are may occur in Juanita Creek, Perry Creek, and Queensborough Creek based on suitable habitat and the presence of other anadromous species, such as Chinook and coho salmon. In general, summer steelhead are not known to be present in the action area or in the Lake Washington system (Kerwin 2001; NOAA Fisheries 2007).

Winter steelhead are documented to 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, such as Bear Creek and Issaquah Creek (WDFW 2019d). Adult steelhead typically enter rivers and streams in the Lake Washington system from November through May and spawn between February and June (Myers et al. 2015). However, historical use of steelhead in the Lake Washington Basin including the Sammamish River and North Creek has not been well documented, and presence of steelhead is considered low in the Lake Washington system (Myers et al. 2015; NOAA Fisheries 2013). According to the recent juvenile salmon production

studies by WDFW, only 12 steelhead migrants were captured in the Cedar River, and no steelhead were captured in Bear Creek in 2014 (Kiyohara 2015). In 2017, there were eight steelhead smolts captured in Cedar River and one steelhead smolt in Bear Creek (Lisi 2018).

Furthermore, very low numbers of steelhead have been observed at Chittenden Locks for the last decade, with few or no fish at the fish ladder for several years (Myers at al. 2015). Given the low steelhead counts at the Chittenden Locks and in the Lake Washington system, the abundance of steelhead in the action area is very low and likely infrequent.

Spawning has not been documented in any streams identified within the action area (WDFW 2019d), and no suitable spawning habitat is present in the action area as most of the streams lack side channels, connectivity to floodplains, ideal substrate, LWD, and covers from predators. Bear Creek is the nearest stream that is known to have spawning habitat for steelhead; however, only one to two wild steelhead smolt was captured at Bear Creek between April and June in 2016 and 2017 (Lisi 2018). Generally, juvenile steelheads spend in freshwater for two to three years and out-migrate from freshwater to saltwater between mid-March and early June. Due to lack of suitable habitat and low counts of juvenile steelhead further upstream of the action area, it is extremely unlikely that juvenile steelhead are present in the action area.

7.2.2.2 Puget Sound Steelhead Critical Habitat

The final rule to designate critical habitat for Puget Sound steelhead was published on February 24, 2016 (81 FR 9252). It includes approximately 2,031 miles of freshwater and estuarine habitat. The entire Lake Washington watershed is excluded from the critical habitat designation.

7.2.3 Coastal/Puget Sound Bull Trout

The Coastal/Puget Sound DPS of bull trout was listed as threatened under the ESA on November 1, 1999 (64 FR 58910). The Coastal Recovery Unit includes all watersheds within the Puget Sound basin and the marine nearshore areas of Puget Sound. The Coastal Recovery Unit consists of eight core areas, each with one or more local populations of bull trout and their habitat (USFWS 2015). Additional species life history information is contained within Appendix F.

7.2.3.1 Species Use of the Action Area

The USFWS considers the Lake Washington basin to be foraging, migration, and overwintering habitat for adult and subadult bull trout, but conclusive information on the bull trout population in the Lake Washington basin is not available (USFWS 2008). Within the action area, bull trout are documented to be present in the Sammamish River, but not in any of the tributaries (WDFW 2019c). Suitable spawning and rearing habitat are not present in any of the water bodies within the action area as the majority of stream habitat in the action area has degraded water quality and elevated water temperatures relative to bull trout habitat needs (USFWS 2008). Water temperatures in the Sammamish River and its tributaries likely preclude bull trout presence in the water bodies during most months (Goetz 1989).

Although a scarce few individual bull trout may occasionally enter the Sammamish River, they are likely adult and subadult bull trout migrants that enter the system solely in search of feeding

opportunities, when juvenile or spawning salmonids are present during winter months (USFWS 2008). As a result, bull trout use of the Sammamish River in the action area is likely to be restricted to foraging on prey fish found in the Sammamish River and migration between suitable thermal habitats.

7.2.3.2 Coastal/Puget Sound Bull Trout Critical Habitat

Effective October 18, 2010, the USFWS designated critical habitat for the Coastal/Puget Sound population of bull trout, which does not include any water body within the action area, including the Sammamish River (75 CFR 63898-64070). Lake Washington is the closest designated critical habitat to the action area.

8.0 EFFECT ANALYSIS

The proposed Project will have both direct and indirect effects on Chinook salmon, steelhead, and bull trout occurring within the action area, as well as effects caused by interrelated and interdependent actions associated with the proposed action.

8.1 DIRECT EFFECTS

Direct effects are defined as those effects that are directly related to the proposed action and occur as a result of Project construction and/or operation (WSDOT 2019a). Potential direct effects on yellow-billed cuckoo likely result from temporary construction noise exceeding the existing background noise as well as the visual presence of construction workers. Potential direct effects on Chinook salmon, steelhead, and bull trout include a temporary increase in sediment and turbidity during construction; a temporary increase in underwater noise during construction, dewatering and fish salvage; changes in water quality; and habitat alteration. There will also be beneficial effects to listed fish from the removal of three fish barriers in streams with listed fish.

8.1.1 Direct Effects to Surrounding Habitat and Terrestrial Species

8.1.1.1 Disturbance during Construction

Increased noise in the action area will occur due to noise associated with construction activities and construction equipment moving to and from the Project site. As described in Section 4.1, noise generated from construction equipment will extend approximately 1.9 miles over land before attenuating to ambient noise levels. General construction activities will require approximately 36 months of construction from 2021 to 2024. If yellow-billed cuckoos are present within the action area, construction noise and the presence of workers could temporarily disturb any cuckoos that may be in the vicinity. There are no other terrestrial listed species that would be disturbed by project construction.

8.1.1.2 Habitat Alteration

Besides riparian vegetation and wetland buffer impacts, up to 24 acres of trees are proposed for removal during construction. Based on the qualitative assessment of trees that will be disturbed, WSDOT determined that no suitable habitat for terrestrial species is present in the area where clearing will occur. No woody plants will be removed from the mitigation site at the University of Washington Bothell/Cascadia College campus, therefore, no potential habitat for yellow-billed cuckoo will be altered.

8.1.2 Direct Effects to Aquatic Species

8.1.2.1 Exposure to Construction-Related Sediment and Turbidity

Construction of the various Project elements, including the roadway, in-water work, retaining walls, and stormwater treatment facilities, could temporarily introduce fine sediments and turbidity into the streams of the action area through erosion and sedimentation. Sedimentation and turbidity will be expected to temporarily increase in areas where construction activities occur within or adjacent to rivers and streams that cross, or flow adjacent to, I-405 within 200 feet from the in-water work locations. Additionally, in the Sammamish River, turbidity could locally

increase during the pier removal activity, within 300 feet downstream from the pier removal locations.

Elevated turbidity has been reported to cause physiological stress, reduce growth, and adversely affect survival of ESA-listed fish. While juveniles of many salmonid species thrive in rivers and estuaries with naturally high concentrations of suspended solids, studies have shown that concentrations of suspended solids (as well as the duration of exposure) can be an important factor in assessing risks posed to salmonid populations (Servizi and Martens 1987). However, these effects will be short term and localized in nature, and turbidity levels are not expected to exceed levels associated with effects on ESA-listed species outside of the mixing zones. As a result, temporary increases in sediment and turbidity levels are not expected to cause in any long-term effects to ESA-listed fish or their forage species. If listed fish are present within the mixing zone during in-water work activities, exposure to increased turbidity could be sublethal to them. However, because the occurrence of Chinook salmon, steelhead, and bull trout is unlikely in the action area during the approved in-water work window, turbidity impacts to these species are insignificant.

Construction BMPs listed in Section 2.12 will also be implemented to limit and minimize the amount of construction-related turbidity from the Project site. With regard to construction-related turbidity, the contractors comply with Ecology's State Water Quality Standards (WAC 173-201) or a mixing zone granted by Ecology in a 401 Water Quality Certification. For systems such as the Sammamish River, which is expected to have a flow greater than 100 cubic feet per second at the time of the turbidity release, the allowable mixing zone is 300 feet downstream of the in-water work activity. Project activities will be monitored to ensure that construction-related turbidity levels do not exceed five nephelometric turbidity units (NTU) above background levels. Should this occur, construction will halt and the BMPs will be inspected and modified as necessary to achieve compliance.

8.1.2.2 Underwater Noise

Temporary noise impacts will occur during Project construction due to the use of a vibratory hammer for installation of the sheet piles around the four piers in the Sammamish River during the approved in-water work window. Impact pile driving will occur in uplands, and no impact pile driving is anticipated to occur in the Sammamish River or any water bodies as a result of the Project. Vibratory installation up to eight sheet piles around one pier is estimated to take approximately two working days (16 to 20 hours). Although up to two piers may be removed at the same time, it is estimated that driving eight sheet piles would take up to 8 working days (64 to 80 hours). Therefore, noise impacts are expected to take approximately 80 hours over a single construction season. During pile driving, increase in underwater noise is expected. However, underwater noise will only be propagated when water levels are greater than 2 feet due to the amplitude of the sound waves (WSDOT 2019a). This condition is predicted to occur mostly in the center of the channel, as the channel is deepest in this area. In-water work can only occur during the approved in-water work window and timing of vibratory driving will avoid the juvenile outmigration period.

The NOAA Fisheries thresholds for behavioral disturbance to fish is 150 dBRMS. To assess the potential behavioral disturbance, the NOAA Fisheries recommends using the Practical Spreading Loss Model to determine underwater noise attenuation rates. The NOAA Fisheries calculator

was used to determine distance to current behavioral disturbance thresholds generated during installation of the sheet piles, and it was estimated that behavioral effects occur as far as 33 feet (100 meters) from the sheet pile driving activities. The estimated underwater sound for installation of the sheet piles is unlikely to result in injury to juvenile salmonids as they are less likely to be present in the Sammamish River during the in-water work window. In addition, vibratory hammers avoid the abrupt over and under pressure changes exhibited by impact hammers. As a result, impacts on fishes or other aquatic organisms have not been observed in association with vibratory hammers (WSDOT 2019a; NOAA Fisheries 2012). Furthermore, migrating salmon and steelhead are accustomed to the noisy environment of turbulent streams, plunge pools at the base of cascades and waterfalls, etc. Low-intensity sound generated by work conducted out of the water, away from the river when fish may be rearing or migrating through the project vicinity would not be expected to have any harmful effects. Multiple years of work in the Lake Washington Ship Canal where a variety of acoustic deterrence devices were employed failed to show any evidence of delay in the migration of steelhead (Tabor et al. 1994). No piles will be installed for temporary work bridges as the temporary bridges can span over the Sammamish River; therefore, no pile driving is anticipated to occur during installation of the temporary work bridges.

8.1.2.3 Dewatering and Fish Salvage

Prior to pier removal at the Sammamish River and work at fish barrier removal locations, the in-water construction area will be isolated. Approximately 460 to 860 square feet of the work area around each pier will be isolated with sheet piles or cofferdam at the Sammamish River. If pumps are used to temporarily bypass water or to dewater residual pools or cofferdams, pump intakes shall be screened to prevent aquatic life from entering the intake. Some handling of listed salmonid species may occur during the pier removal work in the Sammamish River. WSDOT biologists will follow the WSDOT Fish Exclusion Protocols and Standards for safe capture and removal of fish from the isolated work area if necessary. It is unlikely but possible that fish may need to be excluded or handled during Project activities in the Sammamish River.

At fish barrier removal locations, the in-water work area at each location varies. However, the in-water work area is estimated to be relatively small, as most of the channels are narrow, and the majority of the work will occur outside of the existing channel as channels will be realigned at the crossings outside of the OHWMs. Approximately 500 to 2,000 square feet of the work area is estimated to occur within the existing stream channel at the fish barrier correction location. The work area will be isolated with inflatable or sand bags at each fish barrier correction location. Any fish present within the in-water work area will be removed prior to dewatering. Following the WSDOT Fish Exclusion Protocols and Standards, herding listed fish and/or capture and release fish may be required for in-water work at North Fork Perry Creek and Queensborough Creek as the in-water work area likely isolates the entire wetted channel width.

As stated in Section 7, Chinook salmon, steelhead, and bull trout are unlikely to be present in the action area during the approved in-water work window. However, potential direct take of ESA-listed fish, in the unlikely event that they are present during salvage, will be in the form of harassment or harm associated with removal operations. The capture and handling of fish may result in their injury or death. If ESA-listed fish are present during fish salvage activities, all fish will likely be subadults or adults. As such, they should not be missed during salvage efforts. If fish are missed during the salvage operations, they will likely suffer harm or mortality. The

number of fish missed during the salvage operation will be minimized by implementing WSDOT Fish Exclusion Protocols and Standards that were developed to standardize the process.

8.1.2.4 Stormwater Input

Within the Project corridor, the total existing PGIS is approximately 128 acres, and 44 acres of that PGIS receives stormwater treatment. The proposed Project will add approximately 24 acres of PGIS, 100 percent of which would be treated. In addition, 20 acres of the existing PGIS will be retrofitted to provide enhanced stormwater treatment that is in compliance with current requirements. Once the proposed Project is built, 89 acres of PGIS will be treated. Table 9 provides a summary comparison of existing and proposed PGIS quantities and treatment BMPs for each TDA.

The effects on listed species associated with the changes to stormwater management have been evaluated in accordance with the 2009 Memorandum of Agreement between WSDOT, FHWA, NOAA Fisheries, and USFWS, which includes the use of the Western Washington Highway Runoff Dilution and Loading Stormwater (HI-RUN) Model. HI-RUN evaluates existing and proposed pollutant loads prior to discharge into a receiving water body. It can also evaluate pollutant concentrations after discharge into a receiving water body and calculate a zone of effect based on dilution characteristics and established injury standards for fish. The specific pollutants evaluated are total suspended solids (TSS), total zinc (TZn), total copper (TCu), dissolved zinc (DZn), and dissolved copper (DCu). The model was applied based on the current conceptual stormwater management design.

In general, the proposed Project will reduce the pollutant loads and concentrations by constructing multiple stormwater facilities along the Project corridor. The significant increase in stormwater treatment acreage across the Project is the primary factor in improving water quality conditions. The project will maintain the existing levels of treatment, treat stormwater from all new PGIS, and treat an additional 20 acres of PGIS. The HI-RUN results are presented in their entirety in Appendix D. The following sections include the results for TDAs at the Sammamish River and North Creek where pollutants are most likely to reach ESA species-bearing waters.

For water quantity, the Project is expected to reduce peak flows from I-405 into streams, except for the Sammamish River, along the Project corridor. The Project will keep the existing facilities to detain flows from the existing PGIS, and the proposed facilities will detain runoff from the new PGIS in TDAs where flow controls are required. The Project proposes to provide detention for stormwater discharges to North Creek, Stream 25.0L, North Fork Perry Creek, and Queensborough Creek. Overall, no effects on water quantity are anticipated to occur from the Project. Stormwater analysis details are provided in the next section only for those TDAs that discharge to waters that have listed fish.

Threshold Discharge Area G2

TDA G2 drains into the Sammamish River, where Puget Sound Chinook salmon, Puget Sound steelhead, and Coastal/Puget Sound bull trout are documented to be present. Figure 20 shows the location of the new outfall at the Sammamish River.

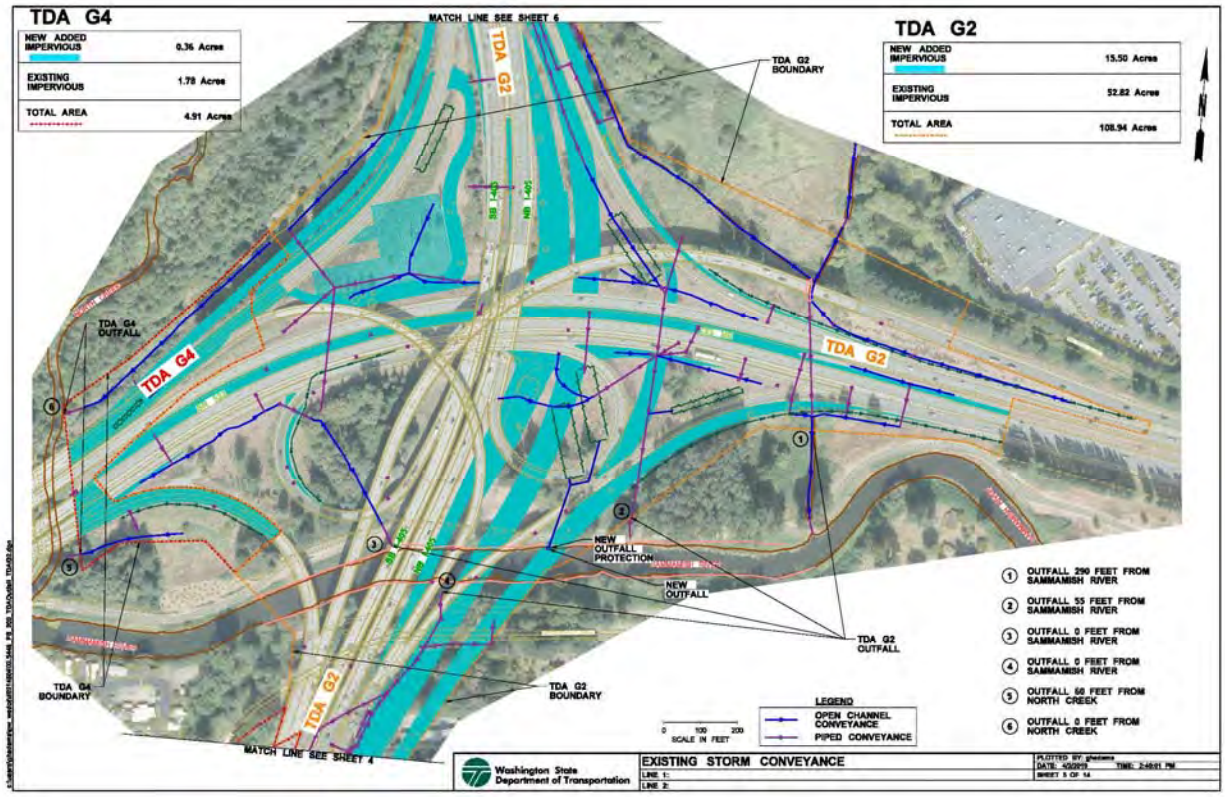
Table 9. Combined Summary of Existing and Proposed Pollution-Generating Impervious Surfaces

Basin	Receiving Water Body	TDA	Listed Species Present at Outfall	Existing PGIS in TDA (acres)	Type of Facility	Existing Treatment (acres)	Proposed New PGIS in TDA (acres)	Type of Facility	Proposed Treated PGIS Post Project (acres)
Sammamish	Stream KL14	F2	Not Present	4.11	n/a	0	0.06	n/a	0
	Stream 42	F3	Not Present	1.40	n/a	0	0	n/a	0
	Sammamish River	G2	Puget Sound Chinook	52.82	CABS	10.65	15.50	CABS	42.43
			Puget Sound steelhead		MFD	3.02			
			Coastal/Puget Sound Bull trout		Wet Vault	3.30		MFD	4.68
	North Creek	G4	Puget Sound Chinook	1.49	MFD	0.29	0.36	CABS	0.46
			Puget Sound steelhead						
	North Creek	I1	Puget Sound Chinook	20.84	MFD	3.52	1.88	MFD	2.87
			Puget Sound steelhead					CABS	3.62
North Creek	Stream 66	I2	Not Present	3.76	MFD	0.55	0.46	MFD	0.63
								CABS	1.03
	Stream 25.0L	I3	Not Present	2.61	MFD	0.91	0.33	MFD	1.63
	Stream 70	I4	Not Present	4.51	MFD	1.26	0.75	MFD	1.54
								CABS	0.82
	Stream C-77	J1	Not Present	4.08	MFD	1.21	0.70	MFD	1.67
								CABS	0.50
					CSW	0.89		CSW	0.89
	North Fork Perry Creek	J2	Puget Sound Chinook Puget Sound steelhead	13.19	Bio-Swale	4.42	1.75	CABS	14.05
					Wet Vault	4.45			

Basin	Receiving Water Body	TDA	Listed Species Present at Outfall	Existing PGIS in TDA (acres)	Type of Facility	Existing Treatment (acres)	Proposed New PGIS in TDA (acres)	Type of Facility	Proposed Treated PGIS Post Project (acres)
North Creek, cont.	North Creek	NW01	Puget Sound Chinook	1.92	n/a	0	0.11	n/a	0
			Puget Sound steelhead						
	Queensborough Creek	NW02	Puget Sound Chinook Puget Sound steelhead	17.25	Wet pond	9.35	2.09	Wet Pond	9.35
					MFD	0.37		CABS	1.40
								MFD	0.71
								MF	0.70
	North Creek	NW03	Puget Sound Chinook	0.39	n/a	0	0.11	n/a	0
			Puget Sound steelhead						
Total				128	n/a	44	24		89

CABS = compost-amended vegetated bioswale; MF = media filter; MFD = media filter drain; n/a = not applicable; PGIS = pollution-generating impervious surfaces; TBD = to be determined; TDA = threshold discharge area

Figure 20. New Outfall Location at the Sammamish River



A HI-RUN end-of-pipe loading analysis was conducted on the Sammamish River as shown in Appendix D. Table 10 shows end-of-pipe loading results, which indicate that the median pollutant loads of total suspended solids, total copper, and total zinc will all be reduced after the Project. However, median pollutant loads of dissolved copper and dissolved zinc will be slightly increased.

Table 10. HI-RUN Results for Threshold Discharge Area G2 – Discharging to the Sammamish River

Parameter	Median Existing Load (pounds/year)	Median Proposed Load (pounds/year)	Distances to Dilution Below Effect Threshold Values, if Applicable (feet)
Total suspended solids	17,403	10,801	
Total copper	4.72	3.7	
Dissolved copper	1.35	1.5	< 1
Total zinc	28	21	
Dissolved zinc	9.21	9.4	< 1

The P(exceed) value for dissolved zinc is 0.5, above the P(exceed) 0.45 threshold, requiring a dilution analysis per HI-RUN protocol. The model results suggest that pollutant loadings and concentrations for all pollutants will be relatively the same or lower than pre-Project conditions for discharges to the Sammamish River. Because the P(exceed) value is greater than the

threshold, a dilution analysis is required in this case. The dilution analysis shows that dissolved copper and dissolved zinc concentrations at the outfall location in the Sammamish River will be below zinc and copper biological thresholds within less than one foot of the outfall for all months of the year (Appendix D).

Stormwater runoff in this TDA will be treated with enhanced treatment methods and discharged to compost amended vegetated bioswales (CABS) and media filter drains (MFDs) or similar BMPs before entering the Sammamish River. All three ESA-listed species occur in the Sammamish River. As a result of significant stormwater treatment retrofit, dissolved copper and zinc will dilute to background thresholds for listed salmonids within less than 1 foot of the discharge point. The outfall location at the Sammamish River is on a steep shoreline with little native vegetation, which does not provide suitable habitat for these listed species, as shown in Figure 21.

Figure 21. Sammamish River at the Proposed Outfall Location

Threshold Discharge Area G4

TDA G4 drains into North Creek, which is documented to support habitat for Puget Sound Chinook salmon and Puget Sound steelhead.

A HI-RUN end-of-pipe loading analysis was conducted on TDA G4 as shown in Appendix D. Table 11 shows end-of-pipe loading results, which indicate that the median pollutant loads of total suspended solids, dissolved copper, total copper, total zinc, and dissolved zinc will all be reduced after the Project.

Table 11. HI-RUN Results for Threshold Discharge Area G4 – Discharging to North Creek

Parameter	Median Existing Load (pounds/year)	Median Proposed Load (pounds/year)
Total suspended solids	679	217
Total copper	0.171	0.064
Dissolved copper	0.04	0.022
Total zinc	1.04	0.37
Dissolved zinc	0.299	0.14

The P(exceed value) for dissolved zinc is 0.268, below the P(exceed) 0.45 threshold (Appendix D). The HI-RUN protocol requires a "land-area based" dilution analysis if the P(exceed) values for dissolved zinc is less than the 0.35 threshold value and water quality of the receiving water body is not properly functioning (WSDOT 2019a). As mentioned in Section 6.2.3.1, North Creek is listed on the 303(d) list for dissolved oxygen, bioassessment, and temperature and is considered not properly functioning. To perform the land-area based dilution analysis, the impervious area for the TDA being analyzed is compared to the total contributing basin area to the receiving water upstream of the Project discharge. If the TDA represents 5 percent or less of the total upstream basin area, it is assumed that the receiving water will have sufficient dilution capacity to mitigate potential impacts from the Project if background water quality conditions are not degraded.

TDA G4 is approximately 5 acres while the total upstream area contributing drainage to the stream is approximately 1,800 acres, indicating that the contribution of this TDA is negligible (<0.3 percent) and much less than the 5 percent threshold. As a result, North Creek is expected to have sufficient dilution capacity to mitigate potential impacts from the Project if background water quality conditions are not degraded. Stormwater runoff in this TDA will be treated with enhanced treatment methods and discharged to CABS and MFD strips before entering North Creek. Puget Sound Chinook salmon and steelhead potentially occur in North Creek.

Threshold Discharge Area I1

TDA I1 drains into North Creek, which is documented to support habitat for Puget Sound Chinook salmon and Puget Sound steelhead. Figure 22 shows the extent of the TDA boundary and the existing outfall location.

A HI-RUN end-of-pipe loading analysis was conducted on TDA I1 as shown in Appendix D. Table 12 shows end-of-pipe loading results, which indicate that the median pollutant loads of total suspended solids, total copper, total zinc, and dissolved zinc will be slightly higher than the baseline conditions after the Project.

Figure 22. Threshold Discharge Area I1 of North Creek

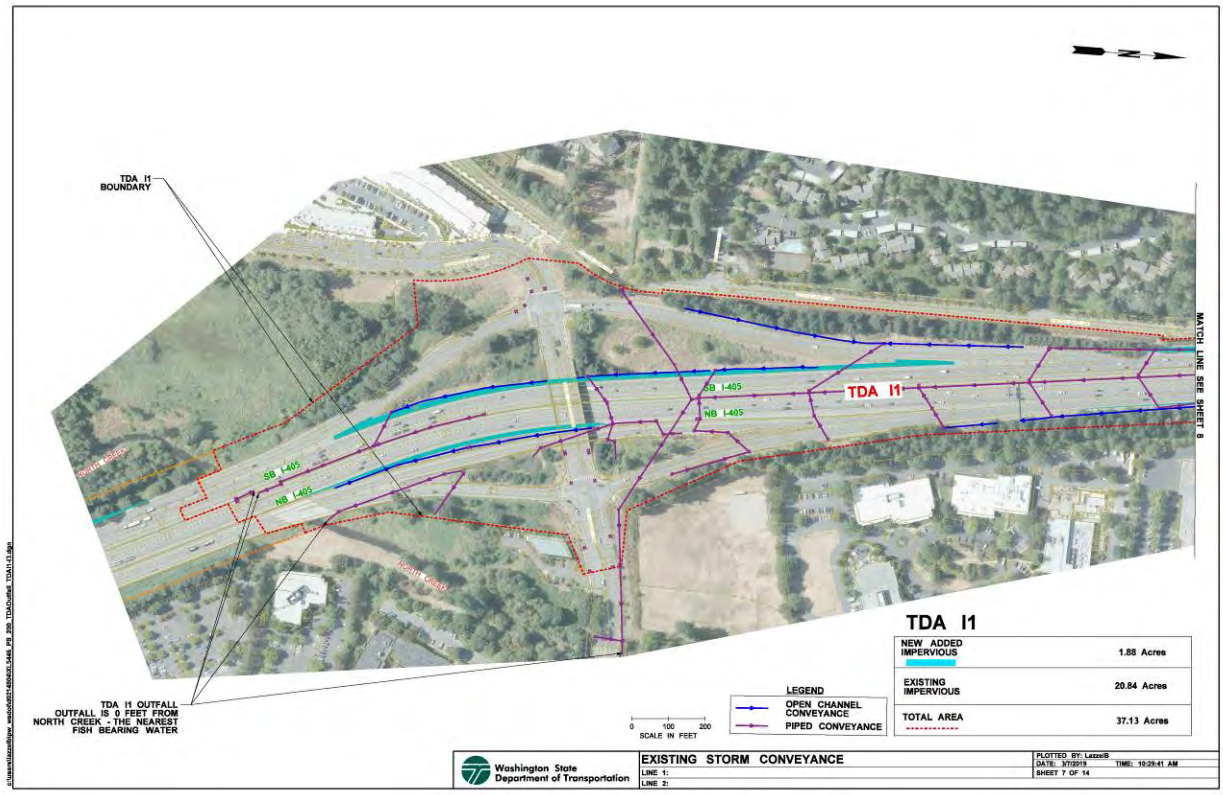


Table 12. HI-RUN Results for Threshold Discharge Area I1 – Discharging to North Creek

Parameter	Median Existing Load (pounds/year)	Median Proposed Load (pounds/year)	Baseline Distance Downstream to Meet Biological Threshold (feet)	Proposed Distance Downstream to Meet Biological Threshold (feet)
Total suspended solids	8,000	8,028	-	-
Total copper	2.01	2.1	-	-
Dissolved copper	0.484	0.55	<1 to 2	<1 to 2
Total zinc	12.4	13	-	-
Dissolved zinc	3.57	3.9	<1 to 57	<1 to 48

The P(exceed value) for dissolved zinc is 0.53, above the P(exceed) 0.45 threshold, requiring a dilution analysis per HI-RUN protocol. The model results suggest that pollutant loadings and concentrations for all pollutants will be higher than pre-Project conditions for discharges to North Creek. The dilution analysis shows that the Project is expected to reduce the potential exposure to stormwater concentrations for listed species as dissolved copper and zinc are modeled to dilute to background thresholds under the proposed conditions at a shorter distance than the distance under the existing conditions.

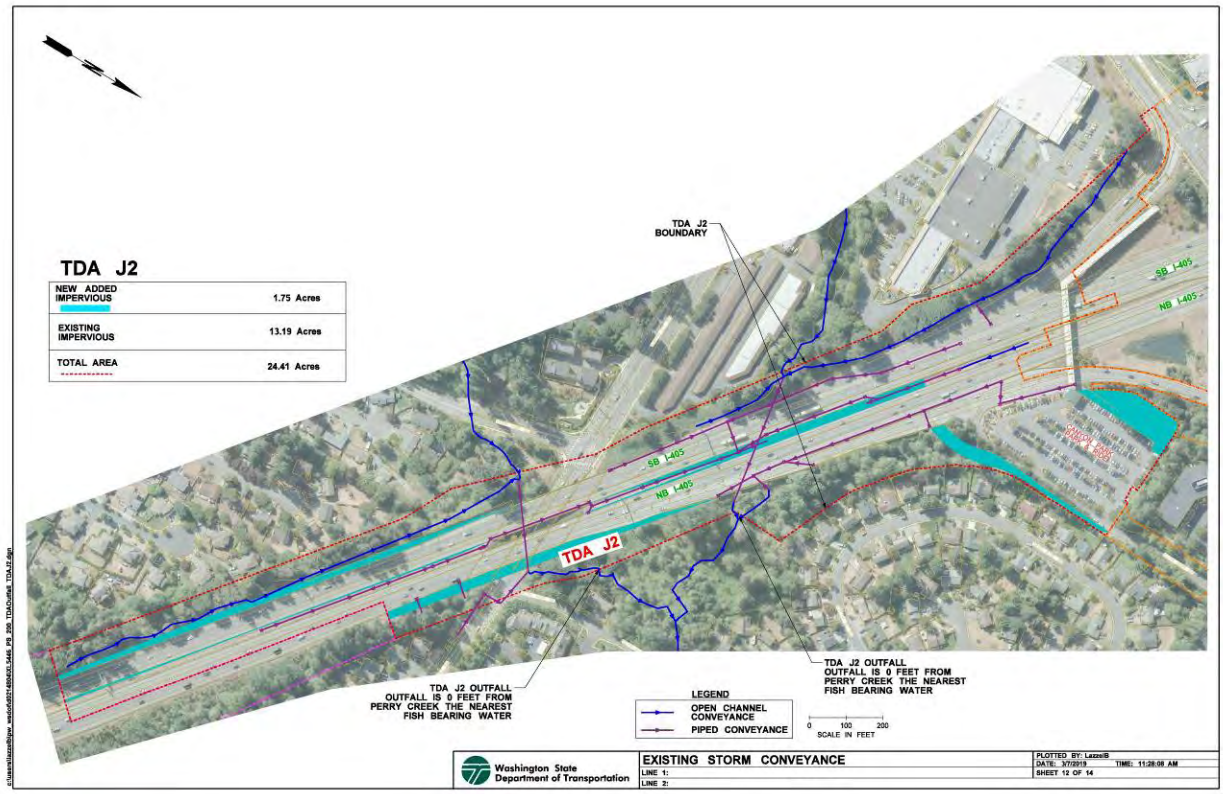
Stormwater runoff in this TDA will be treated with enhanced treatment methods and discharged to CABS and MFD strips before entering North Creek. Puget Sound Chinook salmon and

steelhead are documented to be present in North Creek. Dissolved copper and zinc will dilute to background thresholds for listed salmonids at a shorter distance than the distance under the existing conditions. The discharge point of TDA I1 is located on the right bank of North Creek. The riparian habitat along this channel is dominated by reed canarygrass and Himalayan blackberry.

Threshold Discharge Area J2

TDA J2 drains into north and south forks of Perry Creek. Both streams are presumed to provide habitat for Puget Sound Chinook salmon and Puget Sound steelhead. Figure 23 shows the extent of the TDA boundary and the new outfall locations at North Fork Perry Creek.

Figure 23. Threshold Discharge Area J2 of North and South Forks of Perry Creek



A HI-RUN end-of-pipe loading analysis was conducted on TDA J2 as shown in Appendix D. Table 13 shows end-of-pipe loading results, which indicate that the median pollutant loads of total suspended solids, total copper, total zinc, and dissolved zinc will be all be reduced from the baseline conditions after the Project; however, the median pollutant loads of dissolved copper will result in slight increase.

Table 13. HI-RUN Results for Threshold Discharge Area J2 – Discharging to North Fork Perry Creek

Parameter	Median Existing Load (pounds/year)	Median Proposed Load (pounds/year)	Baseline Distance Downstream to Meet Biological Threshold (feet)	Proposed Distance Downstream to Meet Biological Threshold (feet)
Total suspended solids	3,510	1,945	-	-
Total copper	1.03	0.79	-	-
Dissolved copper	0.358	0.37	7 to >1,000	6 to >1,000
Total zinc	6.01	4.2	-	-
Dissolved zinc	2.29	2.1	>1,000	35 to >1,000

The P(exceed value) for dissolved zinc is 0.461, above the P(exceed) 0.45 threshold. Because the P(exceed) value is greater than the threshold, a dilution analysis is required in this case. The dilution analysis shows that the Project is expected to reduce the potential exposure to stormwater concentrations for listed species for all months of the year. Dissolved copper and zinc are modeled to dilute to background thresholds under the proposed conditions at a shorter distance than the distance under the existing conditions.

Stormwater runoff in this TDA will be treated with enhanced treatment methods and discharged to CABS before entering North Fork Perry Creek. Puget Sound Chinook salmon and steelhead potentially occur in North Fork Perry Creek. Dissolved copper and zinc will dilute to background thresholds for listed salmonids at a shorter distance than the distance under the existing conditions by approximately 1 to 1,000 feet. As described in Section 2.9.1, there are two outfalls discharging into North Fork Perry Creek. The new outfall locations at East Fork Perry Creek are dominated by salmonberry and Himalayan blackberry, as shown in Figure 24 and Figure 25.

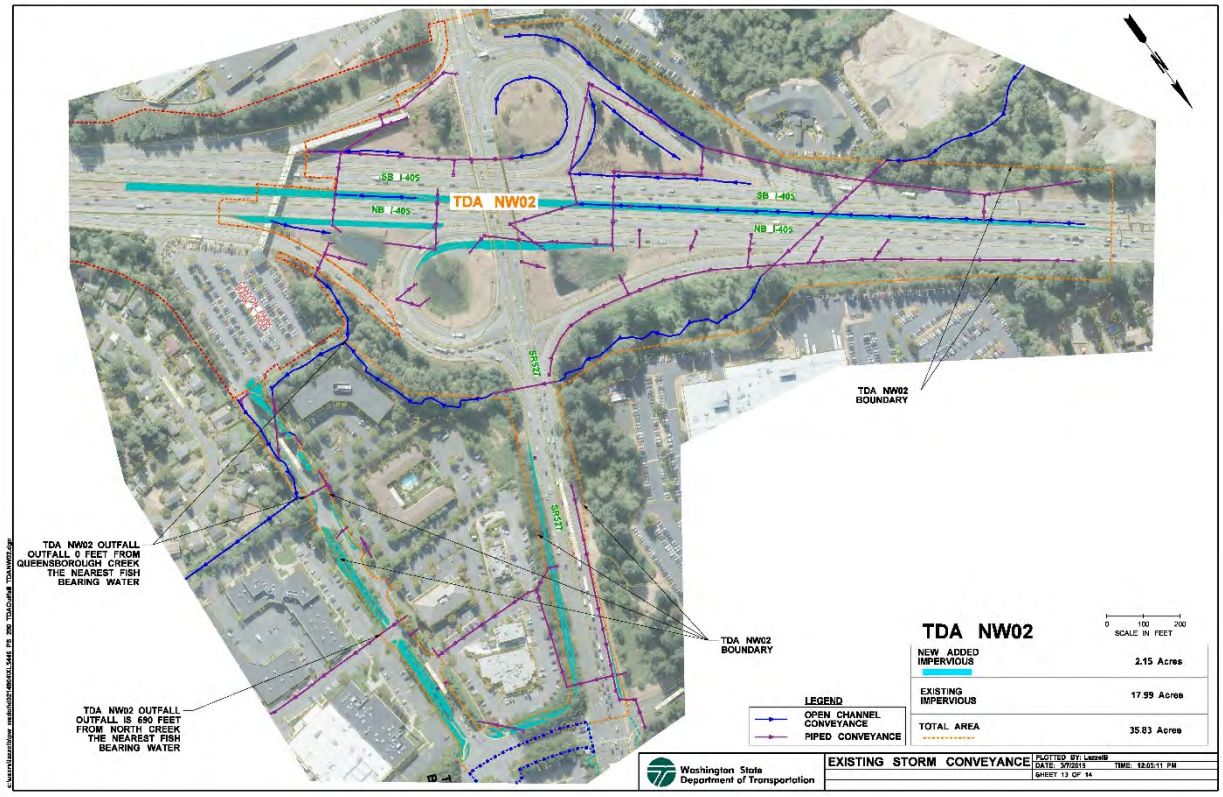
Figure 24. North Fork Perry Creek at the Proposed Outfall Location East of I-405

Figure 25. North Fork Perry Creek at the Proposed Outfall Location West of I-405

Threshold Discharge Area NW02

TDA NW02 drains into Queensborough Creek, which is presumed to support habitat for Puget Sound Chinook salmon and Puget Sound steelhead. Figure 26 shows the extent of the TDA boundary and the existing outfall location.

Figure 26. Threshold Discharge Area NW02 of Queensborough Creek



A HI-RUN end-of-pipe loading analysis was conducted on Queensborough Creek as shown in Appendix D. Table 14 shows end-of-pipe loading results, which indicate that the median pollutant load of total suspended solids will be reduced, total copper will remain the same, and the median pollutant loads of dissolved copper, total zinc, and dissolved zinc will be slightly increased after the Project.

Table 14. HI-RUN Results for Threshold Discharge Area NW02 – Discharging to Queensborough Creek

Parameter	Median Existing Load (pounds/year)	Median Proposed Load (pounds/year)	Baseline Distance Downstream to Meet Biological Threshold (feet)	Proposed Distance Downstream to Meet Biological Threshold (feet)
Total suspended solids	3,770	3,692	-	-
Total copper	1.2	1.2	-	-
Dissolved copper	0.455	0.49	<1	<1
Total zinc	6.77	6.8	-	-
Dissolved zinc	2.82	3	<1	<1

The P(exceed) value for dissolved zinc is 0.529, above the P(exceed) 0.45 threshold. Because the P(exceed) value is greater than the threshold, a dilution analysis is required in this case. The dilution analysis shows that the Project is expected to increase the potential exposure to dissolved copper concentrations for listed species for January, March, April, November, and December. The dilution distance to the biological threshold for dissolved zinc is not expected to exceed the distance under existing conditions (Appendix D).

Stormwater runoff in this TDA will be treated with basic and enhanced treatment methods such as CABS and MFD before entering Queensborough Creek. Puget Sound Chinook salmon and steelhead are presumed to be present in Queensborough Creek. Dissolved copper will dilute to biological thresholds for listed salmonids at the same or a shorter distance than the distance under the existing conditions. The existing outfalls of TDA NW02 are located on the right bank of Queensborough Creek near the Canyon Park Park and Ride and at 17th Avenue SE (Figure 26). The riparian habitat along this channel is dominated by salmonberry and Himalayan blackberry.

8.1.2.5 Habitat Alteration

In-stream Habitat

No new or temporary columns will be installed below OHWM at the Sammamish River; therefore, no permanent alterations to in-stream habitat will occur at the Sammamish River. The installation of the cofferdam will dewater and temporarily displace streambed habitat in the Sammamish River and at fish barrier removal locations. Although this effect will be temporary in nature, an impact to prey species (invertebrates) is likely to occur. The physical disturbance of instream habitat would primarily occur at the Sammamish River. A total of 1,840 square feet of the channel will be temporarily affected by the pier removal work in the Sammamish River. In addition, anchoring the temporary barge, if used, could potentially disturb existing benthic habitat. No spawning habitat for listed fish is present within the Sammamish River where the temporary barge will be anchored. At each end of the fish barrier removal locations, approximately 500 to 2,000 square feet of the channel will be temporarily affected. Instream isolation could result in an immediate and direct loss of benthic productivity from the dewatered construction zone. However, substrates at the pier removal work and bridge demolition in the Sammamish River are mostly silt and clay and exhibit limited benthic habitat. Substrates on streams proposed for fish barrier correction are also primarily fine sediments. As a result, benthic habitat within the instream construction areas is also limited. Additionally, temporarily affected areas are expected to recover relatively quickly by recolonization and recruitment from nearby undisturbed areas; therefore, displacement of benthic habitat from dewatering is expected to be limited in severity, extent, and duration.

Riparian Habitat

The Project will result in the permanent removal of approximately 1 acre of riparian habitat and the temporary disturbance of approximately 2 acres of riparian habitat from construction and demolition of the bridge work at the Sammamish River and culvert replacement work at seven streams. Disturbance of permanent and temporary riparian areas could potentially cause some localized alteration of the adjacent aquatic habitat, including changes in shading patterns, reduction of LWD recruitment, and changes in organic material input. Riparian vegetation

removal at the Sammamish River will be limited to invasive removal along the streambanks near the in-water work area. The banks are primarily dominated by Himalayan blackberry, and trees are absent. Some tree removal may be required for construction access at the fish barrier correction locations; however, the streambanks at these locations will be replanted with native species once the new culverts are in place.

Shading

The Project will construct three new bridges spanning the Sammamish River and will remove two existing bridges. The placement of the new over-water structures will alter the intensities and pattern of in-water shading. Shade effectively creates a different habitat type that contrasts with the adjacent aquatic environment where no shade is present. The transition between light and shade (edge effect) is considered a potential influence on fish behavior and habitat selection.

By removing the existing bridges and replacing them with three bridges, the Project will increase approximately 13,000 square feet (0.3 acre) of over-water shading. The two existing bridges are approximately 45 feet wide whereas the new bridges will be approximately 65 to 80 feet wide. The new bridges will be similar heights as the existing bridges, approximately 35 to 40 feet above the OHWM, and located in similar positions as the existing bridges. The Project will widen the existing over-water shading by 0.3 acre in three locations.

The Project could also build temporary work bridges during bridge demolition work, which will have approximately 8,000 square feet (0.18 acre) of over-water shading adjacent to the existing bridges for up to 16 weeks over three years during construction. This permanent and temporary shading can result in reduced aquatic vegetation density; however, there limited aquatic vegetation is present in the Sammamish River where the new bridges will be constructed. As a result, the shading effects on aquatic vegetation are considered negligible.

However, increasing the footprint of the over-water structures has the potential to alter migration rates and routes for Chinook salmon, especially for juveniles (Celedonia et al. 2008a, 2008b). Although the existing data do not indicate that the existing bridges at the Sammamish River have influence on the migration behavior of adult salmonids, the temporary and new wider bridges could potentially alter normal migration behavior of juvenile Chinook salmon.

Artificial Lighting

The Project will install new light fixtures over the two ramp bridges, and if nighttime work is necessary for bridge construction, temporary nighttime lighting will be used. Artificial lighting has the potential to affect listed species, especially juvenile salmonids. Artificial lighting could potentially increase predation opportunities of juvenile salmon as it serves as an attractant to juvenile salmonids and their predators. The Project will use 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.

8.1.2.6 Fish Barrier Corrections

WSDOT is proposing to replace or mitigate all fish barriers identified by WDFW to comply with a federal permanent injunction (United States et al. vs. Washington et al. No C70-9213, Subproceeding No. 01-1, dated March 29, 2013). WSDOT is currently coordinating with WDFW and the Muckleshoot Indian Tribe to finalize the numbers of fish barriers along the Project corridor. Currently, WSDOT is proposing to replace six culverts at Par Creek at the SR 522 crossing, Stream 25.0L at I-405 MP 25.00, Stream 66 at I-405 MP 25.35, North Fork Perry Creek at I-405 MP 26.46, and Queensborough Creek at I-405 MP 26.87 and at the SR 527 crossing. Of these culverts, North Fork Perry Creek and Queensborough Creek provide habitat for Puget Sound Chinook and steelhead.

There are downstream fish barriers that prevent ESA-listed fish from being present in three of the culvert replacement locations (Par Creek, Stream 25.0L, and Stream 66) that will preclude access to the newly available habitat once culverts are replaced. Therefore, there will be no habitat gains for the ESA-listed fish on Par Creek, Stream 25.0L, and Stream 66. However, these barrier replacements will have future beneficial effects on listed species if any of the downstream culverts are replaced in the future. For North Fork Perry Creek and Queensborough Creek, the Project is anticipated to provide the listed fish greater access to upstream habitat by removing the fish barriers. Replacing the existing culverts with restored stream connections will add 8,281 feet of access for North Fork Perry Creek and 6,663 feet of access for Queensborough Creek providing additional habitat for Chinook salmon and steelhead.

8.2 INDIRECT EFFECTS

Indirect effects are those effects that are caused by the action and occur later in time but are still reasonably certain to occur (WDOT 2019). WSDOT has developed a ten-step approach for consideration of changes to ecological systems resulting in altered predator/prey relationships, long-term habitat alteration, and anticipated changes in human activities, including changes in land use. This ten-step approach for analyzing potential land use indirect effects was approved in 2009 by FHWA, NOAA Fisheries, and USFWS (WSDOT 2019a).

The guidance is a step-by-step approach to assess indirect effects by posing a series of questions about the proposed Project that are used to determine whether it will result in indirect effects related to induced growth. These questions are listed below, along with their applicability to the Project, and are also included in Appendix G.

1) Will the project create a new facility?

The proposed Project will modify and improve an existing transportation facility. The Project will not create a new facility but will increase the capacity of the existing transportation system.

2) Will the project improve a level of service (LOS) of an existing facility as established in local comprehensive plans?

The Project will increase I-405 volumes, and, in turn, more vehicles will use the local streets to enter and exit the highway. While the I-405 traffic volumes will increase, the proposed Project improvements at the intersection of 220th Street with both SR 527 and 17th Avenue will

maintain peak hour LOS within acceptable limits. 3) Determine if the transportation project has a causal relationship to a land use change by answering the following questions:

a) Is there a building moratorium in place that is contingent on the proposed road improvements?

b) Are there any land use changes tied by permit condition to the proposed project?

c) Do the project's NEPA documents identify other actions or land use changes caused by or resulting from the project that are reasonably certain to occur?

d) Do development plans include scenarios for the planning area where land use differs based on a "build" and "no build" outcome related to the proposed project?

e) Is there land use change that is likely to occur at a different rate as a result of the project?

Planning documents reviewed include the most current local Transportation Improvement Program (TIP) and Capital Facilities Program documents, regional Transit Development Plans, Regional Transportation Plan (RTP), regional TIP, Statewide Transportation Improvement Program (STIP), and future private development plans. Based on the review of these documents, there is no development contingent or dependent on the proposed Project. Additionally, there are no anticipated changes in land use or land use patterns as a result of the Project. Therefore, the Project will have no indirect effects related to development, land use or land use patterns on Puget Sound Chinook salmon, Puget Sound steelhead, and Coastal/Puget Sound bull trout.

8.3 INTERRELATED AND INTERDEPENDENT ACTIONS

The effects of actions that are interrelated to or interdependent with the proposed Project must also be considered when defining the action area for the proposed Project and considering the potential effects on listed species and habitats (WSDOT 2019a). Interdependent actions are defined as those actions that have no independent utility apart from the proposed action. Interrelated actions are those actions that are a part of the proposed action and are dependent upon that action for their justification (WSDOT 2019a). At this time, no interrelated and interdependent actions are identified for the Project. Sound Transit is planning to implement a bus rapid transit (BRT) project along I-405 to improve transit speed and reliability. Sound Transit is partnering with WSDOT to deliver the BRT project, which is built upon the I-405 Master Plan. However, the BRT project will occur regardless of the Project. As a result, the BRT project is considered as cumulative effects rather than interrelated or interdependent actions. The cumulative effects are discussed in Section 8.4.

8.4 CUMULATIVE EFFECTS

Under the ESA, cumulative effects are the effects of future state, local, or private (but not federal) activities (unrelated to the proposed Project) that are reasonably certain to occur within the action area. 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
- Sound Transit BRT service along I-405 and SR 522, which builds upon the I-405 Master Plan and Sound Transit 3 (ST3)
- The City of Bothell project at Bothell-Everett Highway Corridor, which includes roadway section improvements between 228th Street SE and I-405 and intersection improvements at Bothell-Everett Highway/228th Street
- WSDOT's ongoing program to purchase wetland mitigation credits.

Planning documents reviewed for this cumulative effect analysis include the ones listed in Section 8.2. Local actions that may affect listed species and their habitat within the action area include planned growth consistent with the land use and growth management plans of King and Snohomish counties, and the Cities of Kirkland, and Bothell, and Woodinville. Additional residential, commercial, and industrial development or redevelopment is certain to occur in the action area. With full implementation of the Comprehensive Plans, Shoreline Management Programs, and Critical Area Ordinances administered by these municipalities, and in conjunction with state and county environmental permit requirements, including those requirements established for the protection of wetlands and for the regulation of private and municipal stormwater discharges, effects to ecological functions may be reduced.

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, WSDOT 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.

The Project will construct two inline stations at SR 522 and two inline stations at the SR 527 area, as well as associated infrastructure for the direct access ramps at each location. The inline stations will ultimately be used by transit service providers, and the direct access ramps will be used by ETL drivers and transit buses. Because these improvements are part of the proposed Project work, they are described within Section 2. Construction of the inline stations will not affect the listed species because they are located away from fish-bearing streams. The in-air noise impacts from construction activities are considered in Section 8.1.

Sound Transit is adding BRT service along I-405 and SR 522, connecting Lynnwood, Bellevue, Bothell, Lake Forest Park, Kenmore, and Tukwila. The total I-405 BRT system will run approximately 37 miles along I-405, Interstate 5, and SR 518. Sound Transit is in the process of planning 10 BRT stations within the I-405 corridor, including two new I-405 stations (NE 85th Street in Kirkland and NE 44th Street in Renton), and three stations that will include

new parking along I-405. Sound Transit is also launching the SR 522 BRT system, which will run approximately 8 miles from Bothell to Shoreline and will include nine stations and a transit center.

Sound Transit's I-405 BRT project is not a federally funded project but builds upon the WSDOT's I-405 Master Plan as well as Sound Transit 3 (ST3), 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, with environmental review and conceptual engineering expected to start later in 2019. Construction is expected to begin in 2023 with BRT open for service in 2024. If the BRT project requires a federal permit or triggers a federal nexus, it is anticipated that Sound Transit will have its own ESA consultation.

The City of Bothell project at the Bothell-Everett Highway Corridor (228th Street SE to I-405) will include roadway section improvements between 228th Street SE and I-405 and intersection improvements at Bothell-Everett Highway and 228th Street. This project is listed as a candidate project within Puget Sound Regional Council (PSRC)'s Regional Transportation Plan (PSRC 2019).

Foreseeable future, state, tribal, local and private actions expected within the Project action area will be required to adhere to applicable local, regional, and state requirements and regulations and will not have negative effects on ESA-listed species. Taken as a whole, these future actions will not have effects on habitat conditions in the action area.

8.5 BENEFICIAL EFFECTS

Beneficial effects to streams and stream habitat include the removal of existing piers from the Sammamish River and restoring stream connections at five streams, especially at Queensborough and Creek and North Fork of Perry Creek. 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. As stated in Section 8.1.5.3, the proposed restored stream connections will provide improved access to approximately 8,281 feet of the stream channel for North Fork Perry Creek and 6,663 feet 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 North Fork 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 avoid the effects of increases in pollutant loading (i.e. TSS, total copper, and zinc) by ensuring that 100 percent of new highway runoff is treated. The Project will also retrofit 20 acres of the existing PGIS.

9.0 CONCLUSIONS AND EFFECT DETERMINATIONS

Based on site visits conducted by the WSDOT biologists, evaluation of the proposed activities, review of pertinent literature, implementation of minimization measures and the occurrence of species addressed, the Project warrants effect determinations of **"**may affect, likely to adversely affect**"** for Puget Sound Chinook salmon, Puget Sound steelhead, coastal/Puget Sound bull trout, and "may affect, but not likely to adversely affect" for yellow-billed cuckoo. As mentioned earlier, no critical habitat for these species is present within the action area. Effect determinations for species and critical habitat are shown in Table 15.

Table 15. Effect Determinations for Listed, Designated, Proposed Species/Critical Habitat

Species/Critical Habitat	Scientific Name	Effect Determination
Puget Sound Chinook salmon	*Oncorhynchus tshawytscha-*	May affect, likely to adversely affect
Puget Sound Chinook salmon critical habitat	-	Not applicable
Puget Sound steelhead	*Oncorhynchus mykiss*	May affect, likely to adversely affect
Puget Sound steelhead critical habitat	-	Not applicable
Coastal/Puget Sound bull trout	*Salvelinus confluentus*	May affect, likely to adversely affect
Coastal/Puget Sound bull trout critical habitat	-	Not applicable
Yellow-billed cuckoo	*Coccyzus americanus*	May affect, but not likely to adversely affect
Yellow-billed cuckoo critical habitat	-	Not applicable

9.1 PUGET SOUND CHINOOK SALMON

The Project **may affect** Puget Sound Chinook salmon for the following reasons:

- Adult and juvenile Chinook salmon are documented to use the Sammamish River, North Creek, Perry Creek, and Queensborough Creek within the action area.
- Some adult Chinook salmon may be present within the action area during the approved in-water work window.
- Vibratory pile driving will increase the underwater noise levels in the Sammamish River.
- Temporary stream dewatering and fish exclusion for in-water will be necessary for the pier removal in the Sammamish River and culvert replacement work at North Fork Perry Creek and Queensborough Creek.
- The removal of existing piers from the Sammamish River and replacing six culverts will have a long-term beneficial effect on habitat for Puget Sound Chinook.
- Existing fish barriers will be replaced with restored stream connections at North Fork Perry Creek and Queensborough Creek, opening up approximately 14,944 feet of upstream habitat.
- Project activities will result in temporary and long-term alterations of in-stream habitat for Puget Sound Chinook salmon. These habitat alterations include the following:

- Temporary increase in turbidity for in-water work activities during construction.
- Disturbance of benthic and riparian habitat during construction.
- Permanent (0.3 acre) and temporary (0.18 acre) increase in over-water shading from new wider bridge structures and temporary work bridges.
- Increased nighttime illumination over the Sammamish River during construction and operation of the Project.

The Project **is likely to adversely affect** Puget Sound Chinook salmon in the action area because:

- Puget Sound Chinook salmon may be present during the in-water construction period. If fish exclusion is required during the instream isolation work, it can result in negative behavioral, and in some cases, physical injury or death.
- Water quality and quantity will be temporarily affected by construction activities in the action area.
- The Project will have a total of 24 acres of new PGIS and provide enhanced treatment for this area and an additional 20 acres of PGIS. However, there will be slight increases in pollutant loads in some TDAs where Puget Sound Chinook are present.
- Puget Sound Chinook salmon may be exposed to higher dissolved copper concentrations within 1,000 feet from the outfall at Queensborough Creek.
- The Project will have 1 acre of permanent riparian habitat impact and 2 acres of temporary riparian habitat impact. Removal of riparian vegetation could disrupt riparian functions in stream reaches where Puget Sound Chinook could be present. Permanent impacts to the riparian vegetation will be mitigated, and temporary buffer impacts will be restored with native vegetation.
- Adult and juvenile Chinook salmon will be migrating through the action area during Project operation and storm events, and they could be exposed to copper or zinc concentrations that exceed threshold at the new outfall locations along the Sammamish River and North Fork Perry Creek. However, long-term reductions in the rate of pollutant loading from stormwater are expected to occur in these streams where Chinook salmon are present.
- Increased over-water shading has the potential to alter the migration behavior of Puget Sound Chinook salmon.
- Increased intensity and distribution of artificial lighting could attract juvenile Chinook salmon and their predators. Appropriate measures will be in place to minimize light effects.

9.2 PUGET SOUND STEELHEAD

The Project **may affect** Puget Sound Steelhead in the action area because:

- Adult Puget Sound steelhead are documented to use the Sammamish River, North Creek, Perry Creek, and Queensborough Creek within the action area.
- Some adult Puget Sound steelhead may be present within the action area during the approved in-water work window.
- Vibratory pile driving will increase the underwater noise levels in the Sammamish River.
- Temporary stream dewatering and fish exclusion for in-water will be necessary for the pier removal in the Sammamish River and culvert replacement work at North Fork Perry Creek and Queensborough Creek.
- The removal of existing piers from the Sammamish River and replacing six culverts will have a long-term beneficial effect on habitat for Puget Sound steelhead.
- Existing fish barriers will be replaced with restored stream connections at North Fork Perry Creek and Queensborough Creek, opening up approximately 14,944 feet of upstream habitat.
- Project activities will result in temporary and long-term alterations of in-stream habitat for Puget Sound steelhead. These habitat alterations include the following:
  - Temporary increase in turbidity for in-water work activities during construction.
  - Disturbance of benthic and riparian habitat during construction.
  - Permanent (0.3 acre) and temporary (0.18 acre) increase in over-water shading from new wider bridge structures and temporary work bridges.
  - Increased nighttime illumination over the Sammamish River during construction and operation of the Project.

The Project **is likely to adversely affect** Puget Sound steelhead in the action area because:

- Puget Sound steelhead may be present during the in-water construction period. If fish exclusion is required during the instream isolation work, it can result in negative behavioral, and in some cases, physical injury or death.
- Water quality and quantity will be temporarily affected by construction activities in the action area.
- The Project will have a total of 24 acres of new PGIS and provide enhanced treatment for this area and an additional 20 acres of PGIS. However, there will be slight increases in pollutant loads in some TDAs where Puget Sound steelhead are present.
- Puget Sound steelhead may be exposed to higher dissolved copper concentrations within 1,000 feet from the outfall at Queensborough Creek.
- The Project will have 1 acre of permanent riparian habitat impact and 2 acres of temporary riparian habitat impact. Removal of riparian vegetation could disrupt riparian functions in stream reaches where Puget Sound steelhead could be present. Permanent impacts to the riparian vegetation will be mitigated and temporary buffer impacts will be restored with native vegetation.

- Adult and juvenile steelhead will be migrating through the action area during Project operation and storm events, and they could be exposed to copper or zinc concentrations that exceed threshold at the new outfall locations along the Sammamish River and North Fork Perry Creek. However, long-term reductions in the rate of pollutant loading from stormwater are expected to occur in these streams where Puget Sound steelhead are present.
- Increased over-water shading has the potential to alter the migration behavior of Puget Sound steelhead.
- Increased intensity and distribution of artificial lighting could attract juvenile steelhead and their predators. Appropriate measures will be in place to minimize light effects.

9.3 COASTAL/PUGET SOUND BULL TROUT

The Project **may affect** Coastal/Puget Sound bull trout in the action area because:

- Adult and subadult Coastal/Puget Sound bull trout are documented to be present in the Sammamish River within the action area.
- Although few adult or subadult bull trout are present in the action area during the approved in-water work window, operation activities will increase the possibility of affecting bull trout.
- Temporary stream dewatering and fish exclusion for in-water will be necessary for the pier removal in the Sammamish River.
- The removal of existing piers from the Sammamish River will have a long-term beneficial effect on habitat for Coastal/Puget Sound bull trout.
- Project activities will result in temporary and long-term alterations of in-stream habitat for Coastal/Puget Sound bull trout. These habitat alterations include the following:
  - Temporary increase in turbidity for in-water work activities during construction.
  - Disturbance of benthic and riparian habitat during construction.
  - Permanent (0.3 acre) and temporary (0.18 acre) increase in over-water shading from new wider bridge structures and temporary work bridges.
  - Increased nighttime illumination over the Sammamish River during construction and operation of the Project.

The Project **is likely to adversely affect** Coastal/Puget Sound bull trout in the action area because:

- Coastal/Puget Sound bull trout may be present during the in-water construction period. If fish exclusion is required during the instream isolation work, it can result in negative behavioral, and in some cases, physical injury or death.

- Water quality and quantity will be temporarily affected by construction activities in the action area.
- The Project will have a total of 24 acres of new PGIS and provide enhanced treatment for this area and an additional 20 acres of PGIS. However, there will be slight increases in pollutant loads in some TDAs where Puget Sound Chinook are present.
- Adult and juvenile bull trout will be migrating through the action area during Project operation and storm events, and they could be exposed to copper or zinc concentrations that exceed threshold at the new outfall locations. However, long-term reductions in the rate of pollutant loading from stormwater are expected to occur in the Sammamish River.
- Increased over-water shading has the potential to alter the migration behavior of bull trout.
- Increased intensity and distribution or artificial lighting could attract juvenile bull trout and their predators. Appropriate measures will be in place to minimize light effects.

9.4 YELLOW-BILLED CUCKOO

The Project **may affect** yellow-billed cuckoo in the action area because:

- Migrating yellow-billed cuckoos could be present during construction as the mitigation site at the University of Washington Bothell/Cascadia College campus could be utilized as their potential habitat during migration.
- If migrant individuals are present within the action area, increased levels of noise or construction activity could cause them to avoid the area.
- The Project **is not likely to adversely affect** yellow-billed cuckoo in the action area because:
- Yellow-billed cuckoos have not been documented to occur within the action area, and presence of any individuals in the action area is very unlikely.
- Any cuckoos that could potential be within the action area would be migrants, and no breeding birds would be affected.
- No suitable hardwood vegetation will be removed from the mitigation site at the University of Washington Bothell/Cascadia College campus as a result of the Project.

10.0 ESSENTIAL FISH HABITAT

10.1 BACKGROUND

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-297), requires federal agencies to consult with National Oceanic and Atmospheric Administration (NOAA) Fisheries on activities that may adversely affect essential habitat (EFH). EFH is defined in the Magnuson-Stevens Act as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The law provides the following additional definitions for clarification:

- "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate.
- "Substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities.
- "Necessary" means the habitat required to support a sustainable fishery and the managed species contribution to a healthy ecosystem.
- "Spawning, breeding, feeding, or growth to maturity" covers the full life cycle of a species.

The objective of this EFH assessment is to determine whether the proposed action(s) "may adversely affect" designated EFH for relevant commercial federally-managed fisheries species within the proposed action area. It also describes conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the proposed action.

The EFH for the Pacific coast salmon fishery is defined as those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. EFH for Pacific salmon in freshwater includes all streams, lakes, ponds, wetlands, and other currently viable bodies of freshwater and the substrates within those water bodies accessible to Pacific salmon in Washington, Oregon, Idaho, and California, except above the impassable natural barriers identified by PFMC (PFMC 1999). Designated EFH for salmonid species in estuarine and marine areas includes nearshore and tidally submerged environments within state territorial water out to the full extent of the exclusive economic zone (370.4 kilometers) offshore of Washington (PFMC 1999).

The Pacific salmon management unit includes Chinook, coho, and pink salmon. Chinook and coho salmon are known to use the Sammamish River basin. As stated in the biological assessment, migration habitat is the primary habitat for Chinook salmon in the action area, occurring in Juanita Creek, Sammamish River, and North Creek. For coho salmon, North Creek provides spawning habitat, and the Sammamish River supports rearing and migration habitat (WDFW 2019c). Adult coho salmon enter the Sammamish River in late September through mid-November, and they spawn from late October through December (Jeanes and Morello 2016). Pink salmon are not distributed within the action area or in the Sammamish River basin.

The EFH designation for ground fishes and coastal pelagic species is defined as those waters and substrate necessary to ensure the production needed to support a long-term sustainable fishery. EFH for groundfish and coastal pelagic species includes all waters from the mean high water line along the coasts of Washington upstream to the extent of saltwater intrusion and seaward to the boundary of the U.S. exclusive economic zone (370.4 kilometers) (PFMC 1998a and 1998b). EFH for groundfish and coastal pelagic species is not present in the proposed action area and would not be affected by the proposed Project. As a result, EFH for groundfish and coastal pelagic species is not discussed further in this section.

The Magnuson-Stevens Act requires consultation for all federal agency actions that may adversely affect EFH. EFH consultation with NOAA Fisheries is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location. Under Section 305(b)(4) of the Magnuson-Stevens Act, NOAA Fisheries is required to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH. Wherever possible, NOAA Fisheries uses existing interagency coordination processes to fulfill EFH consultations with federal agencies. For the proposed action, this goal is being met by incorporating EFH consultation to the ESA Section 7 consultation, as represented by this biological assessment.

10.2 POTENTIAL ADVERSE EFFECTS OF PROPOSED ACTION

Potential impacts of the proposed action to Chinook salmon and habitats are discussed in Sections 8, 9, and 10 of this biological assessment and are expected to be similar for Chinook and coho salmon and their EFH that occurs within the action area. As stated above, pink salmon are not present within the action area, but coho salmon are present within the action area.

During the in-water work for the proposed Project, no coho spawning is expected to occur in the action area. It is unlikely that adult coho would be in the action area during construction, as they would not be migrating until late September. Adult coho, beginning their upstream migration at this time, may hold in areas downstream, awaiting rains and increased flows before ascending the tributaries. However, juvenile coho could be potentially rearing in the action area during the in-water work windows and could be temporarily displaced.

The following list summarizes construction-related activities and changes to existing conditions that could potentially result in adverse effects on Chinook and coho salmon and the EFH upon which the Pacific salmon fishery depends:

- Increases in turbidity and suspended sediments.
- Dewatering and fish salvage activities.
- Stormwater input.
- Physical habitat alteration.
- Increases in upstream habitat access by approximately 24,812 linear feet (4.7 miles).

Increased turbidity and sediment loading can result in the siltation of gravel streambeds and temporal reduction in benthic macroinvertebrate prey organisms as disturbed sediments could redeposit upon the existing benthic community. However, substrates in North Creek where coho

salmon are known to spawn are not likely to be disturbed by the Project because no in-water work is proposed at North Creek.

Foraging habitat may be reduced for the short term due to the temporal loss of the existing benthic community, which could result in changes in the behavior of juvenile salmonids, depending on the duration and concentration of the exposure to elevated turbidity and reduced foraging opportunity related to substrate embeddedness. However, the turbidity effects are considered minor and temporary as benthic organisms are known to be resilient to habitat disturbance and are likely to recolonize quickly from nearby undisturbed areas. Furthermore, substrate conditions in the pier removal work areas in the Sammamish River and in the streams where fish barrier removal will occur consist of silt or clay, indicating that benthic habitat function is already limited. As a result, displacement of benthic habitat from dewatering activities would affect low functioning habitat and impacts to habitat and Pacific salmon species are expected to be limited and temporary. To minimize turbidity effects, the Project would isolate the in-water work areas with appropriate BMPs and ensure that the Project would comply with the terms of the 1998 agreement with Ecology.

As stated earlier, juvenile coho salmon may occur within the in-water work area during the de-watering of the work sites. Due to in-water work isolation during construction, fish passage will be temporarily reduced. Approximately 1,840 square feet of the Sammamish River and approximately 500 to 2,000 square feet of the channels at the fish barrier correction locations will be temporary dewatered during construction. As a result, freshwater quantity will be reduced temporarily due to short-term construction needs. However, by upgrading existing fish barriers to restored stream connections, the Project will add additional acres to upstream habitat for Puget Sound Chinook and coho salmon, resulting a long-term benefit for habitat connectivity.

The proposed Project will add approximately 24.13 acres of pollution-generating impervious surface (PGIS); however, all of the new PGIS will be treated, and some existing PGIS will also be retrofitted. To evaluate the potential effects of stormwater, the HI-RUN model was run using the existing and proposed stormwater treatment types and impervious areas in each TDA basin. Based on the output of the HI-RUN model, the pollutant loading of the Project is expected to reduce the pollutant loads and concentrations within the action area. Improvements in stormwater treatment for highway runoff would improve water quality conditions in the Sammamish River and North Creek basins.

The proposed Project will also clear up to 2 acres of riparian vegetation. Any temporary cleared areas will be restored with native vegetation. This temporary loss of riparian habitat will have effects on shading and foraging habitat until native plants become established. Shading from new over-water structures at the Sammamish River would not likely alter the substrate conditions or physical chemical, and biological properties of the water bodies for feeding; therefore, over-water shading would not affect EFH.

10.3 ESSENTIAL HABITAT CONSERVATION MEASURES

Minimization measures as well as BMPs developed to minimize effects on natural resources and habitat for listed species will also help avoid and minimize impacts of Project activities on EFH and Pacific salmon species. A complete list of these measures is included in Section 2.12 of the

biological assessment. In addition, the Design-Builder will be required to adhere to WSDOT Standard Specifications and performance standards that will further minimize impacts from the construction activities.

10.4 CONCLUSION AND EFFECT DETERMINATION

EFH for Pacific salmon is present in the action area. The Project ***may adversely affect*** Pacific salmon EFH because of in-water activities in the Sammamish River, North Fork Perry Creek, and Queensborough Creek, where Chinook and coho salmon are known to occur. However, these effects will be temporary and will not affect the ability of habitat in the action area to function as EFH for Pacific salmon in the long term. Coho salmon are documented to rear in the Sammamish River and spawn in North Creek. Minimization measures proposed for the Project are listed in Section 2.12 of the biological assessment. Pink salmon have not been documented to occur in any of the streams in the action area or in the Sammamish River basin.

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APPENDICES

Appendix A

Species Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Washington Fish And Wildlife Office
510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263
Phone: (360) 753-9440 Fax: (360) 753-9405
http://www.fws.gov/wafwo/

In Reply Refer To: July 12, 2019
Consultation Code: 01EWFW00-2019-SLI-0901
Event Code: 01EWFW00-2019-E-02670
Project Name: I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, and proposed species, designated and proposed critical habitat, and candidate species that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. The species list is currently compiled at the county level. Additional information is available from the Washington Department of Fish and Wildlife, Priority Habitats and Species website: http://wdfw.wa.gov/mapping/phs/ or at our office website: http://www.fws.gov/wafwo/species_new.html. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether or not the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species, and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:
http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.). You may visit our website at http://www.fws.gov/pacific/eagle/for information on disturbance or take of the species and information on how to get a permit and what current guidelines and regulations are. Some projects affecting these species may require development of an eagle conservation plan: (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Also be aware that all marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas. The importation of marine mammals and marine mammal products into the U.S. is also prohibited. More information can be found on the MMPA website: http://www.nmfs.noaa.gov/pr/laws/mmpa/.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Related website:
National Marine Fisheries Service: http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Washington Fish And Wildlife Office
510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263
(360) 753-9440

Project Summary

Consultation Code: 01EWFW00-2019-SLI-0901

Event Code: 01EWFW00-2019-E-02670

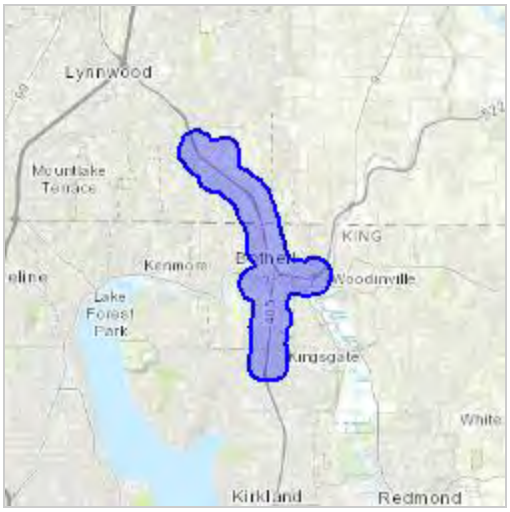
Project Name: I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

Project Type: TRANSPORTATION

Project Description: Consistent with the long-term Interstate 405 (I-405) Master Plan, the Washington State Department of Transportation (WSDOT) proposes to construct roadway improvements between the State Route 522 (SR 522) vicinity and SR 527 to address increasing traffic congestion and improve transit reliability on I-405 in the cities of Kirkland and Bothell. The project generally includes a 6-mile segment of I-405 extending from south of the I-405/160th Street interchange to just north of the I-405/SR 527 interchange. The southern limit of the Project occurs at approximately milepost (MP) 21.79, and the northern limit occurs at approximately MP 27.06. The Project is within the Cedar-Sammamish Water Resource Inventory Area (WRIA) 8) and Hydraulic Unit Code 171100140403. Construction is expected to last three years. All in-water work will be conducted by the design-build contractor within approved in-water work windows.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/47.76528435701951N122.18788262743688W



Counties: King, WA | Snohomish, WA

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Gray Wolf Canis lupus Population: Western Distinct Population Segment No critical habitat has been designated for this species.	Proposed Endangered
North American Wolverine Gulo gulo luscus No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5123	Proposed Threatened

Birds

NAME	STATUS
Marbled Murrelet Brachyramphus marmoratus Population: U.S.A. (CA, OR, WA) There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/4467	Threatened
Streaked Horned Lark Eremophila alpestris strigata There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7268	Threatened
Yellow-billed Cuckoo Coccyzus americanus Population: Western U.S. DPS There is proposed critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

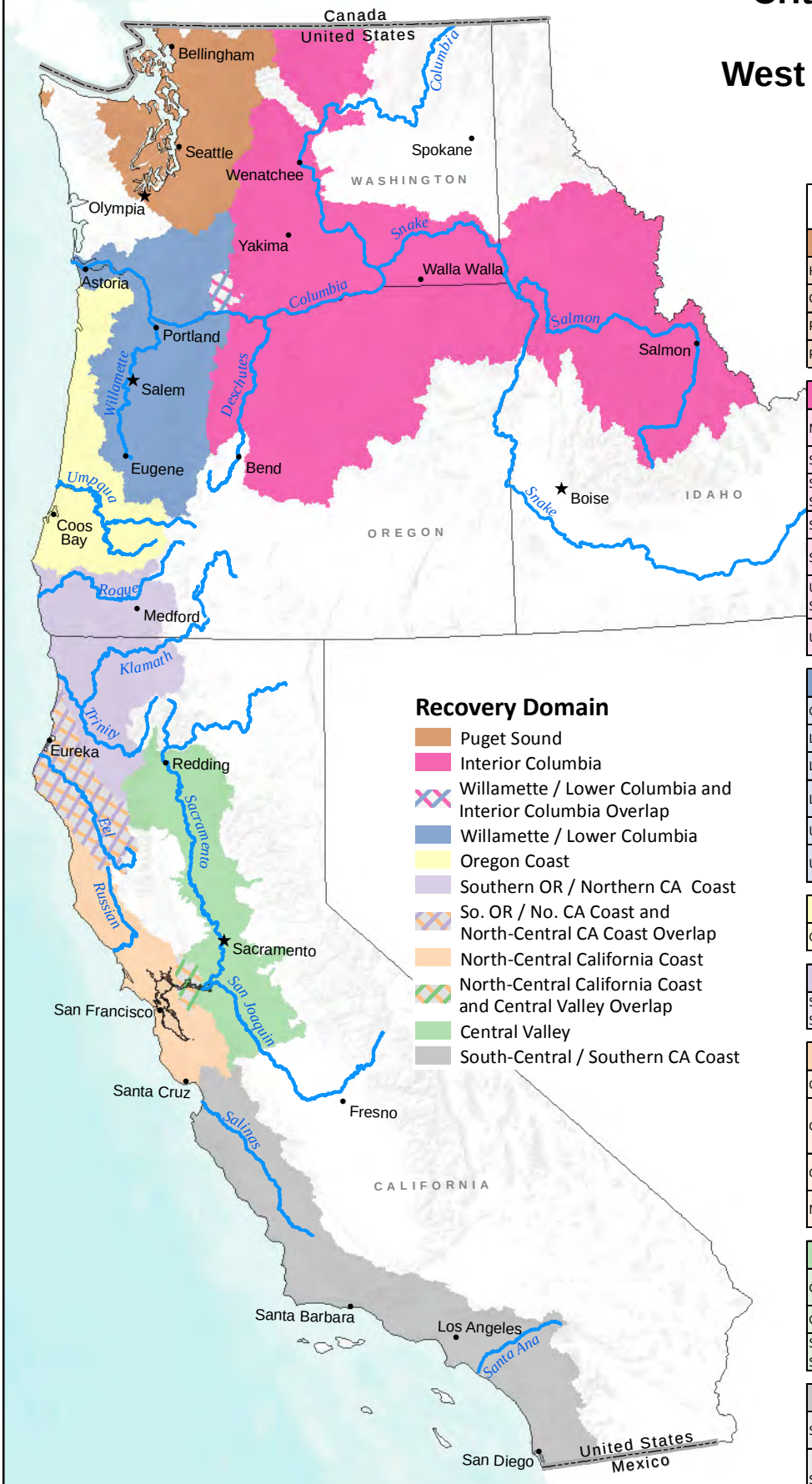
Fishes

NAME	STATUS
Bull Trout Salvelinus confluentus Population: U.S.A., conterminous, lower 48 states There is final critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8212	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead



Updated July 2016

Evolutionarily Significant Unit / Distinct Population Segment	ESA Status	Date of ESA Listing	Date of CH Designation
Puget Sound Recovery Domain			
Hood Canal Summer-run Chum Salmon	T	3/25/1999	9/2/2005
Ozette Lake Sockeye Salmon	T	3/25/1999	9/2/2005
Puget Sound Chinook Salmon	T	3/24/1999	9/2/2005
Puget Sound Steelhead	T	5/11/2007	2/24/2016
Interior Columbia Recovery Domain			
Middle Columbia River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Snake River Fall-run Chinook Salmon	T	4/22/1992	12/28/1993
Snake River Spring / Summer-run Chinook Salmon	T	4/22/1992	10/25/1999
Snake River Sockeye Salmon	E	11/20/1991	12/28/1993
Snake River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Upper Columbia River Spring-run Chinook Salmon	E	3/24/1999	9/2/2005
Upper Columbia River Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Willamette / Lower Columbia Recovery Domain			
Columbia River Chum Salmon	T	3/25/1999	9/2/2005
Lower Columbia River Chinook Salmon	T	3/24/1999	9/2/2005
Lower Columbia River Coho Salmon	T	6/28/2005	2/24/2016
Lower Columbia River Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Upper Willamette River Chinook Salmon	T	3/24/1999	9/2/2005
Upper Willamette River Steelhead	T	3/25/1999 1/5/2006	9/2/2005
Oregon Coast Recovery Domain			
Oregon Coast Coho Salmon	T	2/11/2008	2/11/2008
Southern Oregon / Northern California Coast Recovery Domain			
Southern OR / Northern CA Coasts Coho Salmon	T	5/6/1997	5/5/1999
North-Central California Coast Recovery Domain			
California Coastal Chinook Salmon	T	9/16/1999	9/2/2005
Central California Coast Coho Salmon	E	10/31/1996 (T) 6/28/2005 (E) 4/2/2012 (RE)	5/5/1999
Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Northern California Steelhead	T	6/7/2000 1/5/2006	9/2/2005
Central Valley Recovery Domain			
California Central Valley Steelhead	T	3/19/1998 1/5/2006	9/2/2005
Central Valley Spring-run Chinook Salmon	T	9/16/1999	9/2/2005
Sacramento River Winter-run Chinook Salmon	E	11/5/1990 (T) 1/4/1994 (E)	6/16/1993
South-Central / Southern California Coast Recovery Domain			
South-Central California Coast Steelhead	T	8/18/1997 1/5/2006	9/2/2005
Southern California Steelhead	E	8/18/1997 5/1/2002 (RE) 1/5/2006	9/2/2005

ESA = Endangered Species Act, CH = Critical Habitat, RE = Range Extension
E = Endangered, T = Threatened,

Critical Habitat Rules Cited

- 2/24/2016 (81 FR 9252) Final Critical Habitat Designation for Puget Sound Steelhead and Lower Columbia River Coho Salmon
- 2/11/2008 (73 FR 7816) Final Critical Habitat Designation for Oregon Coast Coho Salmon
- 9/2/2005 (70 FR 52630) Final Critical Habitat Designation for 12 ESU's of Salmon and Steelhead in WA, OR, and ID
- 9/2/2005 (70 FR 52488) Final Critical Habitat Designation for 7 ESU's of Salmon and Steelhead in CA
- 10/25/1999 (64 FR 57399) Revised Critical Habitat Designation for Snake River Spring/Summer-run Chinook Salmon
- 5/5/1999 (64 FR 24049) Final Critical Habitat Designation for Central CA Coast and Southern OR/Northern CA Coast Coho Salmon
- 12/28/1993 (58 FR 68543) Final Critical Habitat Designation for Snake River Chinook and Sockeye Salmon
- 6/16/1993 (58 FR 33212) Final Critical Habitat Designation for Sacramento River Winter-run Chinook Salmon

ESA Listing Rules Cited

- 4/2/2012 (77 FR 19552) Final Range Extension for Endangered Central California Coast Coho Salmon
- 2/11/2008 (73 FR 7816) Final ESA Listing for Oregon Coast Coho Salmon
- 5/11/2007 (72 FR 26722) Final ESA Listing for Puget Sound Steelhead
- 1/5/2006 (71 FR 5248) Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead
- 6/28/2005 (70 FR 37160) Final ESA Listing for 16 ESU's of West Coast Salmon
- 5/1/2002 (67 FR 21586) Range Extension for Endangered Steelhead in Southern California
- 6/7/2000 (65 FR 36074) Final ESA Listing for Northern California Steelhead
- 9/16/1999 (64 FR 50394) Final ESA Listing for Two Chinook Salmon ESUs in California
- 3/25/1999 (64 FR 14508) Final ESA Listing for Hood River Canal Summer-run and Columbia River Chum Salmon
- 3/25/1999 (64 FR 14517) Final ESA Listing for Middle Columbia River and Upper Willamette River Steelhead
- 3/25/1999 (64 FR 14528) Final ESA Listing for Ozette Lake Sockeye Salmon
- 3/24/1999 (64 FR 14308) Final ESA Listing for 4 ESU's of Chinook Salmon
- 3/19/1998 (63 FR 13347) Final ESA Listing for Lower Columbia River and Central Valley Steelhead
- 8/18/1997 (62 FR 43937) Final ESA Listing for 5 ESU's of Steelhead
- 5/6/1997 (62 FR 24588) Final ESA Listing for Southern Oregon / Northern California Coast Coho Salmon
- 10/31/1996 (61 FR 56138) Final ESA Listing for Central California Coast Coho Salmon
- 1/4/1994 (59 FR 222) Final ESA Listing for Sacramento River Winter-run Chinook Salmon
- 4/22/1992 (57 FR 14653) Final ESA Listing for Snake River Spring/summer-run and Snake River Fall Chinook Salmon
- 11/20/1991 (56 FR 58619) Final ESA Listing for Snake River Sockeye Salmon
- 11/5/1990 (55 FR 46515) Final ESA Listing for Sacramento River Winter-run Chinook Salmon

Appendix B

Pre-BA Meeting Notes

I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

Prepared By: I-405 Project Team

Subject: Pre-BA Follow-Up Meeting

Project Name: I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

Anticipated BA Submittal Date: July 2019

State Route (SR) and Mileposts (MPs): I-405, MP 21.79 to MP 27.06

Construction Timeline: 2021 through 2024, in-water work window to be verified by the Washington Department of Fish and Wildlife (WDFW) but is likely to be July 15 through August 31 for Sammamish River and North Creek tributaries.

Project Proponent Washington State Department of Transportation (WSDOT)

Contact for Requesting Changes to this Submittal: Rob Thomas, ThomasR@wsdot.wa.gov, 425.456.8556

Federal Action Agency: FHWA

Pre-BA Meeting Date: June 20, 2019

Pre-BA Meeting Attendees: Rob Thomas (WSDOT/I-405 Team), Jennifer Cheung (I-405 Team), Maki Dalzell (I-405 Team), Tricia Gross (I-405 Team), Alan Black (I-405 Team), Alex Strom (I-405 Team), Stephanie Miller (I-405 Team), Rob Woeck (I-405 Team), Michael MacDonald (WSDOT liaison to National Marine Fisheries Service), Leslie Durham (WSDOT liaison to U.S. Fish and Wildlife Service), Sharon Rainsberry (WSDOT liaison to National Marine Fisheries Service and U.S. Fish and Wildlife Service), Jeff Dreier (HQ Fish and Wildlife), Mark Bakeman (HQ Fish and Wildlife)

Project Description

Consistent with the long-term I-405 Master Plan, WSDOT plans to construct roadway improvements to address increasing traffic congestion and improve transit reliability on I-405 in Bothell and south Snohomish County. Exhibit 1 shows improvements proposed with the project. Exhibit 7 near the end of this document provides maps showing the proposed improvements.

Exhibit 1. Improvements Proposed with the I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project

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 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, including the single existing ETL in this area, 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 to create a dual ETL system that ends at the SR 527 interchange. 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 in the I-405 median (one in each direction). 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. Transit station locations to be determined in coordination with Sound Transit. Construct a bus stop and turnaround loop, pick-up and drop-off facilities, and new non-motorized connection near the SR 522 interchange. Funding and construction timeline to be coordinated with local transit agencies. Construct new northbound bridge through the SR 522 interchange. Reconfigure I-405 on- and off-ramps. Add three signalized intersections on SR 522.
228th Street SE	Widen northbound I-405 bridge over 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.

Project Element	I-405, SR 522 Vicinity to SR 527 Express Toll Lanes Improvement Project
Fish passage	Replace eight fish barriers with fish-passable crossings at the following streams: Par Creek Stream 25.0L Stream 66 Two fish barriers at Stream 70 North Fork of Perry Creek Two fish barriers at Queensborough Creek
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 new noise walls. Construct new retaining walls.
Stormwater management	Provide enhanced treatment for 100 percent of new PGIS (approximately 24 acres). Retrofit about 20 acres of existing untreated PGIS and continue to treat stormwater from the approximately 44 acres of PGIS that currently receives treatment. Construct three new stormwater outfalls, one on the Sammamish River and two on the North Fork of Perry Creek.
Construction duration	Construction is expected to last three years, from 2021 through 2024.

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

Exhibit 2 provides a list of the existing fish barriers that would be replaced with fish-passable crossings as part of the proposed project.

Exhibit 2. Fish Barrier Replacements

Stream	Roadway Crossing	MP	WDFW Site ID	Barrier Reason
Par Creek	SR 522	11.31	993083	Depth
Stream 25.0L	I-405	25.00	993104	Water surface drop
Stream 66	I-405	25.35	993106	Water surface drop
Stream 70	I-405	25.59	934219 (northbound)	Water surface drop
	I-405	25.60	934218 (southbound)	Water surface drop
North Fork Perry Creek	I-405	26.46	08.0070 A 0.25	Depth
Queensborough Creek	SR 527	2.78	993084	Slope
	I-405	26.87	993109	Slope

MP = milepost; UNT = unnamed tributary; SR = State Route; I = Interstate

Additional drainages are currently being evaluated with WDFW and the Muckleshoot Indian Tribe, including:

Stream 42 (I-405 MP 23.20; WDFW Site ID 999543);

Stream C-77 (I-405 MP 26.06, I-405 MP 26.10; WDFW Site IDs 934912, 934913); and

Crystal Creek (I-405 MP 26.74; WDFW Site ID 934994).

When additional information regarding these sites becomes available, an update to the BA will be provided, as needed.

Exhibit 3 identifies the proposed project construction activities and assumptions associated with building the proposed project. The contractor would be allowed to determine the appropriate equipment to complete this activity. Equipment to be used on the project includes, but is not limited to, excavators, cranes, drilling rigs to place ramp footings, dump trucks, grinders, graders, pavers, rollers, striping truck, back hoes, cement trucks, water truck, pick-up trucks, etc.

Exhibit 3. Proposed Construction Activities and Assumptions

Project Activity	Activity Duration	Assumptions
Remove existing bridges	The specific project schedule is undetermined at this time.	Equipment used for bridge removal (with the exception of bridge pier removal) would not occur below the OHWM of the Sammamish River. The contractor will provide measures (such as temporary work bridge or barges/work platforms) to prevent any debris from falling into the river.
Remove existing bridge piers	The specific project schedule is undetermined at this time. Work below the OHWM would be conducted during the in-water work window.	Any dewatering areas would be properly isolated to prevent turbid water from entering the Sammamish River. The contractor will provide constructed cofferdams to isolate work areas.
Construct new bridges	The specific project schedule is undetermined at this time.	The new bridge would be constructed in accordance with permit conditions and WSDOT standard specifications. The contractor would confine construction activities to the minimum area necessary. New pavement and the new bridge deck would be placed over the river. The contractor will provide measures (such as a temporary work bridge or barges/work platforms) to prevent any debris from falling into the river.
Construct new outfalls	The specific project schedule is undetermined at this time. Work below the OHWM would be conducted during the in-water work window.	Outfalls would be constructed in accordance with permit conditions and WSDOT standard specifications.
Fish removal/exclusion	The specific project schedule is undetermined at this time. Work below the OHWM would be conducted during the in-water work window.	Fish removal and exclusion would be conducted by a qualified biologist in accordance with WSDOT protocols.
Stream bypass/dewatering work area	The specific project schedule is undetermined at this time. Work below the OHWM would be conducted during the in-water work window.	Stream bypass/dewatering of the work area would be conducted in accordance with WSDOT standard specifications and would follow WSDOT fish removal and exclusion protocols.

Project Activity	Activity Duration	Assumptions
Culvert excavation and removal	The specific project schedule is undetermined at this time. Work below the OHWM would be conducted during the in-water work window.	Culvert excavation and removal would be constructed in accordance with WSDOT standard specifications.
Culvert installation and backfilling	The specific project schedule is undetermined at this time. Work below the OHWM would be conducted during the in-water work window.	Culvert installation and backfilling would be carried out in accordance with WSDOT standard specifications.

Stormwater Drainage and Treatment

Pollutant Generating Impervious Surfaces and Proposed Stormwater Treatment

This section of I-405 has 127.92 acres of pollutant generating impervious surfaces (PGIS) and 44.20 acres of that PGIS receives stormwater treatment. The proposed project would add 24.04 acres of PGIS, 100 percent of which would be treated. In addition, 19.83 acres of the existing PGIS would be retrofitted to provide enhanced stormwater treatment that is in compliance with current requirements. Once the proposed project is built, 88.07 acres of PGIS would be treated.

Exhibit 4 provides a summary of area basins, receiving waterbodies, listed species, critical habitat, threshold discharge areas (TDAs), and the proposed plan for PGIS in the action area.

Exhibit 4. Stormwater Summary

Basin	Receiving Waterbody	TDA	Potential Listed Species Present at Outfall	Existing PGIS in TDA (acres)	Type of Facility	Existing Treatment (acres)
Sammamish River	Stream KL-14	F2	Not Present	4.11	NA	0
		F3		0.52	NA	0
		F4		0.54	NA	0
	Sammamish River	G2	PS Chinook	52.82	CABS	10.65
			PS Steelhead		MFD	3.02
			Bull Trout		Wet Vault	3.30
	North Creek	G4	PS Chinook	1.49	MFD	0.29
			PS Steelhead			
North Creek	North Creek	I1	PS Chinook	20.84	MFD	3.52
			PS Steelhead			
	Stream 66	I2	Not Present	3.76	MFD	0.55
	Stream 25.0L	I3	Not Present	2.61	MFD	0.91
	Stream 70	I4	Not Present	4.51	MFD	1.26
	Stream C-77	J1	Not Present	4.08	MFD	1.21
					CSW	0.89
	North Fork Perry Creek	J2	PS Chinook	12.73	Bio-Swale	4.42
			PS Steelhead		Wet vault	4.45
	North Creek	NW01	PS Chinook	1.92	NA	0
			PS Steelhead			
		NW02	PS Chinook	17.99	Wet pond	9.35

Basin	Receiving Waterbody	TDA	Potential Listed Species Present at Outfall	Existing PGIS in TDA (acres)	Type of Facility	Existing Treatment (acres)
	Queensborough Creek		PS steelhead		MFD	0.37
Total				127.92	N/A	44.20

TDA = threshold discharge area; PGIS = pollution-generating impervious surfaces; CABS = compost amended vegetated bioswale; MFD = media filter drain; CSW=constructed stormwater wetland

New Stormwater Outfalls

The proposed project would introduce three new stormwater outfalls. Two outfalls would discharge into the North Fork of Perry Creek on each side of I-405, with an estimated pipe size between 18 to 24 inches. The third outfall would discharge into Sammamish River. The estimated pipe size would range between 24 and 30 inches in diameter. Exhibit 11 near the end of this document shows the location of existing and proposed stormwater treatment facilities for the proposed project.

Estimated Pollutant Contributions

There are several TDAs with direct discharge to waters with potential listed species present. The BA focuses on those TDAs to determine the potential effects to listed fish species. The primary streams of concern are, the Sammamish River, North Creek, North Fork Perry Creek, and Queensborough Creek. Exhibit 12 at the end of this document shows the locations of streams within the action area. A summary of the Hi-RUN results most pertinent to the project effects are presented below in Exhibits 5 through 9. A complete Hi-RUN analysis, conducted for each TDA will be provided in the BA submittal. The project is providing a significant amount of treatment and retrofit, to meet HRM requirements and minimize effects to water quality.

Exhibit 5. HI-RUN Results for TDA G2 – Discharging to Sammamish River

Parameter	Median Existing Load (lbs/year)	Median Proposed Load (lbs/year)	Distances to Dilution Below Effect Threshold Values, if Applicable (feet)
Total suspended solids	17,403	10,801	
Total copper	4.72	3.7	
Dissolved copper	1.35	1.5	< 1
Total zinc	28	21	
Dissolved zinc	9.21	9.4	< 1

Exhibit 6. HI-RUN Results for TDA G4 – Discharging to North Creek

Parameter	Median Existing Load (lbs/year)	Median Proposed Load (lbs/year)
Total suspended solids	679	217
Total copper	0.171	0.064
Dissolved copper	0.04	0.022
Total zinc	1.04	0.37
Dissolved zinc	0.299	0.14

Note: The P(exceed) value was 0.268, well below the level required to run the dilution sub-routine.

Exhibit 7. HI-RUN Results for TDA I1 – Discharging to North Creek

Parameter	Median Existing Load (lbs/year)	Median Proposed Load (lbs/year)	Baseline Distance Downstream to Meet Biological Threshold (feet)
Total suspended solids	8,000	8,028	-
Total copper	2.01	2.1	-
Dissolved copper	0.484	0.55	<1 to 2
Total zinc	12.4	13	-
Dissolved zinc	3.57	3.9	<1 to 57

Exhibit 8. HI-RUN Results for TDA J2 – Discharging to North Fork Perry Creek

Parameter	Median Existing Load (lbs/year)	Median Proposed Load (lbs/year)	Baseline Distance Downstream to Meet Biological Threshold (feet)
Total suspended solids	3,510	1,945	-
Total copper	1.03	0.79	-
Dissolved copper	0.358	0.37	89 to >1,000
Total zinc	6.01	4.2	-
Dissolved zinc	2.29	2.1	>1,000

Exhibit 9. HI-RUN Results for TDA NW02 – Discharging to Queensborough Creek

Parameter	Median Existing Load (lbs/year)	Median Proposed Load (lbs/year)	Baseline Distance Downstream to Meet Biological Threshold (feet)
Total suspended solids	3,770	3,692	-
Total copper	1.2	1.2	-
Dissolved copper	0.455	0.49	68 to >1,000
Total zinc	6.77	6.8	-
Dissolved zinc	2.82	3	620 to >1,000

Wetland, Stream, and Buffer Impacts

Overall Vegetation Removal

The proposed project is expected to remove approximately 15 acres of vegetation in the action area. Vegetation temporarily removed for construction would be replanted with native species appropriate to the area, in accordance with the WSDOT *Roadside Policy Manual*.

Impacts to Rivers and Streams and Riparian Areas

Exhibit 8 near the end of this document shows streams in the action area. Approximately 0.45 acre of temporary impacts on rivers and streams are anticipated for the proposed project, including pier removal in the Sammamish River and culvert replacements throughout the action area. Best management practices (BMPs) would be used to minimize impacts to the greatest extent possible. Approximately 1 acre of permanent and 2 acres of temporary impacts on stream buffers are anticipated for the proposed project. The stream buffers would be restored to current conditions or better following construction in accordance with the WSDOT *Roadside Policy Manual*.

Impacts on Wetlands

Exhibit 8 near the end of this document shows wetlands and wetland buffers in the action area. Approximately 5 acres of wetlands and 8 acres of wetland buffer would be permanently affected by the proposed project. These impacts would be mitigated through advanced mitigation or a wetland bank.

Listed Species in the Action Area

Exhibit 10 shows listed species and designated critical habitats in the action area and provides a preliminary effect determination.

Exhibit 10. Listed Species and Designated Critical Habitats in the Action Area

Name	Preliminary Effects Determination	Rationale
Aquatic Species		
Puget Sound/Coastal DPS bull trout	Likely to adversely affect	In-water work necessary
Puget Sound steelhead trout	Likely to adversely affect	In-water work necessary
Puget Sound ESU Chinook salmon	Likely to adversely affect	In-water work necessary
Terrestrial Species		
Gray wolf	Will not jeopardize the continued existence	No suitable habitat present in the action area
North American wolverine	Will not jeopardize the continued existence	No suitable habitat present in the action area
Marbled murrelet	No effect	No documented detections in the action area, low quality habitat present
Streaked horned lark	No effect	No suitable habitat present in the action area
Yellow-billed cuckoo	May effect, Not Likely to Adversely Affect	Potential suitable habitat within the action area

DPS = Distinct Population Segment; ESU = Evolutionary Significant Unit

Rationale for the Preliminary Effects Determinations

Puget Sound Chinook Salmon

This Project may affect Puget Sound Chinook salmon for the following reasons:

- Adult and juvenile Chinook salmon are documented to use the Sammamish River, North Creek, Perry Creek, and Queensborough Creek within the action area.
- Project activities will result in temporary and long-term alterations of in-stream habitat for Puget Sound Chinook salmon, which may result potential behavior alterations. These habitat alterations include the following:
- Increased over-water shading due to wider bridge structures.
- Disturbance of benthic and riparian habitat during construction.
- Temporary increase in turbidity for in-water work activities during construction.

This project is likely to adversely affect Puget Sound Chinook salmon in the action area because:

- Increased over-water shading has the potential to alter the migration behavior of Puget Sound Chinook salmon.
- Water quality and quantity will be temporarily affected by construction activities in the action area, although long-term reductions in the rate of pollutant loading from stormwater are expected to occur in most TDA basins.
- Puget Sound Chinook salmon may be exposed to higher dissolved copper concentrations within 1,000 feet from the outfall at Queensborough Creek.
- The project will permanently remove 1 acre of riparian vegetation.
- Adult and juvenile Chinook salmon will be migrating through the action area during project operation and storm events, and they could be exposed to copper or zinc concentrations at the new outfall locations along the Sammamish River and North Fork Perry Creek. However, long-term reductions in the rate of pollutant loading from stormwater are expected to occur in these streams where Chinook salmon are present.

Puget Sound Steelhead

This project may affect Puget Sound Steelhead in the action area because:

- Adult Puget Sound steelhead are documented to use the Sammamish River, North Creek, Perry Creek, and Queensborough Creek within the action area.
- Project activities will result in temporary and long-term alterations of in-stream habitat for Puget Sound steelhead, which may result potential behavior alterations. These habitat alterations include the following:
- Increased over-water shading due to wider bridge structures.
- Disturbance of benthic and riparian habitat during construction.
- Temporary increase in turbidity for in-water work activities during construction.

This project is likely to adversely affect Puget Sound steelhead in the action area because:

- Increased over-water shading has the potential to alter the migration behavior of Puget Sound steelhead.
- The project will permanently remove 1 acre of riparian vegetation.
- Water quality and quantity will be temporarily affected by construction activities in the action area, although long-term reductions in the rate of pollutant loading from stormwater are expected to occur in most TDA basins.

- Puget Sound steelhead may be exposed to higher dissolved copper concentrations within 1,000 feet from the outfall at Queensborough Creek.
- Adult and juvenile steelhead will be migrating through the action area during project operation and storm events, and they could be exposed to copper or zinc concentrations at the new outfall locations along the Sammamish River and North Fork Perry Creek. However, long-term reductions in the rate of pollutant loading from stormwater are expected to occur in these streams where Puget Sound steelhead are present.

Coastal/Puget Sound Bull Trout

This project may affect Coastal/Puget Sound bull trout in the action area because:

- Adult and subadult Coastal/Puget Sound bull trout are documented to be present in the Sammamish River within the action area.

Project activities will result in temporary and long-term alterations of in-stream habitat for Coastal/Puget Sound bull trout, which may result potential behavior alterations. These habitat alterations include the following:

- Increased over-water shading due to wider bridge structures.
- Disturbance of benthic and riparian habitat during construction.
- Temporary increase in turbidity for in-water work activities during construction.

This project is likely to adversely affect Coastal/Puget Sound bull trout in the action area because:

- Increased over-water shading has the potential to alter the migration behavior of bull trout.
- Water quality and quantity will be temporarily affected by construction activities in the action area, although long-term reductions in the rate of pollutant loading from stormwater are expected to occur.
- Adult and juvenile bull trout will be migrating through the action area during project operation and storm events, and they could be exposed to copper or zinc concentrations at the new outfall locations. However, long-term reductions in the rate of pollutant loading from stormwater are expected to occur in the Sammamish River.

Yellow-Billed Cuckoo

This project may affect Yellow-Billed Cuckoo in the action area because:

- Yellow-billed cuckoos breed and forage in large (50 acres or greater), dense, willow and cottonwood stands in river floodplains. A stand of approximately 60 acres of potentially suitable habitat is located within the action area.
- Project activities will result in temporary, construction-related, in-air noise that may result potential behavior alterations.

This project is not likely to adversely affect Yellow-Billed Cuckoo in the action area because:

- The potential habitat within the action area is immature and contains a mix of willow, cottonwood, and conifers.
- Yellow-billed cuckoos are have not been documented to occur within the action area, and presence of any individuals in the action area is very unlikely.
- Any cuckoos that could potential be within the action area would be migrants, and no breeding birds would be affected.

North American Wolverine

North American wolverines historically occur in the alpine and subalpine habitats of the Cascades, Blue Mountains, and Rocky Mountains and avoid human influence and developed areas. The proposed project would have no effect on this species because there is no suitable habitat in the action area.

Marbled Murrelet

Marbled murrelets nest inland in forests that are generally characterized by large trees with large branches or deformities for use as nest plat forms. Murrelets are known to nest in contiguous coniferous-dominated forested area. Review of the Davis layer identified two potential sites as potential suitable habitat. A site evaluation was conducted at those two sites, and both sites did not contain a contiguous coniferous stand with trees larger than 15-inch diameter at breast height (DBH), indicating that the two sites identified in the Davis layer are not suitable habitat. Based on the field visit, the project will have no effect on murrelet because there is no marine water or suitable nesting trees within the action area.

Streaked-horned lark

Streaked-horned larks nest on grasslands and sparsely vegetated areas at airports, sandy islands, and coastal spits. The proposed project would have no effect on this species because there is no suitable habitat in the action area.

Exhibit 11. I-405, SR 522 Vicinity to SR 527 Express Toll Lane Improvement Project, Sheet 1 of 5

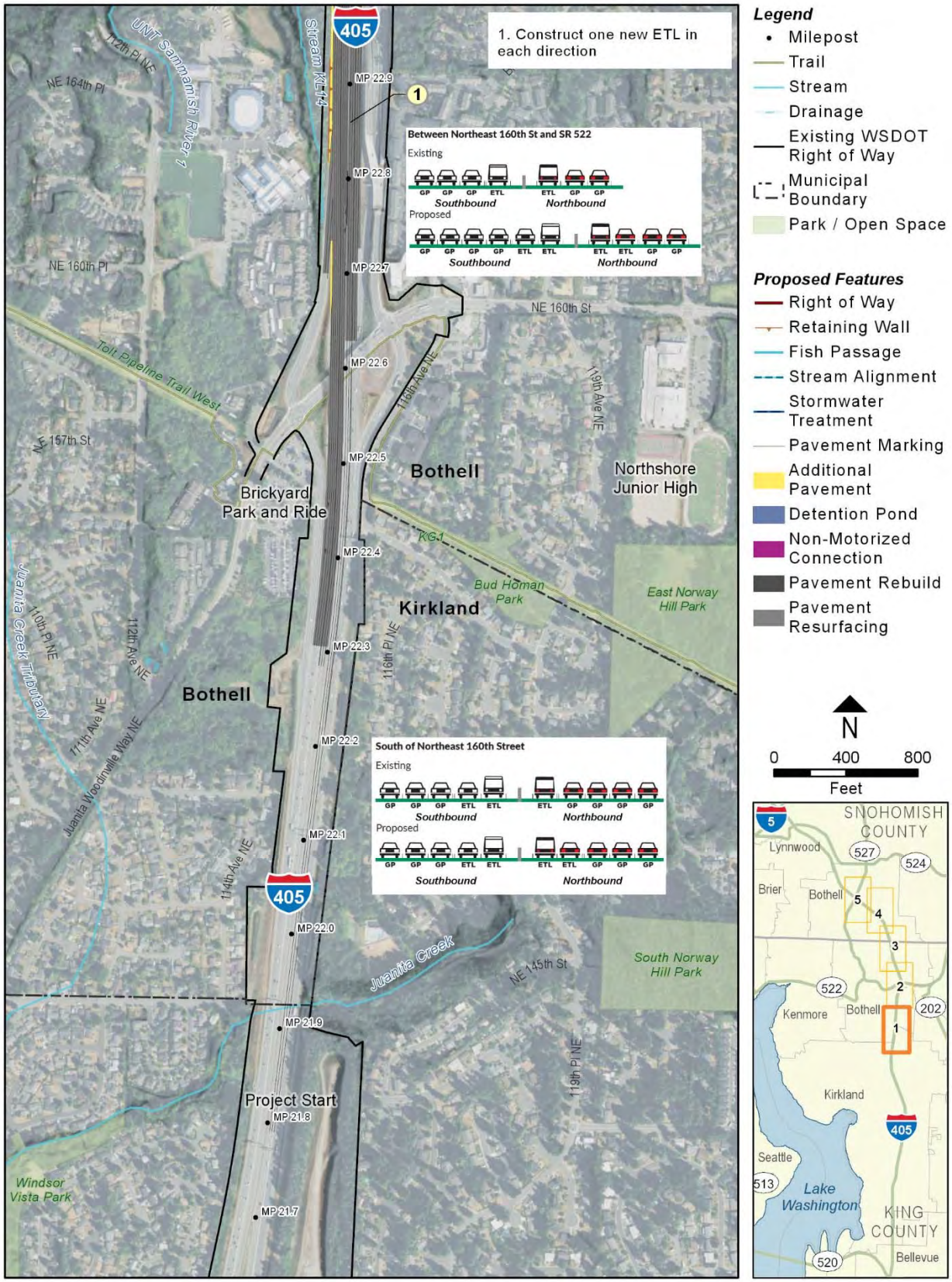


Exhibit 11. I-405, SR 522 Vicinity to SR 527 Express Toll Lane Improvement Project, Sheet 2 of 5

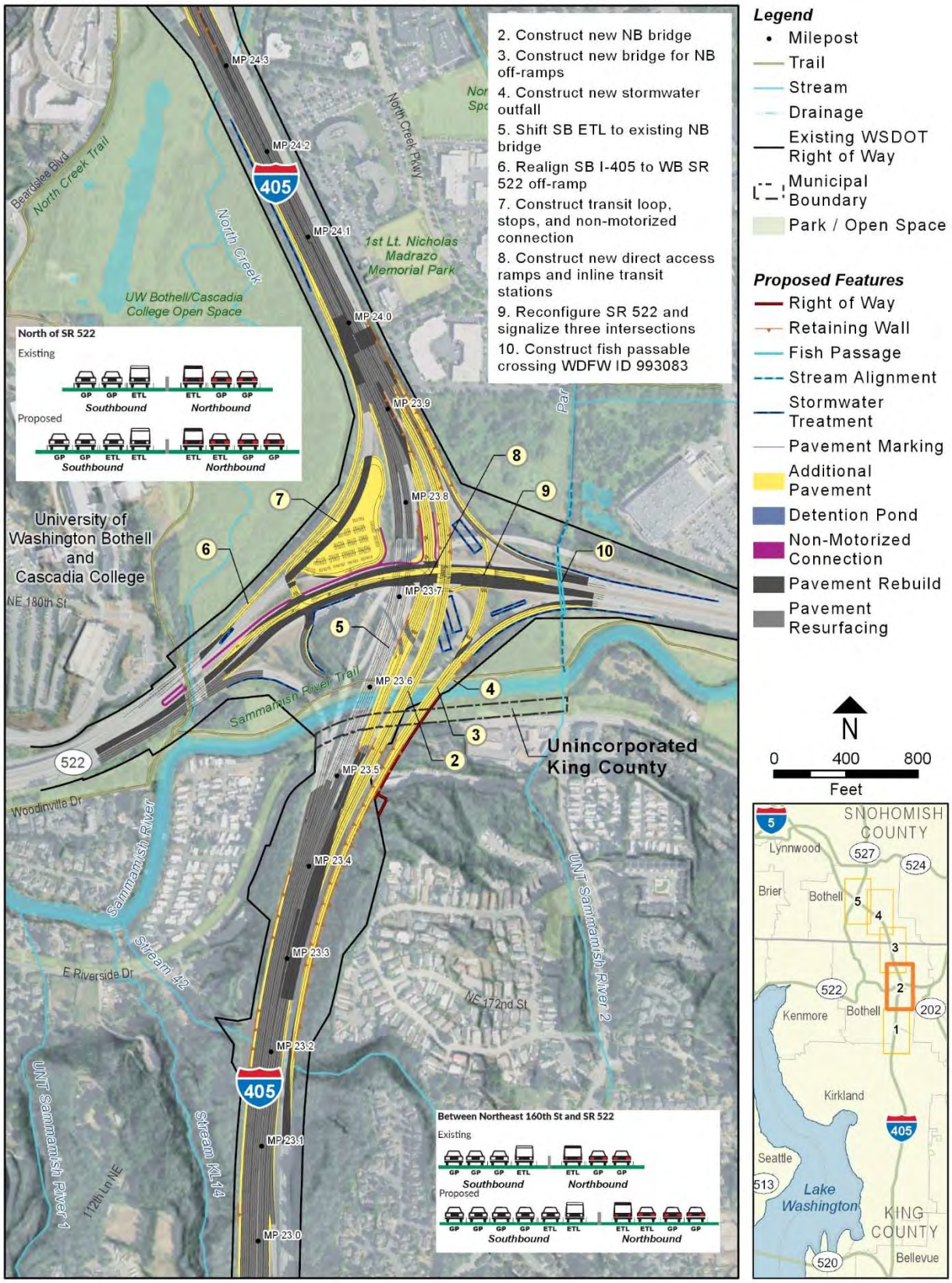


Exhibit 11. I-405, SR 522 Vicinity to SR 527 Express Toll Lane Improvement Project, Sheet 3 of 5

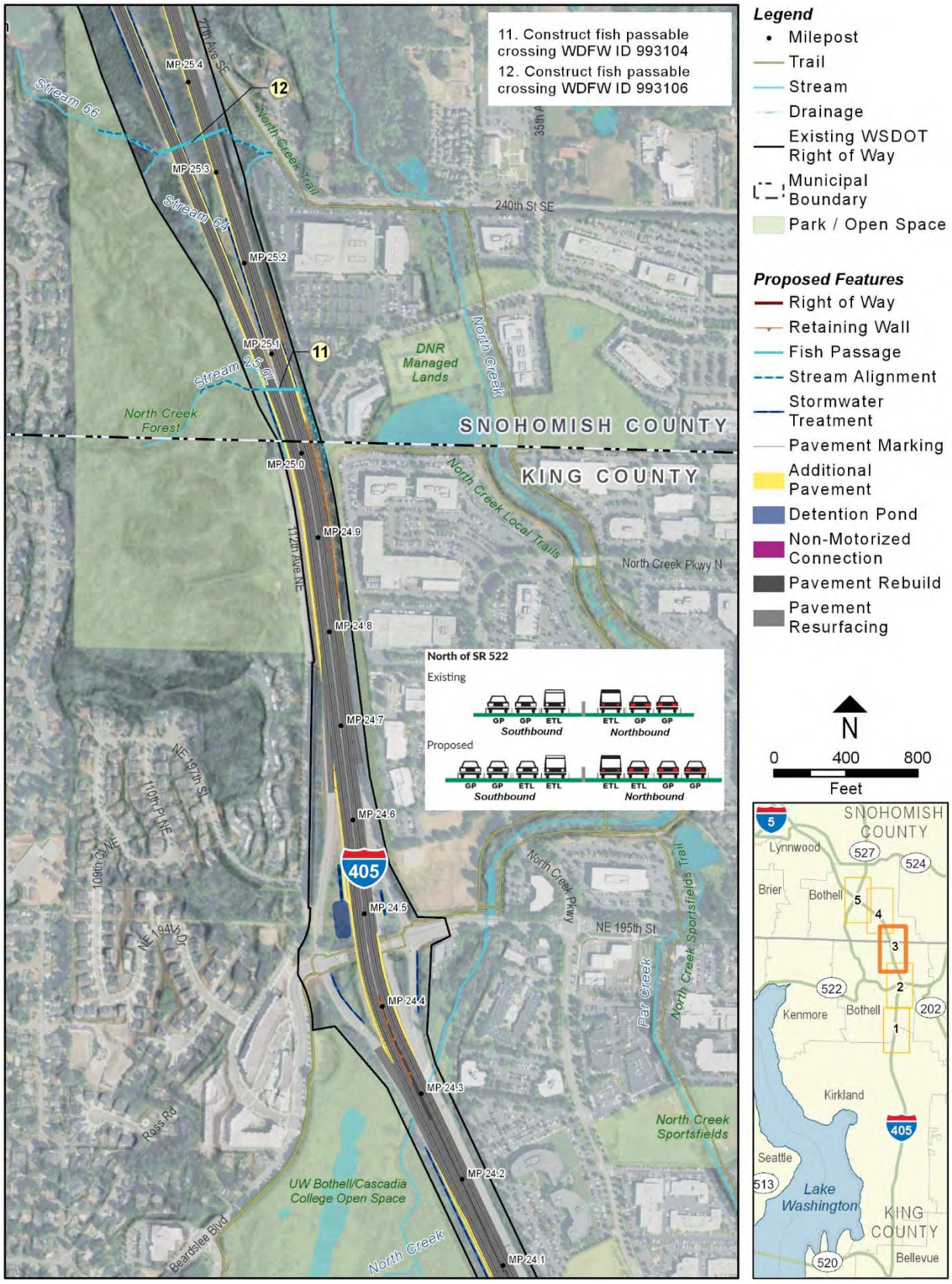


Exhibit 11. I-405, SR 522 Vicinity to SR 527 Express Toll Lane Improvement Project, Sheet 4 of 5

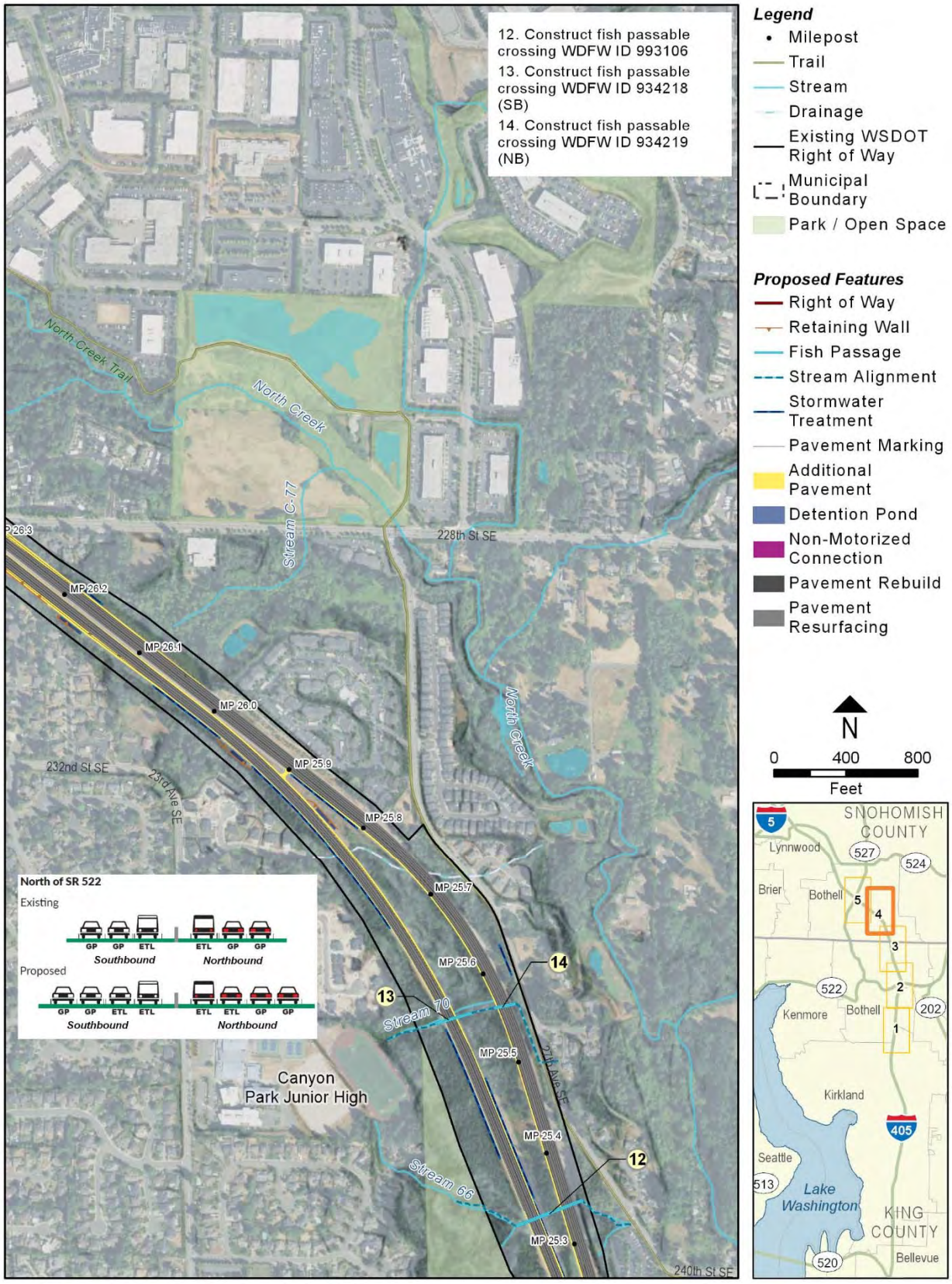
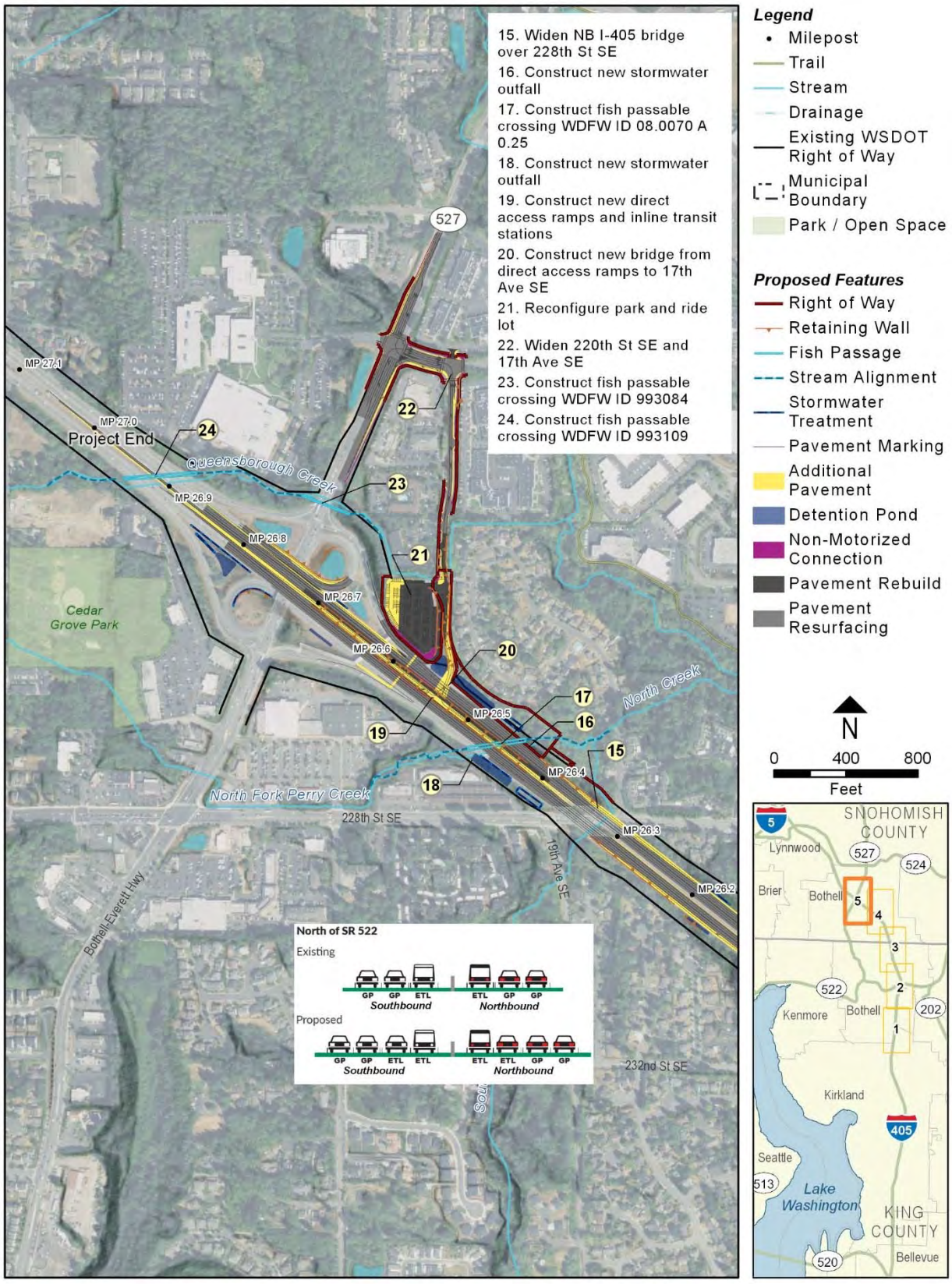


Exhibit 11. I-405, SR 522 Vicinity to SR 527 Express Toll Lane Improvement Project, Sheet 5 of 5



Pre-BA Meeting Notes, December 13, 2018

The meeting began with a quick overview of the project location. There were several exhibits with aerial photography of the corridor.

Rob Thomas had previously prepared a table with various I-405 projects and their status to clarify how the two projects discussed in this meeting related to previous I-405 consultations. Both the SR 522 to SR 527 Capacity Improvement project and the 132nd Street Interchange project will be new consultations. Although previous projects had occurred in both locations, those consultations were complete and both current projects will be new proposed actions and new consultations. Only actions that are currently funded will be consulted on.

This project will add a single express toll lane in each direction from Kirkland (south end, MP 21.8) to Bothell (north end MP 27.1). The new lanes will be added to address congestion issues on the northern end of I-405 and make the corridor more consistent with previous work to the south (Bellevue to Lynwood already has 2 toll lanes). In addition to the new lanes, proposed project improvements include:

- New direct access ramps will be added at SR 522 and SR 527
- Widen a bridge (228th Street NE);
- Remove/replace bridge piers (SR 522);
- Construct new noise and retaining walls;
- Construct new stormwater treatment facilities;
- Construct improvements to arterial streets (roundabouts), and
- Construct transit improvements (transit stations {at SR 522 and SR 527}, park-n-rides, provide bicycle and pedestrian access.

The project will also replace eight fish barrier culverts in various locations. The team discussed the locations of three culvert barriers in southern Snohomish County between MPs 25.6 and 25.3. The median is about 70 feet wide in this location. Washington Department of Fish and Wildlife (WDFW) just reclassified these streams as fish bearing based on physical criteria only; they have very small lineal gains and may not have perennial flow. Rob noted that these small streams are not shown on USGS maps and that WDFW will occasionally change their names. One of the streams is supported from runoff from impervious surface at Canyon Park Jr. High School. It is likely that some of these sites may not support fish or have listed fish.

The majority of the work will occur at or around the SR 522 / I-405 intersection with the new direct access ramps and transit improvements. The project will remove two bridges over the Sammamish River and build three bridges (the new bridge is for the direct access ramp). There will be no changes to the North Creek Bridge. The current bridges have piers below the ordinary high water mark (OHWM) and the replaced/new piers will be above the OHWM. There will be a new stormwater outfall to the Sammamish River. There will be a new park n ride lot but it may not be in the location shown on the plans. The team is coordinating with Sound Transit on the transit issues. The current park-n-ride location would have wetland impacts. This intersection also has mitigated wetlands in the NW quadrant from previous projects commitments and they will not be disturbed. Wetland delineations will be performed in the next few months. A fish barrier on Par Creek will also be replaced.

The team discussed new impervious surface and stormwater treatment. There will be approximately 24 acres of new pollution generating impervious surface (PGIS) and all stormwater from new PGIS will have enhanced treatment. About 20 acres of existing PGIS will receive retrofit treatment, with most of these areas near the SR 522 intersection. There was a question about retrofit treatment near the U. of Washington Bothell campus – they will use media filter drains on limited areas here.

Cindy Callahan with the Federal Highway Administration (FHWA) asked about project phases and funding. She cited past I-405 projects where the ESA consultation was completed on the entire project but constructed in phases as funding became available, and project commitments were sometimes not tracked (primarily for stormwater treatment). She also asked if this project was interrelated to Sound Transit activities?

The project is interrelated to concurrent Sound Transit projects; Sound Transit will be using the new ETLs. The construction scheduled is aligned with the Sound Transit opening in 2024, which is also the construction complete date for the highway portion. The Sound Transit project is full funded for construction; the highway projects currently has $20,000,000 for preliminary engineering but is not funded for construction at this time. If the highway project receives partial funding then southbound lane construction will have the higher priority, as there is more congestion in this direction. Cindy indicated that the team should be deliberate on what the consultation will cover and not relate it to previous consultations; Rob indicated that they will only consult on what is funded.

The team discussed impacts to listed species and habitats. Most of the project will occur within the current right-of-way (ROW) and there are limited habitats for terrestrial species. Rob reviewed potentially suitable habitat for marbled murrelet and there are very few polygons identified in the Davis GIS layer and he will make a no effect call for marbled murrelet and other terrestrial species.

There will be in-water work and stormwater effects in the Sammamish River, which has documented occurrences of Puget Sound (PS) Chinook, PS steelhead, and bull trout. North Creek also has some or all of these species. Preliminary effect determinations for these three species will be likely to adversely affect. There are no designated fish critical habitats on any of the project streams. The project will also likely adversely affect Essential Fish Habitat from the new stormwater (treated or otherwise) and from the bridge pier work in the Sammamish River.

Fish use on some of the drainages is unknown, such as the North Fork of Perry Creek. The team will be conducting additional coordination with WDFW and the Tribes to determine if fish are present. The team will also coordinate with the City of Bothell, which has long-term fish records for some of the local streams. The liaisons asked that the team share those results with them before submittal, as some streams may have only forage fish and may need some level of analysis. Rob will be evaluating project streams for fish presence based on the new classification by WDFW. He hopes to get this done this winter, which is a good time to see seasonal flow.

Project construction will take place over a three year period by a design build contractor, but all in-water work will take place within 1 season, with the fish barrier removals and the bridge replacements over the Sammamish River completed.

DeeDee Jones asked if a new outfall into the Sammamish River might affect flows – the Tribe expressed concern about this. Alan Black replied that we will not increase flows during peak events and that this part of the river is flow exempt. Michael MacDonald mentioned that he had lived in this area for several years and had seen high flows at this location but never flooding.

There were questions about the pier removal in the Sammamish. The piers cannot be excavated for removal as they are 40-50 feet below grade. Each pier will be isolated with a coffer dam during the fish window and cut off 2 feet below the mudline, and this should be acceptable to the Coast Guard. The team will need to describe how much of the river width will be affected by this work to document potential effects to fish migration.

M. MacDonald mentioned that the Sammamish River bridges have nesting swallows and barn owls on the structures; and the Migratory Bird Treaty Act protects active nests – bird issues should be coordinated with Fish and Wildlife biologists at WSDOT HQ.

There will be about 6 acres of wetland impacts and the liaisons asked how this would be mitigated? The team does not know the specific mechanism at this time but is seeking out options for advance mitigation at the Keller Farm mitigation site (located in Redmond at the confluence of Bear, Evans and Perrigo Creeks) or through in-lieu fees from King County. Do any of the wetlands have fish habitat? The team is not sure yet.

Leslie Durham asked that when discussing streams in the consultation materials to use stream miles to reference locations.

Since stormwater will be a major component of the effects analysis, there was a discussion on using Hi-Run, the WSDOT analytical tool for stormwater. D. Jones asked that only threshold discharge areas (TDAs) with listed fish be analyzed, and that simple data summaries would be sufficient for the biological assessment (BA). Show maps of what is flowing to where.

The team would like to submit a BA by March/April 2019. The liaisons asked if there would be any preliminary design on fish structures? They will have conceptual design at about 15% for submittal. Could this project be covered under the WSDOT programmatic ESA consultations? M. Bakeman checked after the meeting and the USFWS programmatic does not have specific language that would prohibit a programmatic submittal, and the NMFS consultation has this condition: “Projects are not covered if they have major indirect effects such as those creating new interchanges or new lanes which extend from interchange to interchange. Mobility improvement projects may result in indirect effects and subsequent adverse effects to listed species from land use changes or increased traffic capacity.” This could be discussed further with the Services, but it looks like it would be a hard fit for a programmatic submittal.

The project will likely have indirect effects at SR 522 because of congestion, and an indirect effects section will likely be needed for the BA. Since the project will be formal for both Services, a cumulative effects section will also be needed.

There were questions about how this work will fit with Sound Transit work? Sound Transit supports this project and they are both on the same timeline with their consultation. Sound Transit will likely use the federal nexus of funding through the Federal Transit Administration (FTA) to complete their Section 7 consultation. Cindy Callahan works with FTA and she will discuss this consultation with her FTA counterparts. Cindy will review a draft of the BA after a review by HQ biology staff.

It was suggested and agreed that the project team should have a second pre-BA meeting prior to BA submittal.

Second Pre-BA Meeting Notes, June 20, 2019

Attending: Rob Thomas (WSDOT/I-405 Team), Jennifer Cheung (I-405 Team), Maki Dalzell (I-405 Team), Tricia Gross (I-405 Team), Alan Black (I-405 Team), Alex Strom (I-405 Team), Stephanie Miller (I-405 Team), Alan Black (I-405 team), Rob Woeck (I-405 Team), Cindy Callahan (Federal Highway Administration), Michael MacDonald (WSDOT liaison to National Marine Fisheries Service), Leslie Durham (WSDOT liaison to U.S. Fish and Wildlife Service), Sharon Rainsberry (WSDOT liaison to National Marine Fisheries Service and U.S. Fish and Wildlife Service), Jeff Dreier (HQ Fish and Wildlife), Mark Bakeman (HQ Fish and Wildlife)

A second pre-BA meeting was held on this project to provide updates on project design and to follow-up on questions/issues raised in the December 2018 pre-BA meeting. Rob Thomas began by going through the review and submittal schedule for the biological assessment. There will be internal and FHWA reviews of the draft BA in July, with the submittal in mid-August or September.

Team members reviewed various project elements for the benefit of the liaisons; there have not been many changes since the December meeting. The focus of the project will be to relieve congestion on the northern section of I-405 by adding a single express toll lane in each direction from Kirkland (south end, MP 21.8) to Bothell (north end MP 27.1). Most of the other project elements are related to adding these lanes. The work that will affect listed species includes in-water work in the Sammamish River (the removal of existing bridges and the construction of new bridges), the addition of about 24 acres of new pollution generating impervious surface (and associated treatment facilities) and the replacement of eight or more fish barrier culverts. This will be a design-build (DB) contract.

Much of the work will be at the SR 522 interchange, with the removal and construction of multiple bridges. There will be two new inline transit stations in the I-405 median here (one in each direction), with locations to be determined in coordination with Sound Transit. The University of Washington Bothell campus wetland, which is in the NW quadrant of I-405 and SR 522 will not be disturbed. Stream 42 south of the SR 522 interchange is considered non-fish bearing and will not be included in the BA, but discussion is on-going with the Muckleshoot Tribe over potential fish use status. There are a few additional streams whose status is unclear. If these streams are added to the proposed action at a later date for barrier removal, it could just be a project update, or a reinitiation if they are determined to have listed fish species.

There was discussion about the demolition of the old bridges and construction of the new bridges at SR 522 in the Sammamish River. Details on construction methods will be determined by the DB contractor. The existing piers will probably be cut two feet below the mudline and removed – they are on deep foundations (50-100 ft deep). A barge may be needed since they cannot reach everything from shore. The barge would be used as containment under the bridges to be demolished, or to aid in placement of additional containment BMPs to prevent broken concrete or other debris from being dropped in the river. Washington Department of Fish and Wildlife (WDFW) did not raise concerns about a barge, as long as it is not anchored in the river bed. It is anticipated that a temporary work bridge will not touch the water. Sheet-pile coffer dams will be used to isolate the piers that will be removed, with an estimated duration of 1 week per pier. Impact pile driving will not be used.

The temporary work platform and barge will be included in the draft BA. The barge presence in the river creates habitat for predatory fish and it is not preferred if possible. Can you avoid grounding it? Can it be tied off to shore? WDFW says if it is anchored to the streambed it would be considered in-water work. Take into consideration the duration of the barge shading effect.

The temporary work bridge would span over the ordinary high water mark (OHWM) and would be a few feet above the river surface. The liaisons urged that the contractor compare the use of the temporary work bridge to use of a barge. What is the footprint of each? Where will work occur and where are the access points? Estimate worst case scenario footprint of each and together and the duration of these elements, and minimize accordingly.

The demolition of each bridge will take 7 weeks, for a total of up to 16 weeks.

Could super sacs be used instead of sheet pile to isolate the piers, especially if the water depth is shallower? Although vibratory installation of piles will not adversely impact fish, it can result in considerable turbidity. Super sacs have been used successfully in deeper systems (the Puyallup River). The final decision on pier isolation will be left to the DB contractor. The current expected fish window is July 15-Aug 31, but this will be cutting it close. The Project Office may request that WDFW extend the work window. WDFWs current preference is that the window be extended (only if necessary) on the front end, with work beginning on or after July 1.

Work north of the SR 522 interchange will mostly be widening, with no work at the North Creek Bridge. There will be also be a number of culvert replacements in the northern part of the project area,

primarily on North Creek or its tributaries. A tie-in to the North Creek pedestrian trail will be provided. There will be no new overwater coverage over North Creek. Will there be enough light to grow plants along the trail at the I-405 underpass? They are not sure. The outfall at North Creek will not be moved or reconstructed.

Streams 25, 66, and 70 will have fish barriers removed. Stream 70 probably only has resident fish, but the team is discussing this with the Muckleshoot Tribe and WDFW, and it may not be included in the BA. Stream 70 had water in the channel as of 6/14/2019. The team was also discussing Stream 77 with WDFW and the Muckleshoot, and WDFW confirmed on 6/20 that potential fish use in this drainage ends downstream of I-405 and there is no requirement for fish passage across I-405. This stream had run dry as of 6/14/2019 and will be removed from the BA because it does not support listed species or directly connect to any stream or wetland that does. These northern streams (70 and 77) are on steep (10-15%) slopes.

The bridge at the I-405 and 228th Street intersection will be widened. Fish barriers will be replaced near the SR 527 intersection on the N. Fork of Perry Creek and on Queensborough Creek. There will be no work at the park-n-ride at this intersection because that culvert is fish passable.

There was a brief discussion of stormwater effects, with much of the information presented in the December meeting unchanged. About 34% of the existing PGIS has stormwater treatment, and at the end of the project > 58% will be treated (including all of the 24 acres of new PGIS). All stormwater BMPs will be for enhanced treatment. The team is working with WSDOT Maintenance on stormwater BMP design. The stormwater designers believe that compost amended biofiltration media will likely be used. There is high groundwater in much of the area, and infiltration is unlikely. There was brief discussion of deep infiltration, which can be used in areas that have soil layers to work with. It is not feasible here because you are at the elevation of the North Creek Valley.

Rob Thomas quickly reviewed changes to the species effect determinations since the December meeting. They have changed the effect determination of yellow-billed cuckoo from no effect to not likely to adversely affect, based on a potential habitat patch at the Univ. Washington wetland area at the SR 522 interchange.

Rob mentioned two areas of potential habitat for marbled murrelet, one area surrounding Juanita Creek just upstream of I-405, and another in the Canyon Park neighborhood in Bothell. Juanita Creek has some large trees, and Canyon Park is under heavy residential development. Both are within municipal boundaries, which indicates murrelet presence is discountable. The team is leaning towards a no effect determination in this urban corridor.

At the December meeting the issue of interrelated and interdependent effects was raised on South Sound Transit components of the project. Bus rapid transit (BRT) will open in 2024 and will operate in the I-405 express toll lanes. They will use direct access ramps, but this will be operated by South Sound Transit with no federal funds. The I-405 project would still be built even if BRT would not use I-405. The team was unsure who was paying for the transit facility.

S. Rainsberry suggested that they should make their case why it is not interdependent and interrelated in that section, but consider it a cumulative effect.

Appendix C

WSDOT Fish Handling Protocol

WSDOT Fish Exclusion Protocols and Standards

Work below the Ordinary High-Water Mark (or Mean Higher High-Water Mark) shall, in general, be conducted in isolation from flowing waters. Exceptions to this general rule or performance measure include: 1) implementation of the work area isolation and fish capture and removal protocols described in this document; 2) placement or removal of small quantities of material (e.g., wood or rock), or structural best management practices (e.g., turbidity curtain), under site conditions where potential exposures and effects to fish life are minimized without isolation from flowing waters[1]; and, 3) work conducted under a declared emergency, under emergency conditions, or where flow conditions prevent safe implementation of work area isolation and fish capture and removal protocols.

Implementation of the work area isolation and fish capture and removal protocols shall be planned and directed by a WSDOT biologist, or qualified biologist under contract to WSDOT, possessing all necessary knowledge, training, and experience (the directing biologist). If electrofishing will or may be used as a means of fish capture, the directing biologist shall have a minimum of 100 hours electrofishing experience in the field using similar equipment, and any individuals operating electrofishing equipment shall have a minimum of 40 hours electrofishing experience under direct supervision. All individuals participating in fish capture and removal operations shall have the training, knowledge, skills, and ability to ensure safe handling of fish, and to ensure the safety of staff conducting the operations.(See Appendix A for requirements)

The directing biologist shall work with Maintenance, Construction, and/or Environmental staff (as appropriate) to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering. This plan should consider the size and channel characteristics of the area to be isolated, the method(s) of dewatering (e.g., diversion with bypass flume or culvert; diversion with sandbag, sheet pile or similar cofferdam; etc.), and what sequence of activities will provide the best conditions for safe capture and removal of fish. Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to isolate the work area and remove all fish life prior to dewatering or flow diversion. Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, it may be necessary to commence with dewatering or flow diversion staged in conjunction with fish capture and removal. The directing biologist shall use his/her best professional judgment in deciding what sequence of activities is likely to minimize exposure of fish to conditions causing stress or injury (including stranding, exposure to extremes of temperature or reduced dissolved oxygen, risk of injury resulting from electrofishing, etc.).

[1] WSDOT shall make this determination with consultation or input from the regulatory agencies with jurisdiction, including the Washington State Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (FWS), and NOAA-National Marine Fisheries Service (NMFS) as appropriate; also, this exception shall not permit work that requires in-water excavation or that presents a risk of increased turbidity beyond the immediate work area or for a duration of more than 15 minutes.

The directing biologist shall plan work area isolation, fish capture and removal, and dewatering with consideration for the following: habitat connectivity and fish habitat requirements; the duration and extent of planned in-water work; anticipated flow and temperature conditions over the duration of planned in-water work; and, the risk of exposure to turbidity or other unfavorable conditions during construction. If the area to be isolated includes only a portion of the wetted channel width (e.g., large or deep rivers where diversion from the entirety of the wetted channel is difficult or impossible), or if the bypass flume or culvert will effectively maintain connectivity and fish passage for the duration of construction activities, it may be less important whether the fish are herded (and/or captured and released) upstream or downstream of the isolated work area. However, if the area to be isolated includes the entire wetted channel width, and especially if conditions make it unlikely that connectivity (i.e., upstream/downstream fish passage) can be effectively maintained for the duration of construction activities, then the directing biologist should carefully consider whether to herd fish (and/or capture and release fish) upstream or downstream of the isolated work area.

If conditions upstream of the isolated work area will or may become unfavorable during construction then fish should be herded or released to a downstream location; this situation is probably most common where the waterbody in question is small, where seasonal flows are substantially diminished, and conditions of elevated temperature and/or reduced dissolved oxygen are foreseeable. However, the directing biologist shall also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish herded or released to a downstream location may be exposed to these conditions.

If large numbers of fish are to be herded (and/or captured and released), and in order to avoid overcrowding or concentrating fish in areas where their habitat needs cannot be met, it may be appropriate to relocate fish both upstream and downstream of the isolated work area. At locations where habitat connectivity or quality is poor, including along reaches upstream and/or downstream of the isolated work area, the directing biologist should carefully consider whether relocated fish can meet their minimum habitat requirements for the duration of planned in-water work. On rare occasions it may be appropriate to relocate fish at a greater distance upstream and/or downstream (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met, or where they may be exposed to unfavorable conditions resulting from construction. On those rare occasions where relocation to a greater distance is deemed necessary, the WSDOT shall provide notice to the agencies with jurisdiction in advance of the operations.

Plans for staging work area isolation, fish capture and removal, and dewatering must comply with WSDOT safety requirements. Safe implementation is a high priority. The directing biologist shall design and adjust the plan as necessary to ensure the safety of all individuals implementing the plan. Under some conditions it may be appropriate to conduct work without isolation from flowing waters, without placement of block nets, fish capture or removal; for a discussion of this topic see page 1.

In order to comply with WSDOT safety requirements, work in or around water outside of daylight hours is not generally permissible. If, under unusual circumstances, the directing biologist identifies work that will or may be necessary outside of daylight hours, he/she shall coordinate and gain approval for this work with appropriate managers (including the WSDOT safety officer and/or supervisors with authority).

Work Area Isolation

The directing biologist shall determine appropriate locations for the placement of block nets, based on site characteristics and a consideration of the type and extent of planned in-water work. Sites that exhibit reduced flow volume or velocity, uniformity of depth, and good accessibility are preferred; sites with heavy vegetation, large cobble or boulders, undercut banks, deep pools, etc. should be avoided due to the difficulty of securing and/or maintaining nets. Sites with a narrow channel cross-section ("constriction") should be avoided if foreseeable flow conditions might overwhelm or dislodge the block nets, posts, or anchors.

Except when planning and intending to herd fish upstream, and upstream block net shall be placed first. With a block net secured to prevent movement of fish into the work area from upstream, a second block net should be used as a seine to herd fish in a downstream direction. Where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish (e.g., thick overhanging vegetation, rootwads, logjams, etc.) it may be appropriate to isolate a portion or portions of the work area, rather than attempting to herd fish from the entirety of the work area in a single downstream pass. Fish capture and removal will be most successful if an effort is made to strategically focus and concentrate fish in areas where they can be easily seined and netted. Care shall be taken not to concentrate fish where they are exposed to sources of stress or to leave them concentrated in such areas for a long duration (e.g., more than 30 minutes).

Depending upon site characteristics, and the planned staging and sequence for work area isolation and dewatering, it may or may not be necessary to place a downstream block net. Typically, however, site characteristics and/or the duration of planned in-water work will necessitate placement of a net(s) to prevent movement of fish into the work area from downstream. If groundwater seepage or site drainage has a tendency to re-wet the area, if the area to be isolated is low-gradient or subject to a backwatering influence, or if the area to be isolated is large and considerable effort will be expended in capturing and removing fish life, a downstream block net should be placed. If foreseeable flow conditions over the duration of planned in-water work might enable fish to re-enter the work area from downstream, a downstream block net should be placed.

In most instances where gradual dewatering or flow diversion is staged in conjunction with fish capture and removal, it is appropriate to delay installation of the downstream block net(s) until after fish have been given sufficient time to move downstream by their own choosing. If flows are reduced gradually over the course of several hours, or the length of an entire workday, some (perhaps many) fish will make volitional movements downstream beyond the area to be isolated. Gradual dewatering can be an effective

means by which to reduce the risk of fish stress or injury. Gradual dewatering and the encouragement of volitional movement are particularly important where the area to be isolated is large and may hold many fish. However, where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish, some (perhaps many) fish will not choose to move downstream regardless of how gradually flows are reduced. The directing biologist should use his/her best professional judgment in deciding what sequence of activities is likely to minimize fish stress or injury (including stranding).

Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to remove all fish life prior to dewatering, or to implement plans for dewatering staged with fish capture over a relatively short timeframe (e.g., 1-2 hours). Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, dewatering or flow diversion should be staged in conjunction with fish capture and removal over a longer timeframe (e.g., 3-6 hours). The largest areas and/or most difficult site conditions may warrant or require that plans for dewatering and fish capture proceed over the length of an entire workday, or multiple workdays. Where this is the case, fish should be given sufficient time and a means to move downstream by their own choosing so as to reduce the total number of fish exposed to sources of stress and injury (including fish handling).

The directing biologist shall select block nets that are appropriate for the site and fish species present. Type of material, length, and depth may vary based on site conditions. It may be necessary and appropriate to contact other WSDOT Regions or offices with access to nets (or other materials) suitable for placement under unique or unusual circumstances. Typically block nets will be composed of 9.5 millimeter stretched nylon mesh and should be installed at an angle to the direction of flow (i.e., not directly perpendicular to flow) so as to reduce the risk of impinging fish. Anchor bags filled (or half-filled) with clean, washed gravel are preferred over sandbags, especially for nets and anchors that will or may remain in-place for a long duration (i.e., more than two weeks). Any use or movement of native substrates or other materials found on-site should be incidental and shall not appreciably affect channel bed or bank conditions.

Block nets shall remain in place until work affecting fish habitat in that reach of stream is complete and conditions are suitable for the reintroduction of fish[2]. Block nets require frequent inspection and debris removal. A qualified biologist, or other field staff trained in safe fish handling, shall be assigned the responsibility of inspecting the nets and safely capturing and relocating any impinged fish. The frequency of these inspections shall be determined on a case-by-case basis. However, block nets shall, at a minimum, be

[2] If plans for work area isolation and fish capture and removal include the installation of temporary cofferdams, and once the directing biologist has confirmed fish life have been successfully excluded from the entire area enclosed by the cofferdam(s), it may be appropriate to remove block nets and allow fish to re-enter the previously isolated work area; this approach is particularly relevant and appropriate where many weeks or months of construction are planned for completion within temporary cofferdams (i.e., isolated from flowing waters).

inspected for impinged fish (especially juvenile fish) at least three times daily or when requested by the Engineer. On working days, these inspections shall be performed at the start, middle and end of the work day. On non-working days, these activities shall be performed between 6:00 am and 8:00 am, between 11:00 am and 1:00 pm and between 4:00 pm and 6:00 pm. They may need to be checked more frequently for the first 24 hours after a significant rainfall (or change in flow volume or velocity). In the event fish are found impinged on the net(s), or if weather or flow conditions change significantly, the directing biologist shall reconsider and adjust the frequency of net inspections so as to minimize the risk of impinging and injuring fish.

Field staff shall be assigned the responsibility of frequently checking and maintaining the nets for accumulated debris, general stability, and proper function. The frequency of these inspections shall be determined on a case-by-case basis, dependent upon the site, seasonal, and weather conditions. Block nets must be secured along both banks and the channel bottom to prevent failure as a result of debris accumulation, high flows, and/or flanking. Some locations may require additional block net support (e.g., galvanized hardware cloth, affixed metal fence posts, etc.).

Fish Capture and Removal

If dewatering and/or flow diversion is deemed necessary, this work (including related fish capture and removal operations) shall comply with any provisions contained in the Hydraulic Project Approval (HPA), or applicable General HPA, issued by the WDFW. If the FWS and/or NMFS have provided relevant Terms and Conditions from a Biological Opinion addressing the work (or action), this work shall also comply with those Terms and Conditions.

If pumps are used to temporarily bypass water or to dewater residual pools or cofferdams, pump intakes shall be screened to prevent aquatic life from entering the intake. Fish screens or guards shall comply with Washington State law (RCW 77.57.010 and 77.57.070), with guidelines prescribed by the NMFS[3], and any more stringent requirements contained in the HPA or General HPA issued by the WDFW. If pumps are to be used on a more permanent basis, as the primary or secondary method for diverting flow around the isolated work area, plans for dewatering shall address contingencies (i.e., extremes of flow or weather). These plans shall include ready access to a larger or additional "back-up" pump with appropriately screened intake. If the directing biologist has confirmed that all fish life has been successfully excluded from the area, there is no risk of entraining fish, and adequate plans are in-place to address contingencies (including a routine schedule for inspection), then pumps may be operated without a screened intake.

[3] National Marine Fisheries Service. 2011. Anadromous Salmonid Passage Facility Design. Chapter 11: Fish Screen and Bypass Facilities. NMFS Northwest Region, July 2011, 140 p..

Fish Capture and Removal Methods:

Methods for safe capture and removal of fish from the isolated work area are described below. These methods are given in order of preference. At most locations, a combination of methods will be necessary. In order to avoid and minimize the risk of injury to fish, attempts to seine and/or net fish should always precede the use of electrofishing equipment. Visual observation techniques (e.g. snorkeling, surveying with polarized glasses or Plexiglas bottomed buckets, etc.) may be used to assess the effectiveness of these methods, to identify locations where fish are concentrating, or otherwise adjust methods for greater effectiveness.

If the planned fish capture and removal methods have not been addressed through consultation (or programmatic consultation), if seining and netting are impracticable (i.e., electrofishing is deemed the only viable means of fish capture), and fish listed under the ESA may be present, the directing biologist shall provide notice to the FWS and/or NMFS (as appropriate). This notice shall be provided in advance of the operations, and shall include an explanation of the unique site conditions or circumstances. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols.

Where fish listed under the ESA will or may be present, the directing biologist shall insure that fish capture and removal operations adhere to the following minimum performance measures or expectations:

1) Only dip nets and seines composed of soft (non-abrasive) material shall be used.

2) The operations shall not resort to the use of electrofishing equipment unless other less injurious methods have removed most or all of the adult and sub-adult fish (i.e., fish in excess of 300 millimeters); the operations shall conduct a minimum of three complete passes without capture using seines and/or nets.

3) The operations shall confirm success of fish capture and removal before completely dewatering or commencing with other work within the isolated work area; the operations shall conduct a minimum of two complete passes without capture using electrofishing equipment.

4) Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator.

5) A plan for achieving efficient return to appropriate habitat will be developed before the capture and removal process.

6) Every attempt will be made to release ESA-listed specimens first.

• **Seining** shall be the preferred method for fish capture. Other methods shall be used when seining is not possible, or when/after attempts at seining have proven ineffective. Seines, once pursed, should remain partially in the water while fish are removed with dip nets. Seines with a "bag" minimize handling stress and are preferred. Seines with a bag are also preferred where obstructions make access to the water (or deployment/retrieval of the seine) difficult.

In general, seining will be more effective if fish, especially juvenile fish, are moved (or "flushed") out from under cover. Methods which may increase effectiveness and/or efficiency include conducting seining operations at dawn or dusk (i.e., during low-light conditions), in conjunction with snorkeling, and/or flushing of the cover. In flowing waters and especially where flow volume or velocity is high or moderately-high, seines that employ a heavy lead line and variable mesh size are preferred. Small mesh sizes are more effective across the full range of fish size (and age class), but also increase resistance and can make deployment/retrieval more difficult in flowing waters. Seines which use a small mesh size in the bag (or body), and a larger, less resistant mesh size in the wings may under some conditions be most effective and efficient.

• **Baited Minnow Traps** are typically used before and in conjunction with seining. Traps may be left in the isolated work area overnight. Traps shall be inspected at least four times daily to remove captured fish and thereby minimize predation within the trap. Traps should be checked more frequently if temperatures are in excess of 15 degrees C (59 F).

Predation within the trap may be an unacceptable risk when minnow traps are left in-place overnight; large sculpin and other predators that feed on juvenile fish are typically much more active at night. The directing biologist shall consider the need and plan for work outside daylight hours (i.e., inspection and removal) before leaving minnow traps in-place overnight.

• **Dip Nets** shall be used in conjunction with seining. This method is particularly effective when employed during gradual dewatering or flow diversion. To be most effective and to minimize stress and risk of injury to fish (including stranding), the directing biologist shall coordinate fish capture operations with plans for dewatering or flow diversion. Plans for dewatering and/or flow diversion should proceed at a measured pace (within constraints), to encourage the volitional downstream movement of fish, and reduce the risk of stranding. Plans for dewatering and/or flow diversion shall not proceed unless there are sufficient staff and materials on-site to capture and safely remove fish in a timely manner. Generally, this will require a minimum of two persons (three if electrofishing), but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing).

Once netted, fish shall remain partially in water until transferred to a bucket, cooler, or holding tank. Dip nets which retain a volume of water ("sanctuary nets") are preferred. However, sanctuary nets may be ineffective where flow volume or velocity is high or moderately-high (i.e., increase resistance lessens ability to net or capture fish). In

addition, where water depths are very shallow and/or fish are concentrated in very small receding pools or coarse substrate, "aquarium" nets may be a better, more effective choice. Use of dip nets in conjunction with snorkeling, flushing of the cover, or around the hours of dawn or dusk (i.e., during low light conditions), can be effective for capturing fish sheltered below cover.

• **Connecting Rod Snakes** may be used to flush fish out of stream crossing structures (i.e., culverts). Connecting rod snakes are composed of wood sections approximately three feet in length. Like other cover attractive to fish, culverts (especially long culverts), can present a challenge to fish capture and removal operations. The directing biologist should plan a strategy for focusing and concentrating fish in areas where they can be easily seined and netted, and should take active steps to prevent fish from evading capture. When first implementing plans for work area isolation, fish capture and removal, and dewatering, it may be appropriate to place block nets immediately upstream and/or downstream of culverts so as to minimize the number of fish that might seek cover within the culvert(s). Once most or all of the fish have been removed from other parts of the work area, the block net placed downstream of the culvert(s) should be removed to encourage volitional downstream movement of fish.

• **Electrofishing** shall be performed only when other methods of fish capture and removal have proven impracticable or ineffective at removing all fish. The directing biologist shall ensure that attempts to seine and/or net fish always precede the use of electrofishing equipment. Larger fish (i.e., adult and sub-adult fish with comparatively longer spine lengths) are more susceptible to electrofishing injury than smaller fish. To minimize the risk of injury (and the number of fish potentially injured), the directing biologist shall confirm that other methods have been effective in removing most or all of the adult and sub-adult fish before resorting to the use of electrofishing equipment; see the related performance measure appearing on page 6. As a general rule or performance measure, electrofishing should not be conducted under conditions that offer poor visibility (i.e., visibility of less than 0.5 meter).

The following performance measures shall apply to the use of electrofishing equipment as a means of fish capture and removal:

1. If the planned fish capture and removal operations have not been addressed through consultation (or programmatic consultation), and fish listed under the ESA may be present, WSDOT shall provide notice to the FWS and/or NMFS prior to the initiation of electrofishing attempts. Upon request, the WSDOT shall permit the FWS, NMFS, and/or their designated representative to observe fish capture and removal operations. Work conducted under a declared emergency (or emergency conditions) shall follow established ESA notification protocols.

2. Electrofishing shall only be conducted when a biologist with at least 100 hours of electrofishing experience is on-site to conduct or direct all related activities. The directing biologist shall be familiar with the principles of electrofishing, including the effects of voltage, pulse width and pulse rate on fish, and associated risk of injury or

mortality. The directing biologist shall have knowledge regarding galvanotaxis, narcosis and tetany, their relationships to injury/mortality rates, and shall have the ability to recognize these responses when exhibited by fish.

3. The directing biologist shall ensure that electrofishing attempts use the minimum voltage, pulse width, and rate settings necessary to create the desired response (galvonotaxis). Water conductivity shall be measured in the field prior to each electrofishing attempt to determine appropriate settings. Electrofishing methods and equipment shall comply with guidelines outlined by the NMFS[4].

4. The initial and maximum settings identified below shall serve as guidelines when electrofishing in waters that may support ESA-listed fish. Only DC or pulsed DC current shall be used. [Note: some newer, late-model electrofishing equipment includes a "set-up" or initialization function; the directing biologist shall have the discretion to use this function as a means to identify proper initial settings.]

Guidelines for initial and maximum settings for backpack electrofishing.[5]

	Initial Settings	**Conductivity (µS/cm)**	**Maximum Settings**
Voltage	100 V	≤300	800 V
		>300	400 V
Pulse Width	500µs		5 ms
Pulse Rate	15 Hz		60 Hz (In general, exceeding 40 Hz will injure more fish)

Each attempt shall begin with low settings for pulse width and pulse rate. If fish present in the area being electrofished do not exhibit a response, the settings shall be gradually increased until the appropriate response is achieved (galvanotaxis). The lowest effective settings for pulse width, pulse rate and voltage shall be used to minimize risks to both personnel and fish. Safe implementation is a high priority. The directing biologist shall ensure the safety of all individuals assisting with electrofishing attempts; this includes planning for and providing all necessary safety equipment and materials (e.g., insulated waders and gloves, first aid/CPR kit, a current safety plan with emergency contacts and phone numbers, etc.). Only individuals that are trained and familiar with the use of electrofishing equipment should provide direct assistance during electrofishing attempts.

5. Electrofishing shall not be conducted where spawning adults or redds with incubating eggs may be exposed to the electrical current. As a general rule or performance measure, waters that support anadromous salmon should not be electrofished from October 15

[4] National Marine Fisheries Service. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act

[5] Adapted from NMFS Backpack Electrofishing Guidelines, June 2000, and WDFW Electrofishing Guidelines for Stream Typing, May 2001

through May 15, and resident waters from November 1 through May 15. If located within waters that may support bull trout, especially waters located within a local bull trout population (i.e., that support spawning and rearing), seasonal limitations on the use of electrofishing equipment may be more restrictive; if you have questions, contact the FWS. If any, more restrictive work windows have been identified through consultation, those windows shall apply. The directing biologist shall ensure that electrofishing attempts are made only during appropriate times of year, and not where spawning adults or redds with incubating eggs may be exposed to the electrical current.

6. An individual shall be stationed at the downstream block net(s) during electrofishing attempts to recover stunned fish in the event they are flushed downstream and/or impinged against the block net(s).

7. The operator shall use caution so as to prevent fish from coming into direct contact with the anode. Under most conditions, the zone of potential fish injury extends approximately 0.5 meter from the anode. Netting shall not be attached to the anode, as this practice presents an increased risk of direct contact and injury. Extra care shall be taken near in-water structures or undercut banks, in shallow waters, or where fish densities are high. Under these conditions fish are more likely to come into close or direct contact with the anode and/or voltage gradients may be intensified. Voltage and other settings shall be readjusted to accommodate changing conditions in the field, including channel depth. When electrofishing areas near undercut banks, overhanging vegetation, large cobble or boulders, or where structures provide cover, fish that avoid capture may be exposed to the electrical current repeatedly. Repeated or prolonged exposures to the electrical current present a higher risk of injury, and therefore galvanotaxis should be used to draw fish out of cover.

8. Electrofishing shall be conducted in a manner that minimizes harm to fish. Once an appropriate fish response (galvanotaxis) is achieved, the isolated work area shall be worked systematically. The number of passes shall be kept to a minimum, but is dependent upon the numbers of fish and site characteristics and shall be at the discretion of the directing biologist. Electrofishing shall not be conducted unless there are sufficient staff and materials on-site, to both minimize the number of passes required and to locate, net, recover, and release fish in a timely manner. Generally, this will require a minimum of three persons, but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing). Care shall be taken to remove fish from the electrical field immediately and to avoid exposing the same fish repeatedly. Fish shall not be held in dip nets while electrofishing is in progress (i.e., while continuing to capture additional fish). [Note: where flow velocity or turbulence is high or moderately-high (e.g., within riffles) it may be difficult to see and net fish; these fish may evade capture (resulting in repeated exposure), or may become impinged on the downstream block net(s); a “frame” net, or small portable block net approximately 3 feet in width, can be effective under these conditions when held downstream in close proximity to the anode.]

9. The condition of captured fish shall be carefully observed and documented. Dark bands on the body and/or extended recovery times are signs of stress or injury. When such signs are noted, settings for the electrofishing unit may require readjustment. The directing biologist should also review and consider changes to the manner in which the electrofishing attempt is proceeding. If adjustments to the electrofishing attempt do not lessen the frequency (or severity) of observed stress, the directing biologist shall have the authority to postpone fish capture and removal operations[6]. Each fish shall be capable of remaining upright and actively swimming prior to release, and will be completely revived in holding tanks as necessary (*See* Fish Handling, Holding and Release).

10. Electrofishing shall not be conducted when turbidity reduces visibility to less than 0.5 meter, when water conductivity exceeds 350 µS/cm, or when water temperature is above 18°C (64 F) or below 4°C (39 F).

Fish Handling, Holding and Release:

• Fish handling shall be kept to the minimum necessary to remove fish from the isolated work area. Fish capture and removal operations shall be planned and conducted so as to minimize the amount and duration of handling. The operations shall maintain captured fish in water to the maximum extent possible during seining/netting, handling, and transfer for release.

• The directing biologist shall document and maintain accurate records of the operations, including: fish species, number, age/size class estimate, condition at release, and release location. Fish shall not be sampled or anesthetized, unless for valid purposes consistent with the WSDOT's Section 10 scientific collection permits.

• Individuals handling fish shall ensure that their hands are free of harmful and/or deleterious products, including but not limited to sunscreen, lotion, and insect repellent.

- The operations shall ensure that water quality conditions are adequate in the buckets, coolers, or holding tanks used to hold and transfer captured fish. The operations shall use aerators to provide for clean, cold, well-oxygenated water, and/or shall stage capture, temporary holding, and release to minimize the risks associated with prolonged holding. The directing biologist shall ensure that conditions in the holding containers are monitored frequently and operations adjusted appropriately to minimize fish stress. If fish listed under the ESA will or may be held for more than a few minutes prior to release, the directing biologist should consider using dark-colored, lidded containers only. Fish listed under the ESA shall not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator; small

[6] If the FWS and/or NMFS have provided an Incidental Take Statement from a Biological Opinion addressing the work (or action), the directing biologist shall ensure limits on take have not been exceeded; if the limits on take are exceeded, or if take is approaching these limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction.

coolers meeting this description are preferred over buckets. Fish will be held for the shortest time necessary for recovery and release.

• The operations shall provide a healthy environment for captured fish, including low densities in holding containers to avoid effects of overcrowding. Large fish shall be kept separate from smaller fish to avoid predation. The operations shall use water-to-water transfers whenever possible.

• The release site(s) shall be determined by the directing biologist. The directing biologist should consider both site characteristics (e.g., flow, temperature, available refuge and cover, etc.) and the types of fish captured (e.g., out-migrating smolt, kelt, prespawn migrating adult, etc.) when selecting a release site(s). More than one site may be designated to provide for varying needs, and to separate prey-sized fish from larger fish. The directing biologist shall consider habitat connectivity and fish habitat requirements, seasonal flow and temperature conditions, and the duration and extent of planned in-water work when selecting a fish release site(s). If conditions upstream of the isolated work area will or may become unfavorable during construction, then fish should not be released to an upstream location. However, the directing biologist shall also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish released to a downstream location may be exposed to these conditions. Site conditions may warrant releasing fish both upstream and downstream, or relocating fish at a greater distance (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met. For a fuller discussion of this topic see page 2.

• The directing biologist shall ensure that each fish is capable of remaining upright and has the ability to actively swim upon release.

• Any ESA-listed fish incidentally killed as a result of fish capture and removal operations shall be preserved and delivered to the appropriate authority upon request (see Documentation).

• If the limits on take of ESA-listed species are exceeded (harm or harassment), or if incidental take is approaching and may exceed specified limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the federal agency (or agencies) with jurisdiction. If dewatering or flow diversion is incomplete and still in-progress, WSDOT shall take remedial actions directed at maintaining sufficient quantity and quality of flow and lessening sources of fish stress and/or injury. If conditions contributing to fish stress and/or injury may worsen before the federal agency with jurisdiction can be contacted, WSDOT should attempt to move fish to a suitable location near the capture site while keeping fish in water and reducing stress as much as possible.

Reintroduction of Flow and Fish to the Isolated Work Area

If conducting work in isolation from flowing waters has required placement of a block net(s), fish capture and removal, and temporary dewatering, the directing biologist shall ensure that the block net(s) remain in place until work is complete and conditions are suitable for the reintroduction of fish. Flows shall be gradually reintroduced to the isolated work area, so as to prevent channel bed or bank instability, excessive scour, or turbidity and sedimentation. The directing biologist shall inspect the work area and downstream reach to ensure no fish are stranded or in distress during reintroduction of flows. If conditions causing or contributing to fish stress and/or injury are observed, WSDOT shall take remedial actions directed at lessening these sources of stress. This may include a more gradual reintroduction of flow, so as to reduce resulting turbidity and sedimentation.

All temporary structures and materials (e.g., block nets, posts, and anchors; bypass flume or culvert; sandbag, sheet pile or similar cofferdam; etc) shall be removed at the completion of work. The directing biologist shall document in qualitative terms the final condition of the isolated work area (including temporary bypass). The directing biologist shall identify and document any obvious signs of channel bed or bank instability resulting from the work, and shall report these conditions to the appropriate Maintenance, Construction, and/or Environmental staff for remedy. WSDOT shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

To avoid and minimize the risk of introducing or spreading nuisance or invasive species, aquatic parasites, or disease, the directing biologist shall ensure that all equipment and materials are cleaned and dried to protocol before transporting them for use at another site or waterbody. Once equipment is fully dried, it should stay dry for at least 48 hours before using in Washington waters. Biologists should avoid the use of felt-soled shoes since they are difficult to decontaminate.

Documentation

- All work area isolation, and fish capture and handling shall be documented in a log book with the following information: project location, date, methods, personnel, water temperature, conductivity, visibility, electrofishing equipment settings, and other comments.

- All fish captured or handled shall be documented: species, number of each species, age/size class estimate, condition at release, and location of release.

- If at any time, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), the directing biologist, if they are a consultant shall immediate notify WSDOT who shall provide immediate notification to the WDFW consistent with any provisions contained in the HPA (or applicable General HPA). Notification shall consist of a phone call or voice mail message directed to the

Area Habitat Biologist identified on the HPA and/or the Washington Military Department Emergency Management Division at (800) 258-5990, as appropriate.

• Any ESA-listed species incidentally killed as a result of fish capture and removal operations shall be documented with the notification provided to the appropriate authority (FWS and/or NMFS) within two working days. If the directing biologist is a consultant, they shall immediately notify WSDOT, who will notify the Services. The consultant shall not independently contact other agencies. Initial notifications shall consist of a phone call or voice mail message. Initial notifications shall be directed to the following: (FWS) the nearest FWS Law Enforcement Office, and the Washington Fish and Wildlife Office at (360) 753-9440; (NMFS) the NMFS Office of Law Enforcement at (800) 853-1964, and the Washington State Habitat Office at (360) 753-9530. Any dead specimens shall be kept whole and preserved on-ice or frozen until WSDOT receives a response and further directions from the appropriate authority; if WSDOT receives no response within 5 working days, the directing biologist shall have the discretion to dispose of specimens. Initial notifications shall be followed by a second notification in writing. All notifications shall provide at a minimum the following: date, time, WSDOT point-of-contact (the directing biologist and/or supervisor), project name (and FWS and/or NMFS tracking number if available), precise location of any incidentally killed or injured and unrecovered fish, number of specimens and species, and cause of death or unrecoverable injury. If the limits on incidental take are exceeded (harm or harassment), the written notification shall also include an explanation of the circumstances causing or contributing to observed levels of take.

• The final condition of the isolated work area (including temporary bypass) shall be documented in qualitative terms, including any obvious signs of channel bed or bank instability resulting from the work. WSDOT shall document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

Appendix A

Requirements for Designated Lead Fish Moving Biologist (Directing Biologist)

- Completion of a minimum of a two day electrofishing class.
- Training in fish ecology and identification
- 100 hours of electrofishing experience in the Pacific Northwest, at least 20 hours of which should have been in the last 5 years in the PNW.
- Possession of a current CPR certification
- Possession of a current first aid certification
- Demonstrated understanding of aquatic invasive species and the appropriate decontamination methods necessary to prevent introducing aquatic invasive species into the work area.
- Demonstrated ability to interpret contract plan sheets/specification, contactor schedule and plans prepared by the contractor (e.g. Temporary Steam Diversion Plan and Spill Prevention Control and Countermeasure Plan)
- Ability to move fish per the most current version of the "**WSDOT Fish Exclusion Protocols and Standards"**
- Must develop and deliver on site field training for individuals assisting with fish moving.

Requirements for Trained Personnel

- Possess training, knowledge, skills and ability to ensure safe handling of fish and to ensure the safety of staff conducting the operations.
- Have a current first aid certification.
- Training must be conducted on site by the Designated Lead Fish Moving Biologist prior to initiation of the fish moving and must cover the following:
    - Review of site specific pre- activity safety plan
    - A site specific job site analysis and fish exclusion plan.
    - A discussion of roles, responsibilities, permit requirements, and species expected.
    - Review of electrofishing guidelines and equipment manufactures recommendations.
    - Definitions of basic terminology (galvanotaxis, narcosis, and tetany) and an explanation of how electrofishing attracts fish.
    - A demonstration and discussion of the proper use of electrofishing equipment (including an explanation of how gear can injure fish and how to recognize signs of injury) and the role of each crew member.
    - A demonstration of proper fish handling including proper netting, sorting by size, keeping buckets cool, releasing small and large fish

in different pools, not overcrowding buckets, avoiding sunscreens/ insect repellants etc on hands moving fish.

- A review of common mistakes.
- A discussion of the use of personal floatation devices.
- A discussion of aquatic invasive species and the decontamination methods necessary to prevent introducing aquatic invasives into the work area.

Appendix D

Stormwater Analysis and Hi-Run Summary

Hi-Run Pollutant Loading Model Input										
	TDA (values in acres)									
	F-2	F-3	G-2	G-4	I-1	I-2	I-3	I-4	J-1	J-2
Subbasin 1: Baseline Conditions	4.11	1.06	52.82	1.49	20.84	3.76	2.61	4.51	4.08	13.19
basic treatment - 0% infiltration	0	0	1.61	0	0	0	0	0	0	6.86
enhanced treatment - 0% infiltration	0	0	11.53	0	0	0	0	0	0.9	0
enhanced treatment - 60% infiltration	0	0	4.03	0	3.33	0.51	0.91	1.26	1.21	0
no treatment - 0% infiltration	4.11	1.06	35.65	1.49	17.51	3.25	1.7	3.25	1.97	6.33
Subbasin 1: Proposed Conditions	4.18	1.06	62.97	1.18	22.72	4.22	3.02	5.25	4.78	14.95
enhanced treatment - 0% infiltration	0	0	43.29	0.36	2.7	0	0	0.82	1.36	12.73
enhanced treatment - 60% infiltration	0	0	4.04	0.43	3.06	1.63	1.42	1.55	1.67	0
no treatment - 0% infiltration	4.18	1.06	15.64	0.39	16.96	2.59	1.6	2.88	1.75	2.22

Hi-Run Dilution Model Input Values				
	TDA			
	G-2	I-1	J-2	NW-02
Depth (ft)	1.94 -1.68	0.46 - 1.32	0.0655-0.2445	1.033
Velocty (fps)	1.68 - 1.94	1.56 - 3.14	0.72-1.73	0.7-1.78
Width (ft)	60.56 - 66.06	24	4	3
Slope	0.0002	0.005	0.014	0.022
Discharge Distance (ft)	1	1	2	2

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 1/17/19 10:53
Outfall ID: F-2 Sammamish River
Rain Gauge: Puget East 40
Description: TDA_F-2 outfall to KL-14

Discharge Areas

Subbasin 1 - Baseline Conditions - 4.11 acres
no treatment - 0% infiltration - 4.11 acres

Subbasin 1 - Proposed Conditions - 4.18 acres
no treatment - 0% infiltration - 4.18 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	178614	224081	14	23	3.69	3.9	80.6	116	111	57
75th Percentile	3850	3883	0.834	0.85	0.195	0.2	5.16	5.2	1.57	1.6
Median	1871	1894	0.47	0.48	0.11	0.11	2.9	2.9	0.823	0.83
25th Percentile	909	924	0.264	0.27	0.062	0.063	1.63	1.7	0.427	0.44
Min	18.3	18	0.01	0.015	0.003	0.003	0.037	0.068	0.012	0.014
P (exceed)		**0.504**		**0.505**		**0.505**		**0.506**		**0.507**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	8412.02	5602.212	0.493	0.476	0.107	0.132	2.889	4.595	1.666	1.472
75th Percentile	125.176	123.942	0.027	0.027	0.006	0.006	0.167	0.167	0.051	0.051
Median	61.962	61.148	0.016	0.016	0.004	0.004	0.095	0.095	0.027	0.027
25th Percentile	30.486	30.29	0.009	0.009	0.002	0.002	0.054	0.055	0.014	0.014
Min	0.882	0.772	0	0	0	0	0.002	0.002	0	0
P (exceed)		0.498		0.501		0.499		0.5		0.502

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 2/6/19 15:49
Outfall ID: F-3 Sammamish River
Rain Gauge: Puget East 40
Description: TDA F-3

Discharge Areas

Subbasin 1 - Baseline Conditions - 1.06 acres
no treatment - 0% infiltration - 1.06 acres

Subbasin 1 - Proposed Conditions - 1.06 acres
no treatment - 0% infiltration - 1.06 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	52507	67571	4.43	4.1	0.977	1.3	34.3	24	11	15
75th Percentile	990	977	0.215	0.22	0.05	0.05	1.33	1.3	0.409	0.41
Median	482	480	0.122	0.12	0.029	0.029	0.743	0.75	0.213	0.21
25th Percentile	234	234	0.069	0.069	0.016	0.016	0.416	0.42	0.111	0.11
Min	4.88	4.5	0.003	0.002	0.001	0.001	0.024	0.01	0.003	0.003
P (exceed)		**0.498**		**0.501**		**0.5**		**0.5**		**0.5**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	5899.975	5142.543	0.647	0.662	0.124	0.096	3.137	5.824	2.082	1.388
75th Percentile	124	125.228	0.027	0.027	0.006	0.006	0.167	0.167	0.051	0.051
Median	61.301	61.472	0.016	0.016	0.004	0.004	0.095	0.095	0.027	0.027
25th Percentile	30.311	30.428	0.009	0.009	0.002	0.002	0.054	0.054	0.014	0.014
Min	0.719	0.481	0	0	0	0	0.002	0.003	0.001	0
P (exceed)		0.502		0.5		0.499		0.499		0.499

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 1/16/19 16:09
Outfall ID: G-2 Sammamish River
Rain Gauge: Puget East 40
Description: Outfall to Sammamish River

Discharge Areas

Subbasin 1 - Baseline Conditions - 52.82 acres
- basic treatment - 0% infiltration - 1.61 acres
- enhanced treatment - 0% infiltration - 11.53 acres
- enhanced treatment - 60% infiltration - 4.03 acres
- no treatment - 0% infiltration - 35.65 acres

Subbasin 1 - Proposed Conditions - 62.97 acres
- enhanced treatment - 0% infiltration - 43.29 acres
- enhanced treatment - 60% infiltration - 4.04 acres
- no treatment - 0% infiltration - 15.64 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	1689457	1296236	143	71	51.3	24	850	424	582	184
75th Percentile	34426	19576	7.9	5.5	2.11	2.2	47.8	31	15.7	14
Median	17403	10801	4.72	3.7	1.35	1.5	28	21	9.21	9.4
25th Percentile	9029	5987	2.89	2.6	0.888	1.1	16.9	14	5.61	6.2
Min	330	230	0.34	0.43	0.108	0.15	1.23	1.4	0.404	0.68
P (exceed)		**0.357**		**0.401**		**0.56**		**0.374**		**0.5**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	3160.02	1501.181	0.407	0.144	0.152	0.032	2.228	1.011	1.298	0.717
75th Percentile	91.446	43.728	0.021	0.012	0.006	0.005	0.127	0.068	0.043	0.031
Median	47.114	24.406	0.013	0.008	0.004	0.004	0.076	0.046	0.025	0.021
25th Percentile	24.791	13.643	0.008	0.006	0.002	0.002	0.047	0.032	0.016	0.014
Min	1.157	0.695	0.001	0.001	0	0	0.006	0.005	0.002	0.002
P (exceed)		0.303		0.315		0.47		0.295		0.418

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 1/17/19 07:24
Outfall ID: G-4 North Creek
Rain Gauge: Puget East 40
Description: Outfall to North Creek

Discharge Areas

Subbasin 1 - Baseline Conditions - 1.49 acres
no treatment - 0% infiltration - 1.49 acres

Subbasin 1 - Proposed Conditions - 1.18 acres
enhanced treatment - 0% infiltration - 0.36 acres
enhanced treatment - 60% infiltration - 0.43 acres
no treatment - 0% infiltration - 0.39 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	88721	16983	7.42	2.7	1.72	0.56	47.1	11	19.6	5.2
75th Percentile	1384	409	0.304	0.099	0.071	0.033	1.85	0.59	0.573	0.22
Median	679	217	0.171	0.064	0.04	0.022	1.04	0.37	0.299	0.14
25th Percentile	332	116	0.097	0.042	0.023	0.015	0.586	0.24	0.157	0.093
Min	5.45	5.2	0.004	0.006	0.001	0.002	0.02	0.028	0.004	0.01
P (exceed)		**0.214**		**0.183**		**0.286**		**0.177**		**0.268**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	3956.545	1893.418	0.567	0.247	0.128	0.094	2.93	1.336	1.768	0.785
75th Percentile	124.797	61.229	0.027	0.015	0.006	0.005	0.168	0.089	0.051	0.035
Median	61.58	33.033	0.016	0.01	0.004	0.004	0.096	0.058	0.027	0.023
25th Percentile	30.508	18.181	0.009	0.007	0.002	0.003	0.055	0.038	0.014	0.015
Min	0.569	1.12	0	0.001	0	0	0.003	0.005	0	0.001
P (exceed)		0.328		0.341		0.503		0.321		0.45

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 1/17/19 07:38
Outfall ID: I-1 North Creek
Rain Gauge: Puget East 40
Description: TDA I-1 outfall to North Creek

Discharge Areas

Subbasin 1 - Baseline Conditions - 20.84 acres
enhanced treatment - 60% infiltration - 3.33 acres
no treatment - 0% infiltration - 17.51 acres

Subbasin 1 - Proposed Conditions - 22.72 acres
enhanced treatment - 0% infiltration - 2.7 acres
enhanced treatment - 60% infiltration - 3.06 acres
no treatment - 0% infiltration - 16.96 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	908883	1407963	79.2	72	14.6	14	639	401	243	234
75th Percentile	16260	16161	3.58	3.6	0.843	0.9	22.1	22	6.78	7
Median	8000	8028	2.04	2.1	0.484	0.55	12.4	13	3.57	3.9
25th Percentile	3907	4046	1.16	1.2	0.278	0.34	7.01	7.3	1.9	2.2
Min	95	80	0.079	0.11	0.021	0.035	0.311	0.43	0.103	0.18
P (exceed)		**0.502**		**0.511**		**0.55**		**0.506**		**0.53**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	4225.969	3214.774	0.426	0.478	0.124	0.104	5.417	2.385	1.316	1.44
75th Percentile	116.634	103.638	0.026	0.023	0.006	0.006	0.157	0.142	0.049	0.045
Median	58.482	52.328	0.015	0.014	0.004	0.004	0.09	0.083	0.027	0.026
25th Percentile	29.303	26.908	0.009	0.008	0.002	0.002	0.052	0.05	0.015	0.015
Min	0.987	0.725	0.001	0.001	0	0	0.004	0.004	0.001	0.001
P (exceed)		0.472		0.476		0.506		0.474		0.494

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 2/13/19 10:23
Outfall ID: I-2 North Creek
Rain Gauge: Puget East 40
Description: TDA I-2

Discharge Areas

Subbasin 1 - Baseline Conditions - 3.76 acres
enhanced treatment - 60% infiltration - 0.51 acres
no treatment - 0% infiltration - 3.25 acres

Subbasin 1 - Proposed Conditions - 4.22 acres
enhanced treatment - 60% infiltration - 1.63 acres
no treatment - 0% infiltration - 2.59 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	154000	214177	13	11	4.66	3.9	77.3	69	52.9	30
75th Percentile	3024	2442	0.666	0.54	0.156	0.13	4.09	3.3	1.25	1
Median	1474	1199	0.379	0.31	0.089	0.076	2.3	1.9	0.66	0.56
25th Percentile	725	599	0.214	0.18	0.051	0.046	1.3	1.1	0.352	0.31
Min	23.2	13	0.014	0.014	0.003	0.004	0.041	0.083	0.019	0.022
P (exceed)		**0.445**		**0.434**		**0.446**		**0.433**		**0.451**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	4200.904	4624.13	0.539	0.439	0.2	0.087	2.961	3.064	1.72	2.18
75th Percentile	117.241	103.149	0.026	0.023	0.006	0.006	0.159	0.14	0.05	0.045
Median	58.431	52.093	0.015	0.014	0.004	0.004	0.091	0.082	0.027	0.026
25th Percentile	29.308	26.849	0.009	0.008	0.002	0.002	0.053	0.049	0.015	0.015
Min	0.985	1.199	0.001	0.001	0	0	0.004	0.005	0.001	0.002
P (exceed)		0.47		0.467		0.511		0.463		0.492

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 1/17/19 08:36
Outfall ID: I-3 North Creek
Rain Gauge: Puget East 40
Description: TDA I-3 Outfall to 30-inch CMP to City of Bothell System

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Discharge Areas

Subbasin 1 - Baseline Conditions - 2.61 acres
enhanced treatment - 60% infiltration - 0.91 acres
no treatment - 0% infiltration - 1.7 acres

Subbasin 1 - Proposed Conditions - 3.02 acres
enhanced treatment - 60% infiltration - 1.42 acres
no treatment - 0% infiltration - 1.6 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	68670	85605	7.13	6.8	1.51	1.8	55.2	51	23.6	26
75th Percentile	1595	1511	0.354	0.34	0.084	0.082	2.14	2.1	0.669	0.65
Median	786	748	0.203	0.2	0.05	0.049	1.22	1.2	0.361	0.35
25th Percentile	391	376	0.117	0.11	0.03	0.03	0.695	0.68	0.198	0.2
Min	14.8	11	0.009	0.011	0.003	0.004	0.06	0.05	0.015	0.017
P (exceed)		**0.488**		**0.488**		**0.497**		**0.489**		**0.495**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	6524.931	2814.063	0.359	0.309	0.119	0.103	3.009	2.585	1.258	0.97
75th Percentile	104.726	95.194	0.023	0.022	0.006	0.006	0.143	0.132	0.046	0.043
Median	52.923	48.608	0.014	0.013	0.004	0.004	0.084	0.078	0.026	0.025
25th Percentile	27.36	25.395	0.008	0.008	0.002	0.002	0.05	0.048	0.015	0.016
Min	0.65	1.217	0.001	0.001	0	0	0.005	0.004	0.002	0.002
P (exceed)		0.474		0.477		0.505		0.476		0.497

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 2/19/19 11:00
Outfall ID: I-4 North Creek
Rain Gauge: Puget East 40
Description: TDA I-4

Discharge Areas

Subbasin 1 - Baseline Conditions - 4.51 acres
enhanced treatment - 60% infiltration - 1.26 acres
no treatment - 0% infiltration - 3.25 acres

Subbasin 1 - Proposed Conditions - 5.25 acres
enhanced treatment - 0% infiltration - 0.82 acres
enhanced treatment - 60% infiltration - 1.55 acres
no treatment - 0% infiltration - 2.88 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	154001	238212	13	13	4.66	4.4	77.3	77	52.9	33
75th Percentile	3035	2794	0.671	0.64	0.159	0.17	4.11	3.8	1.26	1.3
Median	1485	1408	0.384	0.38	0.093	0.11	2.33	2.3	0.678	0.74
25th Percentile	735	732	0.219	0.23	0.055	0.07	1.32	1.4	0.369	0.45
Min	25.1	28	0.016	0.03	0.004	0.007	0.049	0.13	0.023	0.047
P (exceed)		**0.487**		**0.5**		**0.561**		**0.493**		**0.535**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	3865.905	3860.265	0.496	0.367	0.185	0.073	2.725	2.562	1.584	1.822
75th Percentile	108.831	88.467	0.024	0.02	0.006	0.006	0.149	0.121	0.047	0.041
Median	54.744	45.623	0.014	0.012	0.004	0.004	0.086	0.073	0.026	0.025
25th Percentile	27.904	24.024	0.009	0.008	0.002	0.003	0.051	0.045	0.015	0.016
Min	1.043	1.08	0.001	0.001	0	0	0.004	0.005	0.001	0.002
P (exceed)		0.449		0.449		0.509		0.442		0.486

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 1/17/19 09:58
Outfall ID: J-1 North Creek
Rain Gauge: Puget East 40
Description: TDA_J-1 Oufall into larg size wetland

Discharge Areas

Subbasin 1 - Baseline Conditions - 4.08 acres
enhanced treatment - 0% infiltration - 0.9 acres
enhanced treatment - 60% infiltration - 1.21 acres
no treatment - 0% infiltration - 1.97 acres

Subbasin 1 - Proposed Conditions - 4.78 acres
enhanced treatment - 0% infiltration - 1.36 acres
enhanced treatment - 60% infiltration - 1.67 acres
no treatment - 0% infiltration - 1.75 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	83090	79357	11.7	7.4	1.9	1.7	58.9	78	22	19
75th Percentile	1946	1810	0.449	0.43	0.128	0.14	2.72	2.6	0.933	0.95
Median	996	944	0.274	0.27	0.084	0.092	1.63	1.6	0.561	0.6
25th Percentile	523	502	0.172	0.18	0.056	0.063	0.998	1	0.351	0.38
Min	19.4	22	0.022	0.021	0.008	0.008	0.089	0.12	0.044	0.037
P (exceed)		**0.485**		**0.5**		**0.542**		**0.491**		**0.524**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	3379.262	3258.975	0.423	0.189	0.065	0.049	2.323	1.758	0.996	0.743
75th Percentile	78.782	65.307	0.018	0.016	0.005	0.005	0.11	0.094	0.039	0.036
Median	41.192	35.019	0.012	0.01	0.004	0.004	0.068	0.06	0.024	0.023
25th Percentile	22.09	19.13	0.008	0.007	0.003	0.003	0.043	0.04	0.016	0.016
Min	1.295	1.072	0.001	0.001	0	0	0.006	0.006	0.002	0.002
P (exceed)		0.45		0.451		0.493		0.449		0.481

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 1/17/19 10:17
Outfall ID: J-2 North Creek
Rain Gauge: Puget East 40
Description: TDA_J-2 outfall to Perry Creek

Discharge Areas

Subbasin 1 - Baseline Conditions - 13.19 acres
basic treatment - 0% infiltration - 6.86 acres
no treatment - 0% infiltration - 6.33 acres

Subbasin 1 - Proposed Conditions - 14.95 acres
enhanced treatment - 0% infiltration - 12.73 acres
no treatment - 0% infiltration - 2.22 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	268699	107536	28.4	10	7.84	4.3	170	105	83.4	29
75th Percentile	6676	3500	1.61	1.1	0.528	0.54	9.59	6.1	3.61	3.2
Median	3510	1945	1.03	0.79	0.358	0.37	6.01	4.2	2.29	2.1
25th Percentile	1884	1087	0.683	0.56	0.245	0.25	3.87	2.9	1.49	1.4
Min	79.7	40	0.063	0.066	0.026	0.034	0.323	0.38	0.185	0.13
P (exceed)		**0.32**		**0.369**		**0.512**		**0.337**		**0.461**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	2926.924	888.97	0.275	0.103	0.083	0.048	1.334	0.468	0.899	0.284
75th Percentile	67.044	31.398	0.016	0.01	0.005	0.005	0.096	0.054	0.036	0.028
Median	36.033	17.659	0.011	0.007	0.004	0.003	0.062	0.038	0.024	0.019
25th Percentile	19.65	10.012	0.007	0.005	0.003	0.002	0.04	0.027	0.016	0.013
Min	0.972	0.406	0.001	0.001	0	0	0.006	0.004	0.002	0.002
P (exceed)		0.283		0.299		0.446		0.276		0.402

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 2/11/19 12:57
Outfall ID: NW-01 North Creek
Rain Gauge: Puget East 40
Description: TDA NW01

Discharge Areas

Subbasin 1 - Baseline Conditions - 1.92 acres
no treatment - 0% infiltration - 1.92 acres

Subbasin 1 - Proposed Conditions - 2.02 acres
no treatment - 0% infiltration - 2.02 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	85366	71766	8.8	7.6	2.37	2.8	51.6	55	28.7	23
75th Percentile	1772	1882	0.389	0.41	0.091	0.096	2.4	2.5	0.737	0.78
Median	868	920	0.22	0.23	0.052	0.054	1.35	1.4	0.384	0.41
25th Percentile	426	450	0.124	0.13	0.029	0.031	0.756	0.8	0.201	0.21
Min	10.4	7.9	0.003	0.006	0.001	0.001	0.039	0.017	0.005	0.007
P (exceed)		**0.515**		**0.518**		**0.516**		**0.518**		**0.515**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	4771.604	6525.25	0.507	0.504	0.111	0.111	4.521	3.133	3.646	1.19
75th Percentile	124.657	124.556	0.027	0.027	0.006	0.006	0.168	0.167	0.051	0.051
Median	62.109	61.817	0.016	0.016	0.004	0.004	0.095	0.095	0.027	0.027
25th Percentile	30.492	30.487	0.009	0.009	0.002	0.002	0.054	0.054	0.014	0.014
Min	0.623	0.764	0	0	0	0	0.003	0.002	0	0.001
P (exceed)		0.5		0.5		0.498		0.498		0.503

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 2/6/19 11:30
Outfall ID: NW-02 North Creek
Rain Gauge: Puget East 40
Description: TDA NW02

Discharge Areas

Subbasin 1 - Baseline Conditions - 17.25 acres
basic treatment - 0% infiltration - 10.6 acres
enhanced treatment - 60% infiltration - 0.37 acres
no treatment - 0% infiltration - 6.28 acres

Subbasin 1 - Proposed Conditions - 19.62 acres
basic treatment - 0% infiltration - 12.76 acres
enhanced treatment - 60% infiltration - 1.17 acres
no treatment - 0% infiltration - 5.69 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	298174	470640	25.5	25	9.2	8.7	151	153	105	66
75th Percentile	7037	6758	1.81	1.8	0.658	0.71	10.5	10	4.3	4.5
Median	3770	3692	1.2	1.2	0.455	0.49	6.77	6.8	2.82	3
25th Percentile	2071	2041	0.812	0.85	0.314	0.34	4.45	4.6	1.87	2
Min	88.5	68	0.087	0.13	0.04	0.051	0.719	0.46	0.065	0.2
P (exceed)		**0.492**		**0.512**		**0.537**		**0.506**		**0.529**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	1650.7	1745.194	0.214	0.168	0.079	0.037	1.172	1.19	0.683	0.83
75th Percentile	55.225	48.361	0.014	0.013	0.005	0.005	0.082	0.073	0.034	0.032
Median	30.154	26.788	0.01	0.009	0.004	0.004	0.054	0.049	0.023	0.022
25th Percentile	16.782	15.124	0.007	0.006	0.003	0.003	0.036	0.034	0.015	0.015
Min	0.758	0.608	0.001	0.001	0.001	0.001	0.005	0.007	0.002	0.002
P (exceed)		0.461		0.461		0.494		0.456		0.482

Highway Runoff Dilution and Loading model (HI-RUN) Version 2.0

End of Pipe Loading Subroutine Report

This model is for stormwater analysis associated with biological assessments, and is not a design tool.

Input Summary

Run Date/Time: 2/11/19 13:29
Outfall ID: NW-03 North Creek
Rain Gauge: Puget East 40
Description: TDA NW03 Outfall

Discharge Areas

Subbasin 1 - Baseline Conditions - 0.39 acres
no treatment - 0% infiltration - 0.39 acres

Subbasin 1 - Proposed Conditions - 0.5 acres
no treatment - 0% infiltration - 0.5 acres

Load Analysis

	TSS Load (lb/yr)		Total Copper Load (lb/yr)		Dissolved Copper Load (lb/yr)		Total Zinc Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	16546	34788	3.42	2.5	0.674	0.75	13.5	13	4.49	6.3
75th Percentile	363	467	0.079	0.1	0.019	0.024	0.486	0.63	0.149	0.19
Median	179	227	0.045	0.057	0.01	0.013	0.274	0.35	0.078	0.099
25th Percentile	87.2	111	0.025	0.032	0.006	0.008	0.154	0.2	0.041	0.052
Min	2.27	3.2	0.001	0.002	0	0	0.006	0.008	0.001	0.002
P (exceed)		**0.566**		**0.583**		**0.583**		**0.583**		**0.574**

Concentration Analysis

Subbasin 1	TSS Conc (mg/L)		Total Copper Conc (mg/L)		Dissolved Copper Conc (mg/L)		Total Zinc Conc (mg/L)		Dissolved Zinc Conc (mg/L)	
	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed	Baseline	Proposed
Max	7763.686	4928.109	0.601	0.493	0.204	0.152	3.382	3.674	1.41	1.715
75th Percentile	125.035	124.658	0.027	0.027	0.006	0.006	0.167	0.167	0.051	0.051
Median	61.833	61.796	0.016	0.016	0.004	0.004	0.095	0.095	0.027	0.027
25th Percentile	30.613	30.402	0.009	0.009	0.002	0.002	0.054	0.054	0.014	0.014
Min	0.661	0.509	0	0	0	0	0.003	0.003	0	0.001
P (exceed)		0.499		0.5		0.501		0.499		0.501

Highway Runoff Dilution Summary Results

Project: G-2 Sammamish River
Precipitation Series: Puget East 40
Description: Sammamish River data from January to June

Background Concentrations (mg/L)
Dissolved Copper: 0.00068
Dissolved Zinc: 0.00202

Baseline Conditions: 52.82 acres
Basic Treatment Infiltration 0% - 1.61 acres
Enhanced Treatment Infiltration 0% - 11.53 acres
Enhanced Treatment Infiltration 60% - 4.03 acres
No Treatment Infiltration 0% - 35.65 acres

Proposed Conditions: 62.97 acres
Enhanced Treatment Infiltration 0% - 43.29 acres
Enhanced Treatment Infiltration 60% - 4.04 acres
No Treatment Infiltration 0% - 15.64 acres

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Depth (ft)	6.82	6.82	6.94	6.385	5.565	5.565						
Velocity (fps)	1.91	1.91	1.94	1.83	1.68	1.68						
Width (ft)	65.58	65.58	66.06	63.84	60.56	60.56						
Slope	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002						
Discharge Distance (ft)	1	1	1	1	1	1						
Distance Downstream in feet to Meet Biological Threshold												
Dissolved Copper Baseline	< 1	< 1	< 1	< 1	< 1	< 1						
Dissolved Copper Proposed	< 1	< 1	< 1	< 1	< 1	< 1						
Dissolved Zinc Baseline	< 1	< 1	< 1	< 1	< 1	< 1						
Dissolved Zinc Proposed	< 1	< 1	< 1	< 1	< 1	< 1						

Highway Runoff Dilution Summary Results

Project: I-1 North Creek
Precipitation Series: Puget East 40
Description: North Creek Just south of NE 195th St.East of the Bridge

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Background Concentrations (mg/L)
Dissolved Copper: 0.00068
Dissolved Zinc: 0.00202

Baseline Conditions: 20.84 acres
Enhanced Treatment Infiltration 60% - 3.33 acres
No Treatment Infiltration 0% - 17.51 acres

Proposed Conditions: 22.72 acres
Enhanced Treatment Infiltration 60% - 1.88 acres with detention
Enhanced Treatment Infiltration 60% - 1.18 acres
Enhanced Treatment Infiltration 0% - 2.7 acres
No Treatment Infiltration 0% - 16.96 acres

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Depth (ft)	1.32	1.23	1.15	0.9	0.7	0.64	0.52	0.46	0.47	0.7	1.07	1.27
Velocity (fps)	3.14	3	2.87	2.44	2.06	1.94	1.69	1.56	1.58	2.06	2.73	3.06
Width (ft)	24	24	24	24	24	24	24	24	24	24	24	24
Slope	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Discharge Distance (ft)	1	1	1	1	1	1	1	1	1	1	1	1
Distance Downstream in feet to Meet Biological Threshold												
Dissolved Copper – Baseline	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	2	< 1	< 1	< 1
Dissolved Copper – Proposed	< 1	< 1	< 1	< 1	< 1	< 1	< 1	2	2	< 1	< 1	< 1
Dissolved Zinc – Baseline	< 1	< 1	< 1	2	3	4	5	32	57	11	2	< 1
Dissolved Zinc – Proposed	< 1	< 1	< 1	2	3	3	5	30	48	10	2	< 1

Highway Runoff Dilution Summary Results

Project: J-2 North Creek
Precipitation Series: Puget East 40
Description: TDA J02 outfall to perry creek

Background Concentrations (mg/L)
Dissolved Copper: 0.00068
Dissolved Zinc: 0.00202

Baseline Conditions: 13.19 acres
Basic Treatment Infiltration 0% - 6.86 acres
No Treatment Infiltration 0% - 6.33 acres

Proposed Conditions: 14.95 acres
Enhanced Treatment Infiltration 0% - 1.76 acres with detention
Enhanced Treatment Infiltration 0% - 10.97 acres
No Treatment Infiltration 0% - 2.22 acres

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Depth (ft)		0.233	0.2401	0.218	0.1755	0.131	0.107	0.0655	0.0679	0.106	0.1673	0.2358	0.2445
Velocity (fps)		1.67	1.71	1.6	1.38	1.14	0.99	0.72	0.73	0.99	1.34	1.67	1.73
Width (ft)		4	4	4	4	4	4	4	4	4	4	4	4
Slope		0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Discharge Distance (ft)		2	2	2	2	2	2	2	2	2	2	2	2
Distance Downstream in feet to Meet Biological Threshold													
Dissolved Copper	Baseline	8	8	9	13	30	64	> 1000	> 1000	> 1000	28	9	7
	Proposed	7	6	7	10	24	46	> 1000	> 1000	85	23	7	6
Dissolved Zinc	Baseline	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000
	Proposed	42	38	44	100	> 1000	> 1000	> 1000	> 1000	> 1000	> 1000	55	35

Highway Runoff Dilution Summary Results

Project: NW-02 North Creek
Precipitation Series: Puget East 40
Description: NW02 outfall to Queensborough

Background Concentrations (mg/L)
Dissolved Copper: 0.00068
Dissolved Zinc: 0.00202

Baseline Conditions: 17.25 acres
Basic Treatment Infiltration 0% - 9.35 acres
Enhanced Treatment Infiltration 60% - 0.37 acres
No Treatment Infiltration 0% - 7.53 acres

Proposed Conditions: 19.34 acres
Enhanced Treatment Infiltration 60% - 0.71 acres with detention
Basic Treatment Infiltration 0% - 1.38 acres with detention
Basic Treatment Infiltration 0% - 8.09 acres
Enhanced Treatment Infiltration 0% - 2.16 acres
No Treatment Infiltration 0% - 7 acres

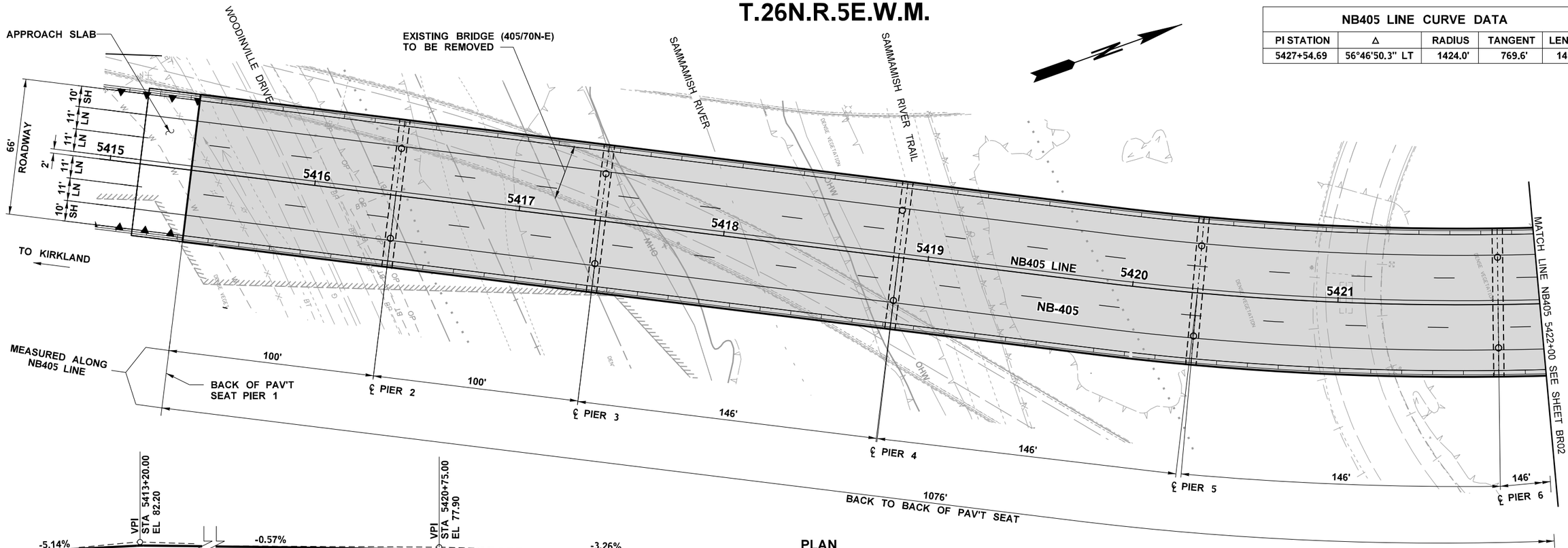
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Depth (ft)	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033	1.033
Velocity (fps)	1.73	1.76	1.64	1.41	1.31	0.98	0.69	0.7	0.95	1.33	1.72	1.78
Width (ft)	3	3	3	3	3	3	3	3	3	3	3	3
Slope	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
Discharge Distance (ft)	2	2	2	2	2	2	2	2	2	2	2	2
Distance Downstream in feet to Meet Biological Threshold												
Dissolved Copper Baseline	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dissolved Copper Proposed	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dissolved Zinc Baseline	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dissolved Zinc Proposed	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Appendix E

Bridge Plan

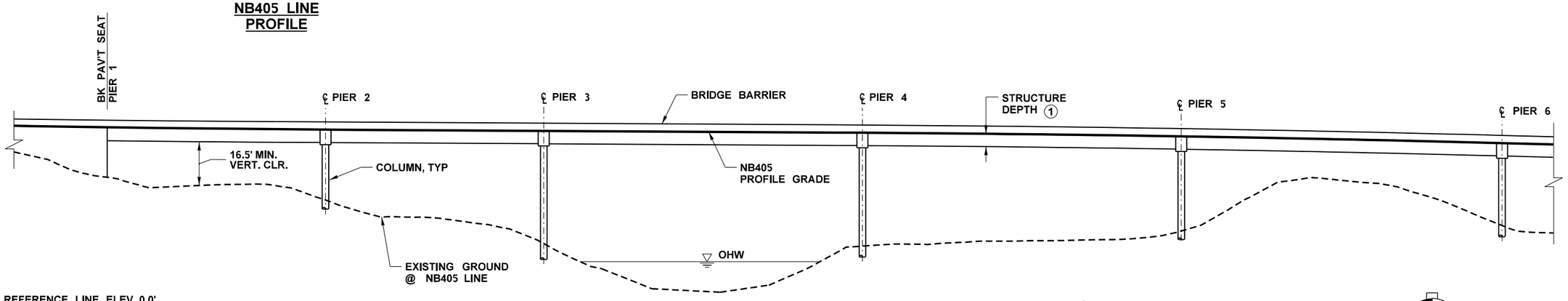
T.26N.R.5E.W.M.

NB405 LINE CURVE DATA				
PI STATION	Δ	RADIUS	TANGENT	LENGTH
5427+54.69	56°46'50.3" LT	1424.0'	769.6'	1411.2'



PLAN
NEW NB I-405 MAINLINE BRIDGE

NB405 LINE PROFILE



REFERENCE LINE ELEV. 0.0'

ELEVATION
GRADE ELEVATIONS ARE FINISH GRADES AT THE TOP OF BRIDGE DECK ON THE PROFILE GRADE

(1) 12" A DIMENSION
66" GIRDER DEPTH
= 78" ASSUMED STRUCTURE DEPTH

P.C. GIRDERS (WF66G)
LOADING: HL93

DATUM
(NAVD) 88

0 25 50
SCALE IN FEET

FILE NAME	c:\users\taylorsu\pw_wsdot\d0143594\XL5446_PS_BR_001.dgn				REGION NO.	STATE	FED.AID PROJ.NO.	REVIEW COPY 15% CONCEPTUAL DESIGN NOT FOR CONSTRUCTION
TIME	5:53:29 PM				10	WASH		
DATE	12/6/2018				JOB NUMBER			
PLOTTED BY	taylorsu							
DESIGNED BY	A. HEITZMANN				CONTRACT NO.		LOCATION NO. XL5446	
ENTERED BY	M. VYPLEL							
CHECKED BY	A. DUVALL							
PROJ. ENGR.	J. CHEUNG							
REGIONAL ADM.	K. HENRY	REVISION	DATE	BY				

Washington State Department of Transportation

I-405
SR 522 TO SR 527
CAPACITY IMPROVEMENTS PROJECT

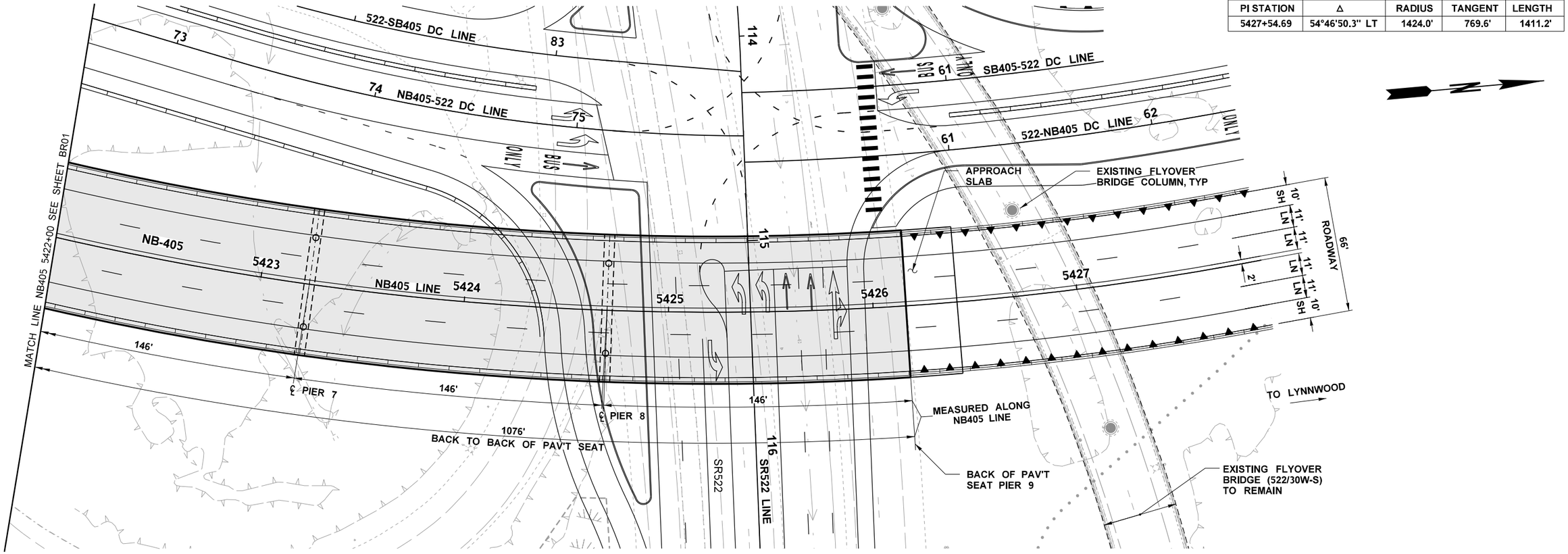
BRIDGE PLAN & ELEVATION

PLAN REF NO **BR01**

SHEET 142 OF 150 SHEETS

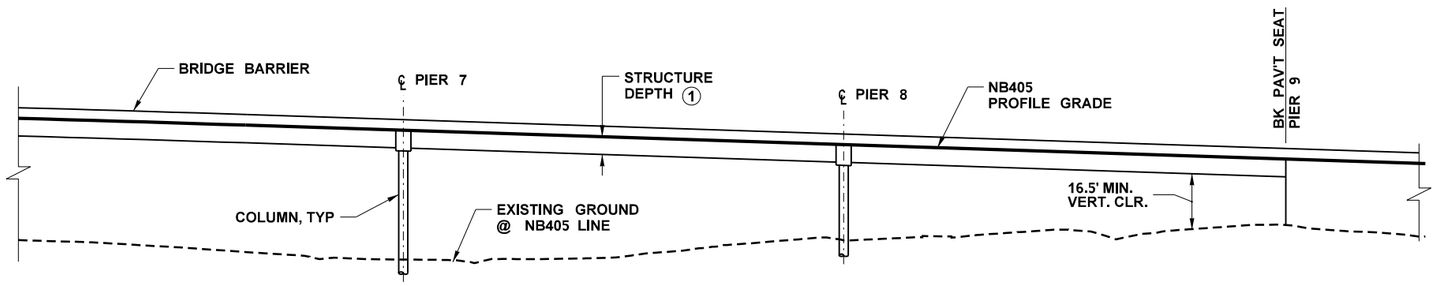
T.26N.R.5E.W.M.

NB405 LINE CURVE DATA				
PI STATION	Δ	RADIUS	TANGENT	LENGTH
5427+54.69	54°46'50.3" LT	1424.0'	769.6'	1411.2'



PLAN

NEW NB I-405 MAINLINE BRIDGE - CONTIN.



REFERENCE LINE ELEV. 0.0'

ELEVATION

GRADE ELEVATIONS ARE FINISH GRADES AT THE TOP OF BRIDGE DECK ON THE PROFILE GRADE

(1) 12" A DIMENSION
66" GIRDER DEPTH
= 78.00" ASSUMED STRUCTURE DEPTH

P.C. GIRDERS (WF66G)
LOADING: HL93

DATUM (NAVD) 88

0 25 50 SCALE IN FEET

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DATE	12/6/2018				JOB NUMBER		
PLOTTED BY	taylorsu						
DESIGNED BY	A. HEITZMANN				CONTRACT NO.		LOCATION NO. XL5446
ENTERED BY	M. VYPLEL						
CHECKED BY	A. DUVALL						
PROJ. ENGR.	J. CHEUNG						
REGIONAL ADM.	K. HENRY	REVISION	DATE	BY			

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Washington State Department of Transportation

I-405
SR 522 TO SR 527
CAPACITY IMPROVEMENTS PROJECT

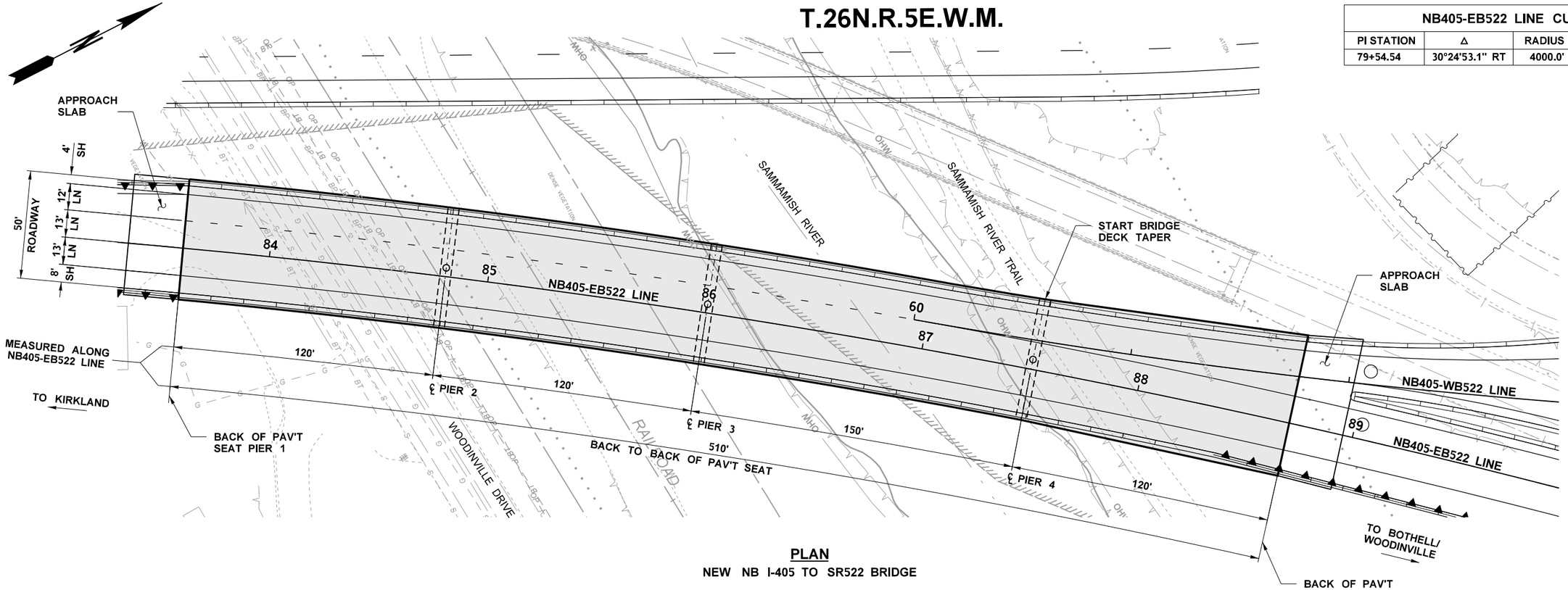
BRIDGE PLAN & ELEVATION

PLAN REF NO BR02

SHEET 143 OF 150 SHEETS

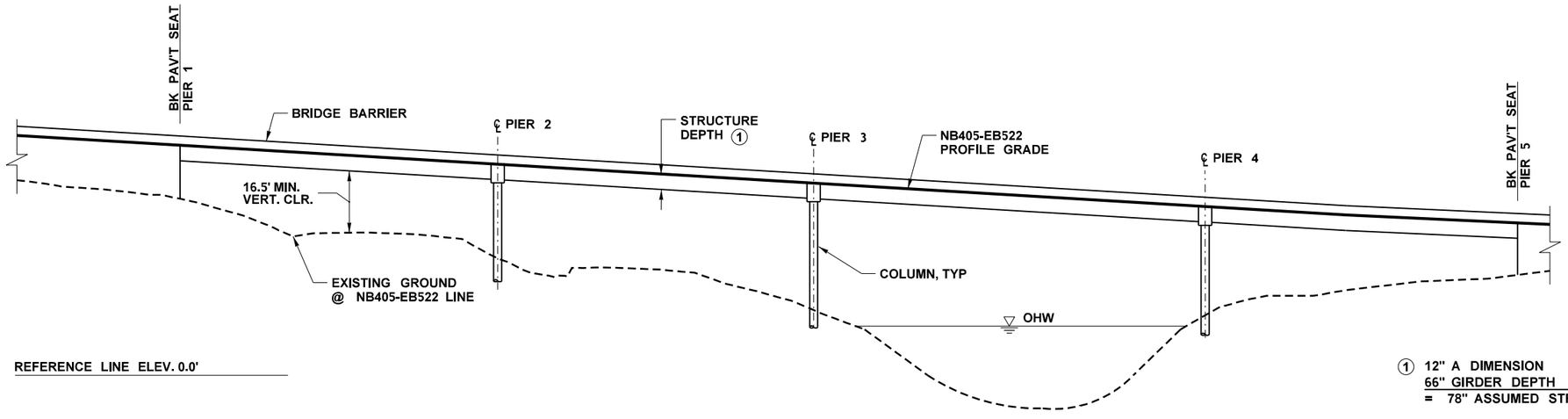
T.26N.R.5E.W.M.

NB405-EB522 LINE CURVE DATA				
PI STATION	Δ	RADIUS	TANGENT	LENGTH
79+54.54	30°24'53.1" RT	4000.0'	1087.3'	2123.4'



PLAN

NEW NB I-405 TO SR522 BRIDGE



ELEVATION

GRADE ELEVATIONS ARE FINISH GRADES AT THE TOP OF BRIDGE DECK ON THE PROFILE GRADE

-5.98%

NB405-EB522 LINE PROFILE

(1) 12" A DIMENSION
66" GIRDER DEPTH
= 78" ASSUMED STRUCTURE DEPTH

P.C. GIRDERS (WF66G)
LOADING: HL93

DATUM (NAVD) 88

0 25 50
SCALE IN FEET

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DATE	12/6/2018						
PLOTTED BY	taylorsu						
DESIGNED BY	A. HEITZMANN						
ENTERED BY	M. VYPLEL						
CHECKED BY	A. DUVALL				CONTRACT NO.		LOCATION NO. XL5446
PROJ. ENGR.	J. CHEUNG						
REGIONAL ADM.	K. HENRY	REVISION	DATE	BY			

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Washington State Department of Transportation

I-405
SR 522 TO SR 527
CAPACITY IMPROVEMENTS PROJECT

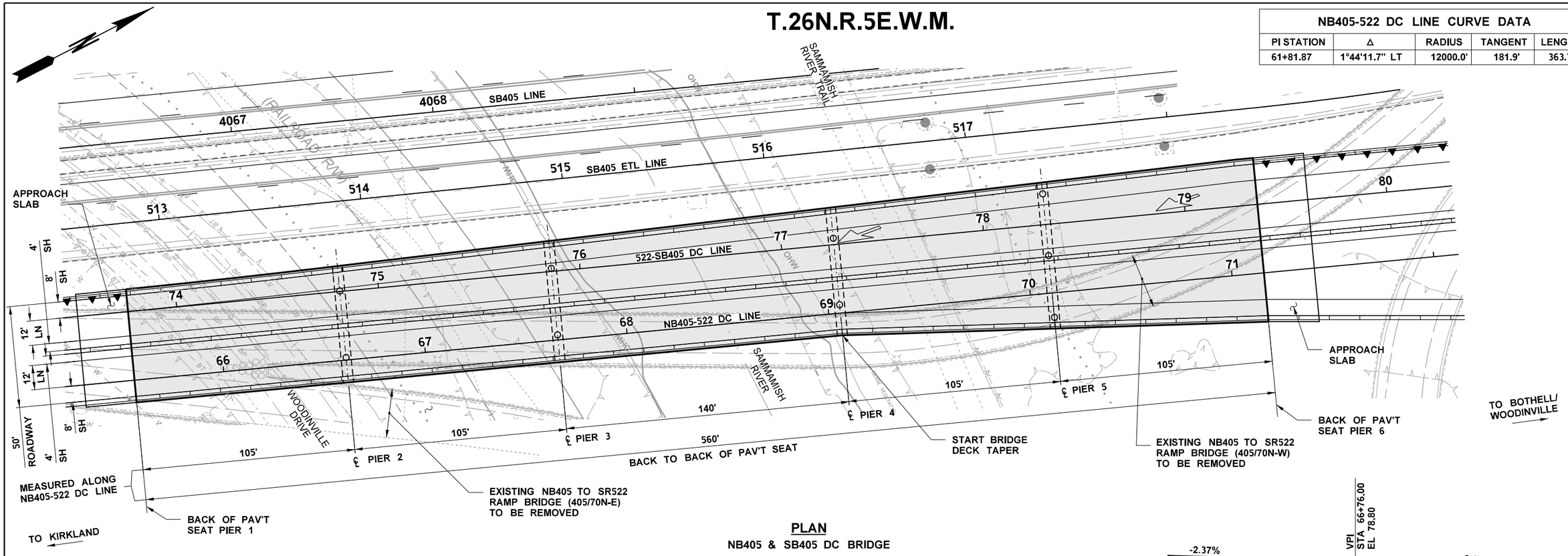
BRIDGE PLAN & ELEVATION

PLAN REF NO BR03

SHEET 144 OF 150 SHEETS

T.26N.R.5E.W.M.

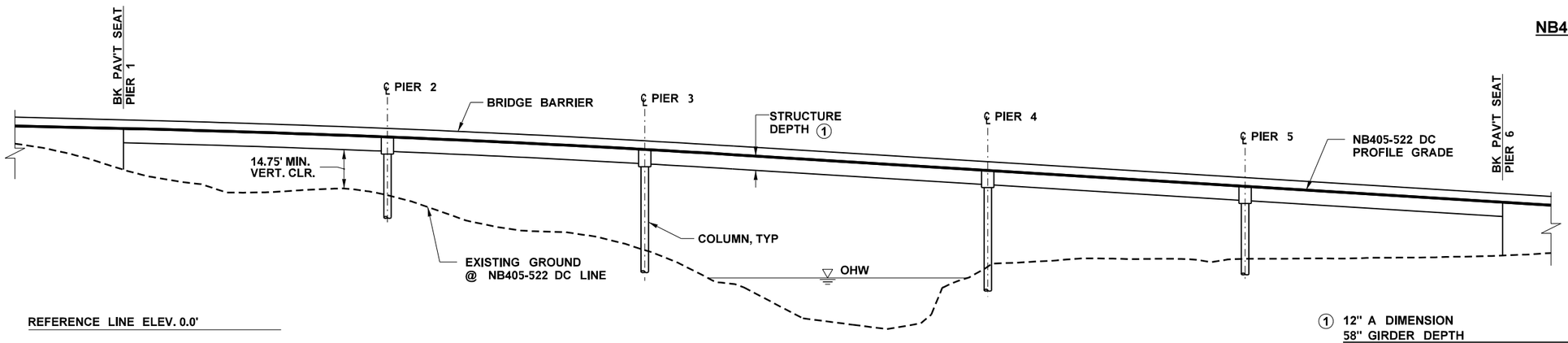
NB405-522 DC LINE CURVE DATA				
PI STATION	Δ	RADIUS	TANGENT	LENGTH
61+81.87	1°44'11.7" LT	12000.0'	181.9'	363.7'



PLAN

NB405 & SB405 DC BRIDGE

NB405-522 DC LINE PROFILE



ELEVATION

GRADE ELEVATIONS ARE FINISH GRADES AT THE TOP OF BRIDGE DECK ON THE PROFILE GRADE

(1) 12" A DIMENSION
58" GIRDER DEPTH
= 70" ASSUMED STRUCTURE DEPTH

P.C. GIRDERS (WF58G)
LOADING: HL93

DATUM
(NAVD) 88

0 25 50
SCALE IN FEET

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DATE	12/6/2018						
PLOTTED BY	taylorsu						
DESIGNED BY	A. HEITZMANN						
ENTERED BY	M. VYPLEL						
CHECKED BY	A. DUVALL				CONTRACT NO.		LOCATION NO. XL5446
PROJ. ENGR.	J. CHEUNG						
REGIONAL ADM.	K. HENRY	REVISION	DATE	BY			

REVIEW COPY
15% CONCEPTUAL DESIGN
NOT FOR CONSTRUCTION

Washington State Department of Transportation

I-405
SR 522 TO SR 527
CAPACITY IMPROVEMENTS PROJECT

BRIDGE PLAN & ELEVATION

PLAN REF NO BR04

SHEET 145 OF 150 SHEETS

Appendix F

Species Life Histories

APPENDIX F - SPECIES LIFE HISTORY

1.0 SPECIES LIFE HISTORY

1.1 Terrestrial Species

1.1.1 Western yellow-billed Cuckoo

Status of Species
The western distinct DPS of the yellow-billed cuckoo (*Coccyzus americanus*) was listed as threatened on October 3, 2014 (79 FR 59991). The western DPS includes populations in portions of 12 western states west of the crest of the Rocky Mountains, with the Canadian and Mexican borders constituting the northern and southern boundaries, respectively (USFWS 2013).

Critical Habitat
Critical habitat was proposed on December 2, 2014, (78 FR 78321) and includes sections of Arizona, California, Colorado, Idaho, New Mexico, Nevada, Texas, Utah, and Wyoming. No proposed yellow-billed cuckoo critical habitat is in the action area or vicinity.

Species Life History
The yellow-billed cuckoo is a medium-sized long-tailed bird with a broad curved bill, found throughout North America. The breeding range of the species formerly included most of North America from southeastern and western Canada to the Greater Antilles and northern Mexico (USFWS 2013). This species is primarily found in cottonwood-willow riparian forest and requires relatively large contiguous patches of multilayered canopy for foraging and nesting.

Historically, the yellow-billed cuckoo was locally common in Washington, occurring on both sides of the Cascade Mountains and throughout the Puget lowlands. The last confirmed breeding records are from the 1930s. Recently, incidental sightings have occurred throughout the state, and the possibility of a vestigial breeding population exists (Wahl et al. 2005). There have been a few exploratory surveys done (in Okanogan, Yakima, Cowlitz, and Wahkiakum counties), but no comprehensive, protocol surveys have been conducted in the state. Available data suggest that if yellow-billed cuckoos still breed in Washington, their numbers are extremely low, with pairs numbering in the single digits (78 FR 78321). While breeding has not been confirmed, recent observations indicate that western yellow-billed cuckoos occasionally occur in Washington and the possibility of breeding in the state cannot be ruled out (79 FR 60014).

Since 1990 there have been 13 sightings in Washington. The most recent was in 2012, on the Little Pend Oreille National Wildlife Refuge. Of these 13 sightings, 11 were east of the cascades and two were in the Puget lowlands. The 2016 and 2017 sightings in Twisp were primarily incidental and made by recreational bird watchers. Some occurred in riparian areas, and some occurred in uplands or developed areas.

Yellow-billed cuckoos generally arrive on breeding grounds in mid-June. Most have left breeding grounds by mid-September. Migration timing is similar throughout the range of the western DPS (78 FR 61632). The cuckoo breeding season varies regionally with availability of preferred food. Nesting peaks mid-June through August. Nesting continues through August, and up to three broods may be raised if there is sufficient prey base (78 FR 61632). The western yellow-billed cuckoo nests almost exclusively in low to moderate elevation riparian woodlands that are 50 acres or larger (78 FR 61633). At a landscape level, the amount of cottonwood/willow dominated vegetation and width of riparian habitat influences distribution and abundance. In California, yellow-billed cuckoos are most likely to be found in patches larger than 200 acres (78 FR 61633).

Little is known about the foraging and migrating habitat of yellow-billed cuckoo. A high foliage volume of cottonwoods appeared important for foraging in a study done along the Colorado River (78 FR 61633). Yellow-billed cuckoos are found in a variety of vegetation types during migration, including coastal scrub, secondary growth woodland, hedgerows, humid lowland forests, and forest edges from sea level to 8,125 ft (78 FR 61633). They may also use smaller riparian patches than those in which they typically nest (78 FR 61632).

1.2 Aquatic Species

1.2.1 Puget Sound Chinook Salmon

Status of Species

The Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) evolutionarily significant unit (ESU) was listed as threatened on March 24, 1999 (64 FR 41836). National Oceanic and Atmospheric Administration (NOAA) Fisheries reaffirmed its listing as threatened on July 28, 2005 (64 FR 14308), and on August 15, 2011 issued results of a five-year review concluding the species should remain listed as threatened (76 FR 50448). This ESU includes all naturally spawned populations of Chinook salmon originating in rivers and streams flowing into Puget Sound from the Elwha River eastward, as well as the rivers and streams flowing into Hood Canal, South Sound, North Sound, and the Strait of Georgia in Washington. Several hatchery stocks are considered part of the listed ESU.

Critical Habitat

Critical habitat for Puget Sound Chinook salmon was designated on September 2, 2005 (70 FR 52630).The rule identifies Lake Washington but excludes all tributaries of Lake Washington and the entire Lake Sammamish and Sammamish River watersheds from the final critical habitat designations.

NOAA Fisheries has defined six primary constituent elements (PCEs) for critical habitat designated for Chinook salmon:

- Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.
- Freshwater rearing sites with (i) water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) water

quality and forage supporting juvenile development; and (iii) natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

- Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
- Estuarine areas free of obstruction and excessive predation with (i) water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
- Nearshore marine areas free of obstruction and excessive predation with (i) water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.
- Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Species Life History

Puget Sound Chinook salmon are anadromous (spawning in freshwater and migrating to marine waters to mature), and semelparous (spawning once, then dying). Chinook salmon follow a generalized life history, which includes deposition and incubation of eggs in gravels of freshwater systems; emergence and rearing of juveniles in freshwater and estuarine habitats; outmigration to marine systems for extended periods of feeding, growth and maturation; and return to natal waters for spawning, and death (Healy 1991).

Chinook salmon require clean, cool water and clean gravel in which to spawn. Eggs are deposited and buried in gravel nests called redds that females excavate in the gravel bottom of areas of relatively swift, well-oxygenated water (Healey 1991). Eggs incubate until hatching at 32 to 159 days depending on water temperature (NMFS 2007), emerging from redds between January and early April (Kiyohara and Zimmerman 2009). Patterns of rearing and outmigration of Chinook salmon vary widely with juveniles spending days to several months in freshwater and estuarine areas before migrating to marine habitats.

In general, optimal rearing habitat is associated with pools and wetlands where woody debris and riparian vegetation provides shade and protection. In the Lake Washington Basin (also called Water Resource Inventory Area (WRIA) 8, juvenile salmon appear to utilize two rearing strategies: some rear in their natal streams and emigrate to the lake as pre-smolts in May, June and July; others emigrate as fry between January and mid-May and rear in Lake Washington or in Lake Sammamish for several months (Celedonia et al. 2011). All Lake Washington Chinook outmigrate through the Ballard Locks to the Puget Sound estuary during their first year typically from April through August. The highly productive nearshore areas of the Puget Sound provide

young fish with optimal conditions for growth, foraging areas for food, protection against predation, and acclimation to salinity during the transition from fresh water to ocean habitat.

Maturation occurs in marine waters until they reach an age between 2 and 6 years old, when Chinook salmon return to their natal streams to spawn. Adult fish enter the Lake Washington basin from Puget Sound through the Ballard Locks from June through September (WRIA8 2017), and begin entering the spawning streams in September and continue until November. Spawning occurs from October to December, with peak spawning activity usually in the first few weeks of October (Burton et al. 2009).

The historical runs of the Puget Sound Chinook Salmon ESU were estimated to be 690,000 (Good et al. 2005). According to the most recent five-year review, current runs are a fraction (<10%) of the historical runs of Puget Sound chinook, and most populations have declined in abundance sense the last status review in 2011 (NOAA Fisheries 2016). The Lake Washington/Cedar/Sammamish Watershed (WRIA 8) is home to two of the 22 Puget Sound Chinook salmon populations: the Cedar population and the Sammamish population. The 10-year average results (2006-2015) for abundance are 1,012 natural-origin spawners (NOS) for the Cedar Population; and 47 NOS for the Sammamish Population. Current habitat pressures on the WRIA 8 populations of Chinook salmon include land conversion, levees and revetments, shoreline armoring, altered flows, increased water temperatures, increased predation by native and non-native species, and fish passage at the Ballard locks (WRIA8-2017).

1.2.2 Puget Sound Steelhead

Status of Species

The Puget Sound DPS of steelhead trout (*Oncorhynchus mykiss*) was listed as threatened under the Endangered Species Act (ESA) on May 11, 2007, by NMFS (72 FR 26722).

Critical Habitat

Critical habitat for Puget Sound steelhead was proposed on January 14, 2013 (50 CFR Part 226). On February 24, 2016, NOAA Fisheries issued their final rule for critical habitat including 2,031 mi of freshwater and estuarine habitat in Puget Sound WA (81 FR 9251). The entire Lake Washington basin is excluded from the critical habitat designation.

Species Life History

Steelhead are the anadromous form of freshwater resident rainbow trout (*O. mykiss*). Steelhead are capable of repeat spawning, and are known to have the greatest diversity of life history patterns of any Pacific salmonid species. This includes varying degrees of anadromy, differences in reproductive biology, and plasticity of life history between generations.

Steelhead are distributed from Asia to Alaska, and south to the U.S. Mexico border. Spawning migrations occur throughout the year, with seasonal peaks of activity varying by location. In a given river basin, there may be one or more peaks of migration activity generally named for the season in which they occur: winter, spring, summer, or fall steelhead. The names of seasonal

runs in the Pacific Northwest have generally been consolidated into winter and summer steelhead runs, based on the state of sexual maturity at the time they enter freshwater and the duration of spawning migrations (Burgner et al. 1992).

Steelhead in the Puget Sound DPS exhibit two distinct life history strategies: summer-run and winter-run migrations (Myers et al. 2015). The summer-run (stream-maturing) steelhead returns to freshwater in a sexually immature condition during late spring and early summer, and sexually matures in freshwater over several months, typically spawning in the following winter/spring. In contrast, the winter-run (ocean-maturing) steelhead enters freshwater in a sexually mature condition during winter and early spring months and spawns shortly thereafter. The Puget Sound steelhead DPS is predominantly winter-run (Myers et al. 2015).

The period of freshwater entry for adult winter-run steelhead in Puget Sound can vary considerably depending on basin specific characteristics, and annual climatic variation in temperature and precipitations (Kerwin 2001). Maturing adults may reside in pools or side-channels to avoid high winter flows, and will ultimately spawn in moderate gradient sections of streams. Steelhead females may dig several redds in a spawning season, however do not guard the nests and instead return to the ocean following spawning.

In general, juvenile steelhead reside in freshwater for two years prior to emigrating to marine habitats, with seaward migration occurring primarily from April to mid-May (Myers et al. 2015). It is thought that steelhead smolts move through the nearshore water of Puget Sound within a few weeks, and recent acoustic tagging studies (Moore et al. 2010) have shown smolts to migrate to the Strait of Juan de Fuca in one to three weeks. Steelhead feed in the ocean for one to three years before returning to their natal streams to spawn. Steelhead that occur in the Lake Washington Basin are a winter-run steelhead stock only, with adults migrating in a mature reproductive state in December and generally spawning from February through May (Kerwin 2001).

A general downward trend in Puget Sound steelhead DPS populations has occurred throughout the range since the early 1990s (NMFS 2018). The Lake Washington steelhead stock is considered to be depressed, with only the Cedar River providing any substantial natural production (Myers et al. 2015). Primary risk factors for widespread declines in abundance and productivity include urban development, dams, harvest and predations, ocean and climate conditions and hatchery propagation.

1.2.3 Coastal/Puget Sound Bull Trout

Status of Species

The Coastal/Puget Sound bull trout (*Salvelinus confluentus*) DPS was listed as threatened by the U.S. Fish and Wildlife Service (USFWS) on November 1, 1999 (64 FR 58932). This DPS includes all bull trout populations supported in Pacific Coast drainages within Washington, including Puget Sound.

Critical Habitat

USFWS designated critical habitat for the Coastal/Puget Sound DPS of bull trout on September 26, 2005 (70 FR 56212).

Habitat requirements for bull trout are listed by USFWS in terms of functions and PCEs. Bull trout require the following habitat functions:

1. Spawning, rearing, foraging, or over-wintering habitat to support essential existing local populations.
2. Movement corridors necessary for maintaining essential migratory life history forms.
3. Suitable habitat that is considered essential for recovering existing local populations that have declined or that need to be re-established to achieve recovery.

These functions are provided by areas containing these PCEs:

1. Water temperatures ranging from 36°F to 59°F, with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade such as that provided by riparian habitat, and local groundwater influence.
2. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and in-stream structures.
3. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter and minimal substrate embeddedness are characteristic of these conditions.
4. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.
5. Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.
6. Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.
7. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
8. Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.
9. Few or no nonnative predatory species (e.g., lake trout, walleye, northern pike, smallmouth bass); inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.

Species Life History

Bull trout are members of the char subgroup of the salmonid family. They exhibit resident and migratory life history strategies through much of their current range (Reiman and McIntyre 1993). Resident forms of bull trout spend their entire lives in freshwater, while migratory forms rear in tributary streams for one to four years before migrating to either a lake (adfluvial form),

river (fluvial form), or saltwater (anadromous form) to mature and live as adults. The Coastal/Puget Sound population segment contains 35 subpopulations of native char and is the only anadromous bull trout found in the conterminous United States (Bowerman et al. 1998).

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Bull trout prefer low-gradient reaches with loose, clean gravel as spawning habitat (Goetz 1989, Fraley and Shepard 1989). Time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and stream flows and the newly emergent fry rear near their spawning areas (Ratliff and Howell 1992). Juvenile and sub-adults may be found anywhere in the basin downstream of spawning areas as they migrate throughout the system looking for feeding opportunities.

Bull trout have more specific habitat requirements compared to other salmonids (Reiman and McIntyre 1993). Bull trout, require access to large, connected, high quality freshwater habitat that includes cool water temperatures, deep pools, LWD and other forms of complex cover, clean substrates, and unimpaired flow regime and channel floodplain interactions. Bull trout require cold water for spawning (46 degrees Fahrenheit) and egg incubation (below 40 degrees Fahrenheit) (Fraley and Shepard 1989, Reiman and McIntyre 1993). Throughout all their life history stages Bull trout also require complex cover, such as large woody debris (LWD), undercut banks, boulders, and pools. Juvenile and adult bull trout frequently use side channels, stream margins, and pools that have suitable cover. Because of this strong association with cover, bull trout eggs and juvenile bull trout are susceptible to adverse effects associated with sediment deposition and bedload movement during incubation, emergence, and rearing (Fraley and Shepard 1989). Channel form and stability are also significant aspects of bull trout habitat requirements. Watershed conditions and activities within the watershed can affect channel stability and flow patterns, which can directly affect bull trout. Alterations of natural flow patterns may affect spawning bull trout, and channel instability may decrease survival of eggs and juvenile bull trout.

The Coastal/Puget Sound bull trout population segment includes resident and migratory forms, and is the only known segment of bull trout in the United States that includes the anadromous life history form. Unlike strict anadromy, Coastal/Puget Sound bull trout are “amphidromus” meaning sub-adults often return seasonally to freshwater seeking forage opportunities to feed on salmonid eggs, smolts or juveniles. Habitat is severally fragmented throughout the Coastal/Puget Sound population range, and threats to bull trout include poor water quality, sedimentation, harvest and non-native species, and migratory barriers such as dams (PSSRP 2007). As a result, population abundance and distribution has declined within individual river basins in the region.

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Appendix G

Indirect Effects Flow Chart

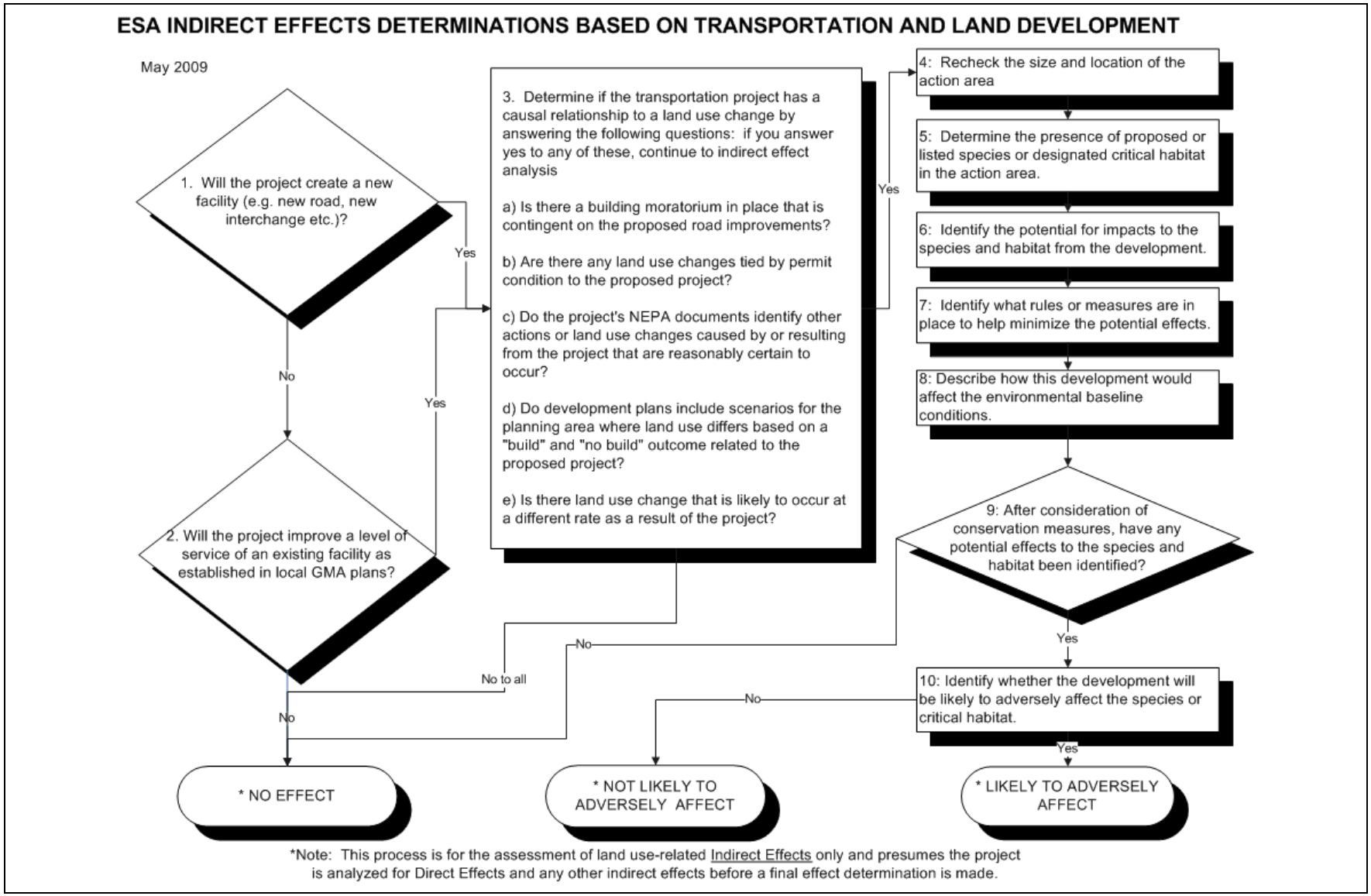

Figure 10-1. Flow chart.