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

Refer to NMFS No:
WCRO-2023-00024

April 1, 2024

Todd N. Tillinger P.E.
Chief, Regulatory Branch
United States Army Corps of Engineers, Seattle District
4735 East Marginal Way South, Building 1202
Seattle, Washington 98134-2388

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the State Route 531-43rd Avenue to 67th Avenue Widening and Fish Passage Project (USACE Number NWS-2022-925-DOT)

Dear Mr. Tillinger:

Thank you for your letter on January 17, 2022, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the State Route 531-43rd Avenue to 67th Avenue Widening and Fish Passage Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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

The enclosed document contains the biological opinion (opinion) prepared by the NMFS pursuant to section 7 of the ESA on the effects of the proposed action. In this opinion, the NMFS concludes that the proposed action would adversely affect but is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS steelhead trout. The NMFS also concludes that the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon but is not likely to result in the destruction or adverse modification of PS Chinook salmon designated critical habitat. This opinion also documents our conclusion that the proposed action is not likely to adversely affect Southern Resident Killer Whales and their designated critical habitat.

This opinion includes an incidental take statement (ITS) that describes reasonable and prudent measures (RPMs) the NMFS considers necessary or appropriate to minimize the incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the Federal Highway Administration (FHWA) must comply with to meet those measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

Section 2.10. of this document includes our Conservation Recommendations

Section 3 of this document includes our analysis of the action's likely effects on EFH pursuant to Section 305(b) of the MSA. Based on that analysis, the NMFS concluded that the action would adversely affect designated freshwater EFH for Pacific Coast Salmon. Therefore, we have provided 5 conservation recommendations that can be taken by the United States Army Corps of Engineers (USACE) to avoid, minimize, or otherwise offset potential adverse effects on EFH. We also concluded that the action would not adversely affect EFH for Pacific Coast groundfish and coastal pelagic species. Therefore, consultation under the MSA is not required for EFH for Pacific Coast groundfish and coastal pelagic species.

Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving this recommendation. If the response is inconsistent with the EFH conservation recommendations, the USACE must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation you clearly identify the number of conservation recommendations accepted.

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

Sincerely,

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

cc: Jeff Dreier, WSDOT Biology Program Manager
Michelle Meade, WSDOT
Katina Kapantais, WSDOT Biology Program
Samantha Stanford, United States Army Corps of Engineers
Joëlle Cihak, WSDOT Biologist

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

State Route 531-43rd Avenue to 67th Avenue Widening and Fish Passage Project
(USACE Number NWS-2022-925-DOT)

NMFS Consultation Number: WCRO-2023-00024

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

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

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes
Pacific Coast Groundfish	No	No

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: April 1, 2024

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LIST OF ABBREVIATIONS

BA – Biological Assessment
BMP – Best Management Practices
CFR – Code of Federal Regulations
cfs – cubic feet per second
USACE – Corps of Engineers, U.S. Army
dB – Decibel (common unit of measure for sound intensity)
DIP – Demographically Independent Population
DPS – Distinct Population Segment
DQA – Data Quality Act
EF – Essential Feature
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
HAPC – Habitat Area of Particular Concern
HUC – Hydrologic Unit Code
HPA – Hydraulic Project Approval
ITS – Incidental Take Statement
JARPA – Joint Aquatic Resources Permit Application
mg/L – Milligrams per Liter
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NOAA – National Oceanic and Atmospheric Administration
PAH – Polycyclic Aromatic Hydrocarbons
PBF – Physical or Biological Feature
PCE – Primary Constituent Element
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSTRT – Puget Sound Technical Recovery Team
PSSTRT – Puget Sound Steelhead Technical Recovery Team
RPA – Reasonable and Prudent Alternative
RPM – Reasonable and Prudent Measure
SEL – Sound Exposure Level
SL – Source Level
SPCC – Spill Control and Counter Measures Plan
SRKW – Southern Resident Killer Whale
SR –State Route
TDA –Threshold Discharge Area
VSP – Viable Salmonid Population
WCR – West Coast Region (NMFS)
WDFW – Washington State Department of Fish and Wildlife
WDOE – Washington State Department of Ecology

1. INTRODUCTION

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

1.1. Background

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

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

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

1.2. Consultation History

Two pre-Biological Assessment (BA) meetings for this project were held virtually on September 19, 2019 and September 15, 2022. The NMFS received a request to initiate formal consultation and a BA from USACE originally on January 17, 2023 to address potentially adverse effects to Puget Sound DPS steelhead trout and Critical Habitat, Puget Sound ESU Chinook salmon and Critical Habitat, Southern Resident Killer Whales (SRKW), and Essential Fish Habitat (EFH) for Coho salmon and Chinook salmon. NMFS responded with a letter of insufficiency on February 28, 2023 due to lack of information to initiate ESA Section 7 or conduct EFH review.

USACE and Washington State Department of Transportation (WSDOT) sent a revised BA to NMFS on May 19, 2023, yet the BA revisions did not address all information requested in the letter of insufficiency. USACE, WSDOT, and NMFS met in a virtual meeting on June 21, 2023 to discuss the BA revisions and information needs. After the meeting, USACE and WSDOT responded via electronic mail to NMFS with responses and Joint Aquatic Resource Permit Application plan sheets. WSDOT/USACE revised the BA and sent it to NMFS on August 22, 2023. NMFS reviewed the information in total and determined that sufficient information had been received and ESA section 7 consultation was initiated on August 22, 2023.

This opinion is based on information in the BA and construction plan drawings. Information to complete this opinion includes published and unpublished best available scientific information on the biology and ecology of the species, and relevant scientific and gray literature (see Section 5; References).

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (see 50 CFR 402.02). Under MSA, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded or undertaken by a federal agency (50 CFR 600.910).

The USACE proposes to issue a Clean Water Act (CWA) Section 404 permit for the WSDOT's proposal to widen State Route (SR) 531 from two lanes to four lanes from milepost (MP) 7.00 to MP 8.68 in the cities of Arlington and Marysville, Washington (Figure 1). The proposed improvements on SR 531 extend from the intersection at 43rd Avenue (Ave) Northeast (NE) to 67th Ave NE and include constructing three, two-way roundabouts at the intersections of SR 531 with 51st Ave NE, 59th Ave NE, and 67th Ave NE. Highway widening would include adding two lanes of pavement on the south side of the existing highway for travel to the east, and the existing highway pavement would be converted to two lanes of traffic for travel to the west. Additional widening would be created to the south to construct a shared use pathway for bikes and pedestrians. The existing railroad crossing west of 67th AVE NE would be reconstructed to align with the grade of the new highway configuration. In addition, the project would pave six access points from the highway that service existing developed (five access points) and undeveloped property (one access point).

The highway profile would need to be lowered in the eastern portion of the project corridor requiring reconstruction of the existing railroad crossing just west of 67 Ave NE. The proposed highway improvements intercept a fish barrier underneath the highway west of 67 Ave NE and immediately west of the railroad crossing. The project proposal includes replacing the deficient culvert structure with a stream simulation culvert to restore fish passage upstream of SR 531 for an unnamed tributary (hereby referred to as UNT) to Edgecomb Creek.

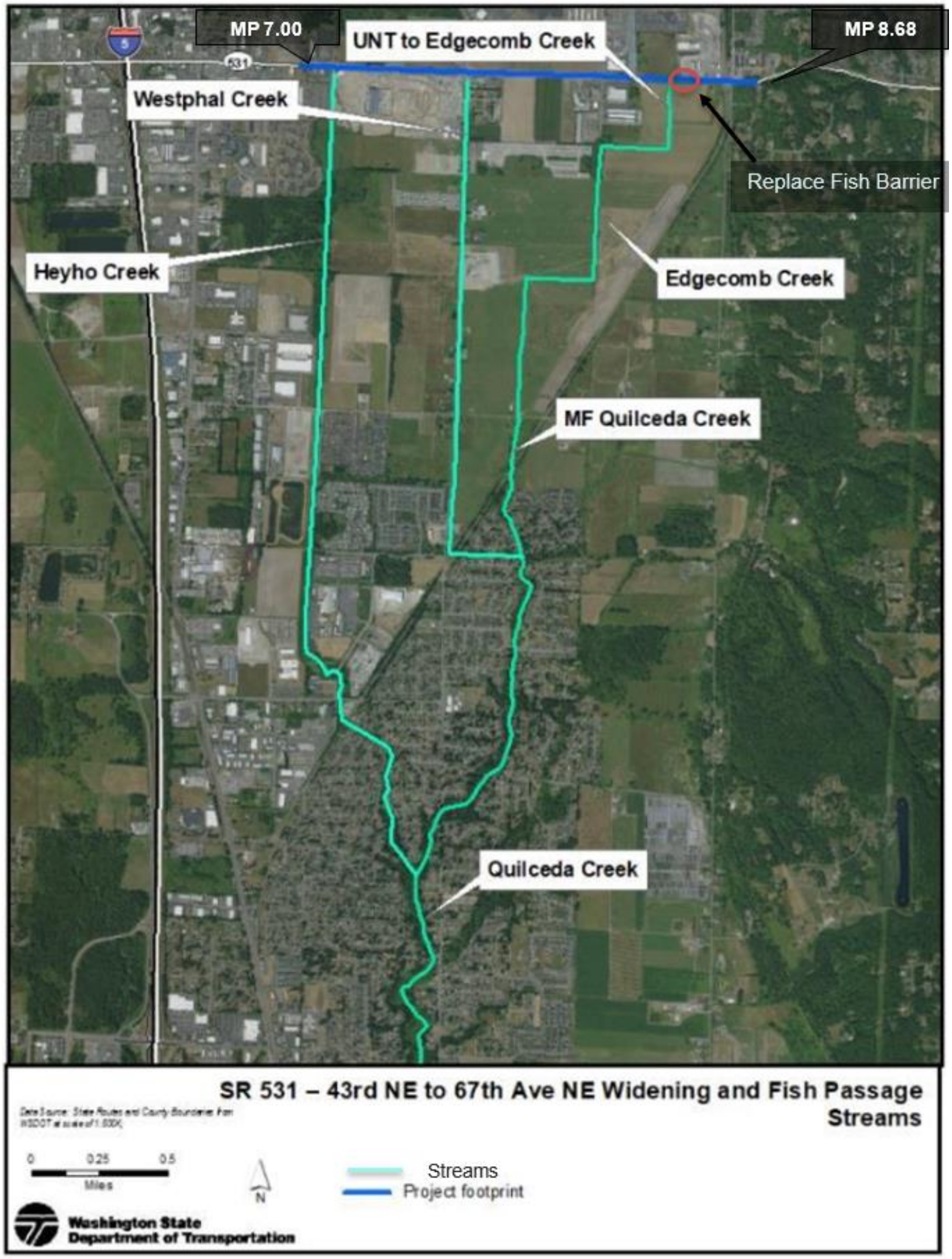

Figure 1. Map of the project corridor (in blue), extending east on SR 531 from 43rd Ave NE to 67th Ave NE, including a fish culvert replacement west of 67th Ave NE.

A description of the proposed action is provided herein, with more detail about the construction schedule, conservation measures, vegetation clearing, riparian impacts, fish barrier correction (culvert replacement), construction stormwater management, permanent stormwater treatment facilities, temporary and permanent lighting, wetland impacts and wetland mitigation.

Construction Schedule

The project is proposed for construction in 2025 and is estimated to take one year to complete. Seeding and planting to restore disturbed soils would likely continue into 2026 and riparian vegetation would be monitored for 80% survival for three years, in accordance with Washington State regulations. During construction, one season of in water work is proposed for fish passage restoration in the UNT. The project proposes to conduct in-water work from July 15 to September 30 to minimize impacts to fish and fish habitats (USACE 2024). The in-water work window would enable the project to avoid peak migration times for salmonids and ensure construction takes place during low flows when salmon are least likely to be present.

Conservation Measures

To reduce potential for and intensity of impacts to ESA and EFH protected species and their habitats the WSDOT and their contractor will be required to abide by avoidance and minimization measures, EFH conservation measures, and Fish Removal Protocols and Standards in Section 1.5.1, Section 1.5.2, and Section 1.5.3 of the BA. Those measures include compliance with a Spill Protection, Control, and Countermeasure (SPCC) plan to prevent and respond to events that may release contaminants into protected waterways and habitats for ESA listed species. Conservation measures include compliance with a Temporary Erosion and Sediment Control Plan that includes installation of temporary erosion and sediment control best management practices (BMP) to prevent and minimize the release of sediment laden runoff into protected waterways. At the end of the project, workers would remove work area isolation structures, temporary BMPs, and SPCC measures.

An additional measure has been added to this list to use a cobra head lamp style for any street or sidewalk lighting next to the UNT and Edgecomb Creek to reduce effects from night time lighting on these fish bearing streams.

Vegetation Clearing

The first stage of construction involves site preparation that would include marking construction boundaries for vegetation clearing, installation of BMPs, mobilizing and staging equipment, and clearing vegetation. Construction will include the use of heavy equipment for clearing herbaceous and woody vegetation.

The proposed project includes clearing approximately 8.46 acres of vegetation in non-riparian areas, which includes 3.30 acres of temporary disturbance and 5.16 acres of permanent vegetation disturbance. Terrestrial vegetation that will be disturbed consists of predominately mowed, non-native pasture grasses and reed canarygrass (*Phalaris arundinacea*) on highway shoulders and adjacent agricultural pastures.

Riparian vegetation impacts total 1.22 acres of clearing, which includes 0.36 acre of temporary disturbance and 0.86 acre of permanent disturbance in the project footprint (Table 1). At the end of the project, workers would revegetate temporarily disturbed areas with native vegetation and monitor planted vegetation in riparian areas for three years following construction to ensure successful survival.

Table 1. Riparian impacts next to Edgecomb Creek and Unnamed Tributary

Location	Temp Riparian Acres	Permanent Riparian Acres	Total Acres	Vegetation composition
UNT to Edgecomb Creek Buffer	0.31	0.80	1.11	Reed canarygrass
Edgecomb Creek Buffer	0.05	0.06	0.11	Red alder/Himalayan Blackberry
Totals (Acres)	0.36	0.86	1.22	

Riparian vegetation clearing includes 1.11 acres in the buffer of the UNT. This includes 0.31 acre of temporary and 0.80 acre of permanent impacts to pasture grasses and reed canarygrass. Permanent impacts are due to the widening of SR 531 south into the stream buffer, correction of the fish passage barrier, and installation of stormwater treatment BMPs.

Riparian vegetation clearing includes 0.11 acres in the buffer of Edgecomb Creek. This includes 0.05 acre of temporary and 0.06 acre of permanent impact to Himalayan blackberry and red alder trees measuring less than 6 inches diameter at breast height. Permanent impacts are due to the widening of the roundabout to the southeast and installation of a sidewalk at this same location in the buffer of Edgecomb Creek. Permanent lighting will be installed in this location.

All temporary clearing impacts will be revegetated at the end of construction with native plant species.

Construction Stormwater Management

Without proper management, construction activities could create temporary adverse effects on water quality in nearby waterbodies, such as increased turbidity or the accidental release of fuels and soluble or water-transportable construction materials. To minimize potential contamination, accidental spills will be managed according to the site specific SPCC. Typical runoff from construction sites could include oils, greases, metals, solvents, and/or high-pH water from concrete cleanout. Stormwater treatment BMPs would be installed to manage and treat construction generated runoff. Site-specific BMPs may include pretreatment facilities, such as oil-water separators and sediment traps, baker tanks, and BMPs to comply with the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit, as required by the Washington Department of Ecology (WDOE) for construction projects that disturb more than 5 acres of land. In accordance with the permit, water quality standards for turbidity and pH are monitored at the point of discharge throughout construction including locations where the site intercepts with streams. Discharges must not cause or contribute to a violation of surface water quality standards (Chapter 173-201A WAC).

At construction stormwater discharge locations, weekly monitoring is required by the permit for turbidity and PH. For turbidity, discharges exceeding 25 Nephelometric Turbidity Units (NTUs) require immediate action to install or repair stormwater BMPs and review the Stormwater Pollution Prevention Plan (SWPPP) for water quality compliance. If a turbid discharge occurs to an on-site stream, monitoring is required to comply with water quality standards of 5 NTUs over background within the turbidity mixing zone as required by the WAC for core summer salmonid habitat. For pH, monitoring is required by the permit to ensure stormwater PH from concrete runoff measures between 6.5 and 8.5. If the pH is not meeting the benchmark, the permittee is either required to prevent the high pH water (8.5 or above) from entering storm sewer systems or surface waters of the state; or, if necessary, adjust or neutralize the high pH water until it is in the range of pH 6.5 to 8.5 using an appropriate treatment BMP. such as carbon dioxide (CO2) sparging, dry ice or food grade vinegar. Written approval from WDOE must be obtained before using any form of chemical treatment other than CO2 sparging, dry ice or food grade vinegar.

Fish Barrier Correction

Stream Isolation

No in-water work is planned for Edgecomb Creek, yet a culvert replacement is proposed for the UNT in the project area. A stream diversion will be used to bypass flow around the work area in UNT prior to in-water work in accordance with conservation measures described in Section 1.5.3 of the BA. Stream isolation will occur after or in coordination with fish exclusion work, to reduce the risk of diverted flows from stranding fish. If no flows are present in the creek, contingency measures will be followed so that incoming flows to not introduce flow or fish into the work area.

Fish Salvage

Biologists will follow the WSDOT Fish Exclusion Protocols (WSDOT 2021) to conduct work area isolation, fish capture and removal, and dewatering/re-watering activities in the UNT. Block nets will be installed during the in-water work window and prior to stream diversion to salvage fish in the channel and prevent fish from potential injury during construction. Fish exclusion may include herding, blocking, netting, and electroshocking as part of the fish exclusion operation. The UNT is typically dry during the proposed in-water work window, and contingency measures including block nets will be prepared for any flow observances in the creek. Any fish captured during fish exclusion will be moved downstream in the UNT or in Edgecomb Creek away from low flows or other sources of potential injury during construction.

Culvert and Stream Channel Construction

After flows are diverted and fish are safely moved out of the work zone, the existing culvert will be replaced with a fish passable structure that has a minimum hydraulic width of 13 feet and is approximately 140 feet long. The existing culvert is a 36-inch diameter concrete culvert approximately 110 feet long, with concrete headwalls at both ends and bank armoring guiding the stream to cross under SR 531 at an angle. Additionally, there is no bed material throughout the culvert.

The inlet of newly proposed structure will be placed approximately 50 feet west of the existing culvert structure to reduce the angle of the crossing under the highway. The upstream channel will have improved sinuosity, gravel bed, and large woody material installed to improve upstream habitat connectivity.

The downstream portion of the culvert and its new outlet will be constructed to provide passage under the newly constructed lanes of SR 531 and result in the removal of two additional existing metal culverts (36-inch and 48-inch diameter) about 25 feet long currently located on private property. About 25 feet downstream of the proposed culvert outlet, the new stream channel will tie into an existing stream restoration project on private property that is realigning and improving the UNT south of the project corridor (WCRO-2020-03191). Replacing the culvert under SR 531 will result in improved fish passage upstream to 152 meters of rearing habitat in UNT.

Roadway Construction and Stormwater Improvements

The project proposes to create a total of 4.92 acres of new pollutant generating impervious surfaces (PGIS). Replaced PGIS total 5.99 acres in the roadway corridor. The new and replaced PGIS would be located within four sub-watersheds of Quilceda Creek basin: Heyho Creek, Westphal Creek, UNT, and Edgecomb Creek. Drainage areas in the project corridor have been broken down into 16 Threshold Discharge Areas (TDA) to assess and design stormwater runoff treatment and detention areas (Table 2).

Existing stormwater conveyance is minimal throughout the project area. For mainline portions of SR 531, the majority of existing stormwater sheet flows off-site and either infiltrates into the ground or flows overland to Heyho, Westphal, the UNT, or Edgecomb Creek. TDA 1 and TDA 2 near 43rd Ave NE were removed from the WSDOT SR 531 widening design, because portions of the roundabout approach drain to a private bioretention/infiltration pond built as a part of the adjacent Amazon warehouse facility.

At 51st Ave NE and 59th Ave NE, stormwater sheet flows off the roadway onto adjacent properties and infiltrates or flows overland to Heyho Creek in TDA 3, 4, and 5; to Westphal Creek in TDAs 6, 7, 8, and 9; and to the UNT or Edgecomb Creek in TDAs 10, 11, 12, 13, 14, 15 and 16. At 67th Ave NE, stormwater is captured into an enclosed system. The northern half of the intersection flows to a detention facility north of the project area, and the southern half of the intersection flows to a detention facility south of the project area.

No BMPs are proposed for TDAs 4, 6, 11, 12, 14, 15 and 16 as the project will not add enough new PGIS to trigger runoff treatment or flow control minimum requirements per the WSDOT Highway Runoff Manual (HRM) (WSDOT 2019). The stormwater design is constrained due to limited right-of-way availability, proximity of nearby developments, and high groundwater levels. The location of the roundabout at 67th Ave NE along with the treatment and flow control design are further constrained by a protected WSDOT restoration site next to Edgecomb Creek and the Burlington Northern Santa Fe (BNSF) railroad.

Table 2. Project Summary of Proposed Threshold Discharge Areas, Receiving Waterbodies, and Existing and Proposed Pollutant Generating Impervious Surfaces

Receiving Waters and TDAs	**Existing (acres)**		**Proposed (acres)**			
	Total PGIS Area	**Total Treated Area**	**Total PGIS Area**	**New PGIS**	**Replaced PGIS**	**Total Treated Area**
Heyho Creek						
3	0.854	0.372	0.751	0.040	0.638	0.403
4	0.973	0	0.916	0	0.916	0.723*
5	1.732	0	1.383	0.768	0.586	1.241
Subtotal	3.559	0.372	3.050	0.808	2.139	2.367
Westphal Creek						
6	0.214	0	0.113	0.011	0.069	0
7	1.322	0	0.924	0.768	0.100	0.768
8	0.538	0	0.100	0	0.021	0
9	0.647	0	2.385	1.325	1.060	0.655
Subtotal	2.721	0	3.522	2.104	1.250	1.423
UNT to Edgecomb Creek						
10*	0.343	0	0.000	0	0	0
11	0.422	0	0.101	0.057	0.019	0
12	0.568	0	0.191	0	0.080	0
13	1.408	0	3.780	1.822	1.959	3.532
Edgecomb Creek						
14	0.205	0	0.179	0.001	0.094	0
15	0.855	0	0.268	0.030	0.190	0
16	0.283	0	0.633	0.098	0.264	0*
Subtotal	4.084	0	5.152	2.008	2.606	3.532
Project Total	10.364	0.372	11.723	4.920	5.996	7.322

* Existing TDA 4 does not require treatment due to no new PGIS. The total treated area represented is a grass lined swale that would provide incidental treatment; but is not a constructed treatment BMP.

* Existing TDA 10 is completely integrated into TDA 13 to facilitate flow control and runoff treatment of the roundabout approach. As a result, it is not included in the post-project conditions.

* TDA 16 is calculated as zero treatment; however, the proposed PGIS (0.633 acre) will be discharged in a dispersion trench to filter through 20-50 feet width riparian buffer before discharging into Edgecomb Creek. Some incidental treatment is expected.

Proposed Treatment of New and Replaced PGIS

The existing project corridor currently has 10.364 acres of PGIS with a total treatment area of 0.372 acres from existing stormwater facilities. The project proposes to add 4.920 acres of new PGIS and replaced PGIS is equal to 5.996 acres. The final proposed PGIS in the project corridor will be equal to 11.723 acres. WSDOT and USACE are proposing to offset stormwater runoff impacts by treating 7.322 acres of PGIS in the project corridor.

Threshold Discharge Areas – Heyho Creek

TDA 3 currently has stormwater treatment for 0.372 acres of existing PGIS. The existing closed system flows 1,200 feet south to Heyho Creek. Post project, TDA 3 is decreasing in area by approximately 0.1 acres and 0.04 acres of new PGIS will be added, which will be treated with bioretention. A series of detention pipes and a pump system will be constructed, which will discharge to an existing pipe system in the 43rd Ave NE intersection.

TDA 4 discharges flows through approximately 8,000 feet of existing grass-lined conveyance ditch before discharging to Heyho Creek, which will provide some amount of natural pollutant removal. Under the proposed condition, no runoff treatment or flow control BMPs are proposed for TDA 4 because the project is not constructing new PGIS in this TDA.

Existing PGIS in TDA 5 decreases by 0.349 acres while the treated area increases from zero to 1.241 acres. Overall, PGIS in the three TDAs that discharge to Heyho Creek will be reduced by 0.509 acres of PGIS. The project proposes a total of 0.808 acres of new PGIS and replaced impervious surface totals 2.139 acres. The project proposes a total of 2.367 acres of stormwater treatment for these stormwater runoff discharges to Heyho Creek.

Threshold Discharge Areas – Westphal Creek

Baseline conditions for TDAs that drain to Westphal Creek do not provide any stormwater treatment for the existing PGIS of 2.72 acres. Under the proposed condition, no runoff treatment or flow control BMPs are proposed for TDA 6, because the project reduces PGIS acreage, and the resulting area will not trigger runoff treatment or flow control minimum requirements per the HRM. TDA 7 has a proposed total of 0.768 acres of new PGIS, which is proposed for treatment. No new PGIS is proposed for TDA 8, thus no treatment is required.

TDA 9 will contain detention vaults and a pump system and/or compost amended vegetated filter strips (CAVFS), which will discharge to an existing ditch system along the east side of commercial properties south of the roadway. The existing ditch flows south 3000 feet before discharging to Westphal Creek. As one of the TDAs selected for additional compensatory treatment, Compost Amended Vegetated Filter Strips (CAVFS) and infiltration BMPs will be installed. Flow control will be provided via a detention vault.

Overall, a total of 2.10 acres of new PGIS will be installed for drainages to Westphal Creek and replaced PGIS totals equal 1.25 acres. The project proposes a total of 1.42 acres of stormwater treatment for these stormwater runoff discharges to Westphal Creek.

Threshold Discharge Areas – UNT to Edgecomb Creek / Edgecomb Creek

No treatment is currently provided for TDAs that drain to the UNT and Edgecomb Creek. The project proposes no BMPs for TDAs 11, 12, 14, 15 and 16 as the project will reduce PGIS area in these TDAs and the small quantities do not trigger runoff treatment or flow control minimum requirements per the HRM. Existing TDA 10 is completely integrated into TDA 13 to facilitate flow control and runoff treatment of the roundabout. As a result, it will no longer generate stormwater runoff.

The project is proposing to use an equivalent area approach to treat more PGIS than is required in TDA 13 to compensate for the lack of treatment of some replaced impervious and smaller TDAs that drain to UNT and Edgecomb Creek (Figure 2). TDA 13 will have two new stormwater outfalls constructed to the UNT located between 59 Ave NE and 63 Ave NE. The proposed design includes 12-inch diameter detention pipes and pump systems along the north side of the roadway to detain and convey stormwater regulating the inflow into two compost-amended biofiltration swales for enhanced treatment. Treated stormwater will discharge directly to the UNT.

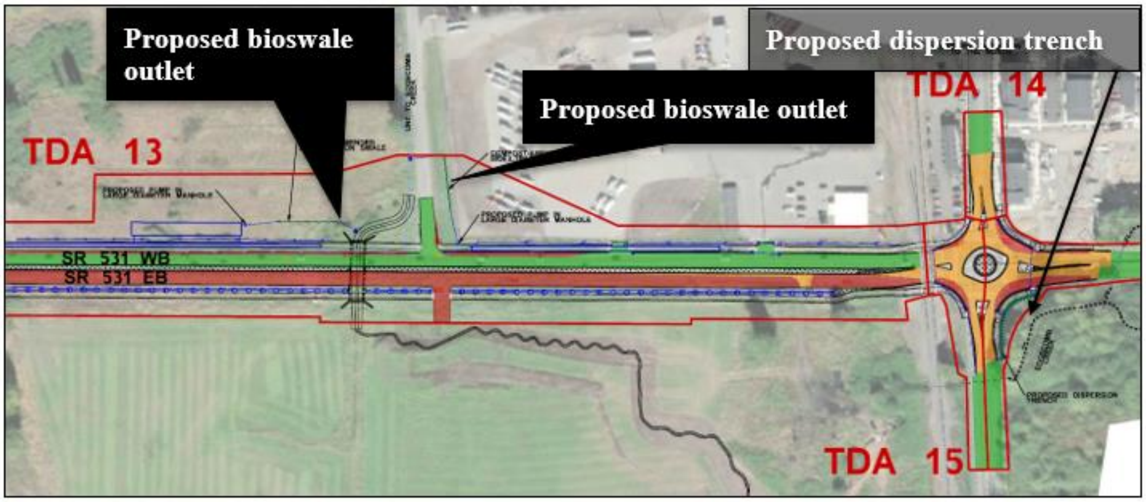

Figure 2. Proposed condition for two compost amended biofiltration swales in TDA 13 upstream of the fish passage correction site.

There is no existing or proposed treatment or flow control in TDAs 14 or 15. Total PGIS in TDA 14 and TDA 15 will decrease under the proposed project, thus no treatment was required. The project will remove 0.026 acre of PGIS in TDA 14 and 0.587 acre in TDA 15. TDA 16 will contain a dispersion trench along the back of the sidewalk southeast of the 67 Avenue NE intersection with SR 531. There is not enough of a sheet flow path to meet HRM standards for enhanced treatment, however stormwater will sheet flow over 20-50 feet of protected riparian area before flowing into Edgecomb Creek.

Overall, a total of 2.008 acres of new PGIS will be installed for drainages to UNT and Edgecomb Creek and replaced PGIS totals equal 2.606 acres. The project proposes a total of 3.532 acres of enhanced stormwater treatment for treatment of these stormwater runoff discharges to UNT and Edgecomb Creek.

Temporary and Permanent Lighting

Temporary lighting will likely be required during night work along the project corridor to reduce traffic disruptions during the day. Permanent highway illumination will be installed throughout the project corridor for highway safety. Permanent lighting along the new sidewalk within approximately 35 feet from the OHWM of the UNT and Edgecomb Creek will have a cobra lamp installed that shines directly on the roadway and sidewalk to reduce back lighting and potential effects to salmonids.

Wetland Impacts and Wetland Mitigation

The project will have approximately 0.02 acres of permanent wetland impact and 0.30 acres of buffer impacts associated with the Category III depressional wetland within the sub-watershed of the UNT. Wetland impacts are located in a ditch upslope of the proposed culvert replacement site, which will result in a wider stream channel and habitat improvements. If wetland functions are not fully compensated for on site at the fish passage location, WSDOT will mitigate for permanent wetland impacts at an approved wetland mitigation bank in Snohomish County due to limited space within the WSDOT right of way. Mitigation will occur at one of three approved wetland mitigation banks that are located outside the Quilceda Watershed, but within Water Resource Inventory Area 07: Snohomish Basin Mitigation Bank, Paine Field Wetland Compensation Bank, or Skykomish Habitat Mitigation Bank. A summary of these mitigation banks is provided in Section 1.3.2.6 of the BA.

Other Activities

The NMFS considered, under the ESA, whether or not the proposed action would cause any other activities and determined that the project supports increasing use of the highway corridor and increased stormwater discharge from roads. The project will pave access points along the project corridor extending the life of the access points and their use to undeveloped land. The project area is zoned as industrial and is reasonably certain to be developed next to the project corridor in the near future.

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

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

The USACE determined the proposed action is not likely to adversely affect SRKW and their critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12).

Table 3. ESA-listed species and critical habitat that may be affected by the proposed action.

ESA-listed species and critical habitat likely to be adversely affected (LAA)				
Species	**Status**	**Determination**	**Critical Habitat**	**Listing (Designated Critical Habitat)**
Chinook Salmon *(Oncorhynchus tshawytscha)* Puget Sound	Threatened	LAA	LAA	6/28/05 (70 FR 37160) 5/11/07 (70 FR 52630)
Steelhead Trout *(O. mykiss)* Puget Sound	Threatened	LAA	LAA	6/11/07 (72 FR 26722) 2/24/16 (81 FR 9252)

2.1. Analytical Approach

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

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

The designations of critical habitat for PS Chinook salmon and PS steelhead trout use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

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

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Major ecological realignments are already occurring in response to climate change (IPCC WGII, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC WGI, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier 2020).

Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier 2015, 2016, 2017, Crozier and Siegel 2018, Siegel and Crozier 2019, 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al. 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the projected impacts of climate change on instream flows:

> Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter's precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Myers et al. 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time-spans by removing riparian cover (Koontz et al. 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to the removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and Williams et al. 2019), however, impacts of ocean acidification and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxin (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford 2022, Lindley et al. 2009, Williams et al. 2016, Ward et al. 2015). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al. 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al. 2020, FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of *en route* or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Keefer et al. 2018, Barnett et al. 2020).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Holsman et al. 2012, Burke et al. 2013). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish are more likely to survive (Gosselin et al. 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al. 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon *O. nerka* from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale causing the highest levels of synchrony in the last 250 years (Black et al. 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al. 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura el al. 2014) and Atlantic salmon (Olmos et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Healey 2011; Wainwright and Weitkamp 2013, Gosselin et al. 2021). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel 2006; Crozier et al. 2010, Crozier et al. 2019).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al. 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al. 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al. 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al. 2019, Munsch et al. 2022).

2.2.1 Status of the Species

Table 4 provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include

DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

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

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05 (70 FR 37159)	Shared Strategy for Puget Sound 2007 NMFS 2006	NMFS 2016; Ford 2022	This ESU comprises 22 populations distributed over five geographic areas. All Puget Sound Chinook salmon populations continue to remain well below the TRT planning ranges for recovery escapement levels. Most populations also remain consistently below the spawner–recruit levels identified by the TRT as necessary for recovery. Across the ESU, most populations have increased somewhat in abundance since the last status review in 2016, but have small negative trends over the past 15 years. Productivity remains low in most populations. Overall, the Puget Sound Chinook salmon ESU remains at “moderate” risk of extinction.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound steelhead	Threatened 5/11/07	NMFS 2019	NMFS 2016; Ford 2022	This DPS comprises 32 populations. Viability of has improved somewhat since the PSTRT concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 DIPs (Hard et al. 2015). Increases in spawner abundance were observed in a number of populations over the last five years within the Central & South Puget Sound and the Hood Canal & Strait of Juan de Fuca MPGs, primarily among smaller populations. There were also declines for summer- and winter-run populations in the Snohomish River basin. In fact, all summer-run steelhead populations in the Northern Cascades MPG are likely at a very high demographic risk.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization • Dikes, hardening of banks with riprap, and channelization

2.2.2 Status of the Critical Habitat

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

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

For southern DPS green sturgeon, a team similar to the CHARTs — a critical habitat review team (CHRT) — identified and analyzed the conservation value of particular areas occupied by southern green sturgeon, and unoccupied areas necessary to ensure the conservation of the species (USDC 2009). The CHRT did not identify those particular areas using HUC nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For southern DPS eulachon, critical habitat includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). We designated all of these areas as migration and spawning habitat for this species.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 5, below.

Table 5. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value.
Puget Sound steelhead	2/24/16 81 FR 9252	Critical habitat for Puget Sound steelhead includes 2,031 stream miles. Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS.

2.3. Action Area

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

As described in Section 1.3, the project will occur along State Route 531. Roadway widening will occur to the south of the existing roadway and stormwater treatment facilities will be built on both sides of the roadway. New PGIS will be installed and the newly configured roadway will discharge stormwater to newly constructed treatment facilities draining to four sub-basins within the headwaters of the Quilceda Creek watershed: Heyho Creek, Westphal Creek, the UNT, and Edgecomb Creek. The action area extends from the constructed project area through these sub-basins into Quilceda Creek for over five miles downstream to the confluence with the marine waters of the Ebey Slough, a tributary part of the Snohomish River estuary (Figure 3).

Aquatic habitats in the action area include work areas along the UNT up to 100 feet downstream of SR 531 where a water quality mixing zone would be implemented during installation of the stream diversion and reintroduction of flows back into the creek, in accordance with WAC 173-201A-200. The action area includes 500 feet of upstream habitat in UNT where fish would have improved access to habitat following construction of the new fish passable culvert.

Riparian habitats are located in the action area and will be affected by the proposed project. Riparian habitats in the action area include proposed work areas adjacent to the UNT where vegetation disturbance and soil excavation will be required to replace the culvert. Riparian habitats include the buffer of Edgecomb Creek will be impacted to construct the roundabout at SR 531 and 67th Ave NE and its associated sidewalk landward of the OHWM of Edgecomb Creek, as well as install permanent lighting in close vicinity to Edgecomb Creek. No actual work will occur below the OHWM of Edgecomb Creek, however, effects from these actions will extend to adjacent waters associated with Edgecomb Creek in this location.

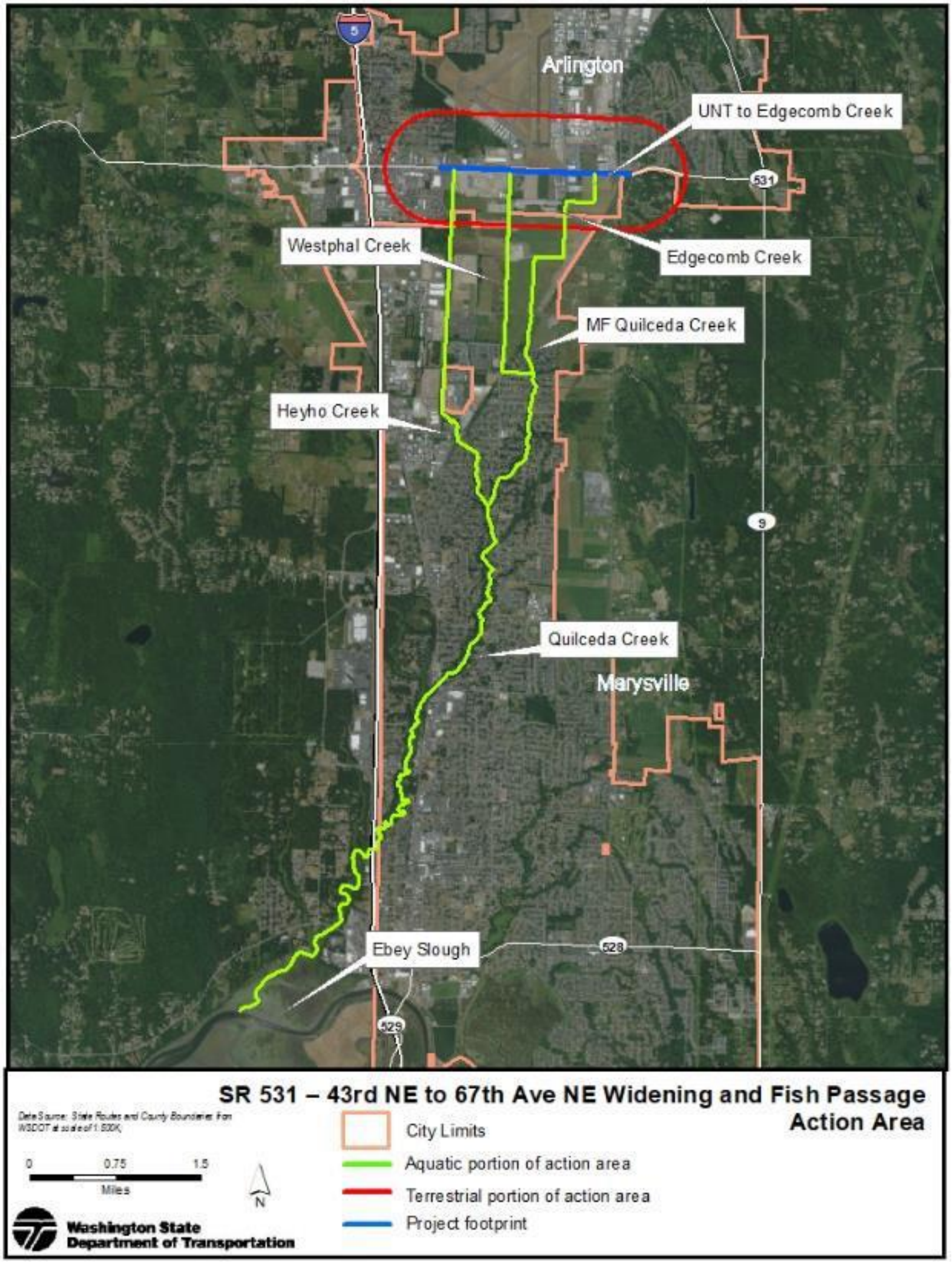

Figure 3. Action area

2.4. Environmental Baseline

The “environmental baseline” refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency’s discretion to modify are part of the environmental baseline (50 CFR 402.02).

The project is located along SR 531 highway, an east/west transportation corridor connecting Interstate 5 to Highway 9 through city of Arlington with adjacent land uses including industry, manufacturing, residences, and agriculture. The project corridor is zoned as industry and commercial development. A significant development in the project corridor is the Cascade Industrial Complex (CIC), consisting of nine buildings on 426 acres of zoned industrial land. The CIC extends north and south of the project corridor and further south into the City of Marysville. Stormwater runoff and associated pollutants (Table 6) are increasing in the project action area due to ongoing land development for industry.

The project is located within the headwaters of the Quilceda Creek watershed. Quilceda Creek drains an area of glacial plateau within Arlington and City of Marysville in Snohomish County. The headwaters of Quilceda Creek include many agricultural ditches, historical wetland complexes that expand into a network of tributaries. Downstream of this network the mainstem drains through the Tulalip Tribe reservation, finally into to the lower reaches of the Ebey Slough and Snohomish River Estuary of the Puget Sound. The Quilceda Creek basin has seven fish-bearing streams that total approximately 31 miles and include another nearly 27 miles of non-fish bearing streams. Quilceda Creek supports fish bearing runs of coho salmon, Chinook salmon, and steelhead trout.

Water quality conditions are relatively poor within Quilceda Creek. As early as 1990, watershed planning efforts in the Quilceda Creek identified water quality issues within the watersheds to include high sediment, nutrient, and bacteria levels and contaminants conveyed by runoff (Carroll 1999). The mainstem of Quilceda Creek is listed as a 303(d) impaired water body for dissolved oxygen (Ecology, 2023).

The WDOE) conducted water quality monitoring along Edgecomb Creek in 2015 and 2016. The WDOE data indicate that dissolved oxygen occasionally exceeds Washington Administrative Code (WAC) 173-201A-200) criteria for salmonid rearing and migration. Edgecomb Creek and the UNT are listed as a Category 2 (water of concern) for dissolved oxygen, and WDOE has implemented a Total Maximum Daily Load (TMDL) plan for bacteria in the stream.

Table 6. Pollutants commonly found in stormwater runoff in Washington State. (WDOE 2011; WDOE 2015).

Pollutant Class	**Examples**	**Urban Sources**
PBT (persistent bio-accumulating toxicants)	POPs (persistent organochlorine pollutants) PCBs (polychlorinated biphenyls) PBDEs (polybrominated diphenyl ethers) PFCs (poly- and per-fluorinated compounds) Pharmaceuticals (estrogen, antidepressant)	Eroding soils, solids, development, redevelopment, vehicles, emissions, industrial, consumer products
Petroleum hydrocarbons	PAHs (poly aromatic hydrocarbons)	Roads (vehicles, tires), industrial, consumer products
Microplastics	6PPD/6PPD-q	Vehicle tires
Metals	Mercury, copper, chromium, nickel, titanium, zinc, arsenic, lead	Roads, electronics, pesticides, paint, waste treatment
Common use pesticides, surfactants	Herbicides (glyphosate, diquat), insecticides, fungicides, adjuvants, surfactants (detergents, soaps)	Roads, railways, lawns, levees, golf courses, parks
Nutrients and sediment	Nitrogen, phosphorus fertilizers, fine-grained inorganic sediment	Fertilizer, soil erosion
Temperature and dissolved oxygen	Warm water, unvegetated exposed surfaces (soil, water, sediments)	Impervious surfaces, rock, soils (roads, parking lots, railways, roofs)
Bacteria	*Escherichia coli*	Livestock waste, organic solids, pet waste, septic tanks

The WDOE) conducted water quality monitoring along Edgecomb Creek in 2015 and 2016. The WDOE data indicate that dissolved oxygen occasionally exceeds Washington Administrative Code (WAC) 173-201A-200) criteria for salmonid rearing and migration. Edgecomb Creek and the UNT are listed as a Category 2 (water of concern) for dissolved oxygen, and WDOE has implemented a Total Maximum Daily Load (TMDL) plan for bacteria in the stream.

Stormwater runoff from SR 531 drains to four sub-basins within Quilceda Creek watershed: Heyho Creek, Westphal Creek, UNT, and Edgecomb Creek. Heyho Creek is a heavily modified and disturbed stream. The headwaters are in the City of Arlington on the edge of a Walmart parking lot and residential development, south of the intersection of 43rd AVE NE and SR 531. Downstream of SR 531, Heyho Creek flows through agricultural land in a channelized ditch overgrown by reed canary grass and Himalayan blackberry thickets. Fish presence in the upper reaches of the creek include primarily coho salmon. Heyho Creek continues to flow south for 2.3 miles, where it enters a residential development and then joins with Middle Fork Quilceda Creek. Riparian buffer conditions improve in the lower portion of Middle Fork Quilceda Creek.

Westphal Creek is a heavily modified and disturbed stream. Headwaters of Westphal Creek include the Arlington Airport. Surface water emerges in a ditch system next to commercial properties and drains 3000 feet south of SR 531 into Westphal Creek. The ditched portion of Westphal Creek flows for about two miles before reaching the Middle Fork Quilceda Creek. Fish presence primarily includes coho salmon.

The UNT to Edgecomb Creek crosses under SR 531 about 1000 feet west of 67 AVE NE within the project area and drains southeast for approximately 850 feet before reaching Edgecomb Creek. The existing UNT has a ditch configuration, reed canarygrass infestations, little channel complexity, and is lined with silt. The stream provides rearing habitat for juvenile salmon (primarily coho salmon) and possible presence of juvenile steelhead trout that stray over from the mainstem of Edgecomb Creek (Tulalip Tribe, pers. comm. 2023).

Edgecomb Creek is located about 50 feet south of the existing intersection of SR 531 and 67 Ave NE and flows west underneath the BNSF Railroad Station into the newly restored two miles of stream channel, where it becomes Middle Fork Quilceda Creek about 2.3 miles downstream.

Edgecomb Creek southeast of the proposed roundabout at 67th AVE NE provides spawning habitat with documented use by coho salmon and presumed use by steelhead trout. Fish with hybrid characteristics of both rainbow trout and cutthroat trout have been documented in Edgecomb Creek by WSDOT biologists 2017), so use of the headwaters of Quilceda Creek by PS steelhead is considered possible. Edgecomb Creek has a recent history of restoration projects including fish barrier removals in 2018 and relocation of over two miles of Edgecomb Creek downstream of the project action area in 2023. North Point Development has been permitted by USACE to build a large-scale development known as the Cascade Logistics Park in Marysville, which extends north up to SR 531, thus they funded the 2023 Edgecomb Creek restoration project as part of the proposed action to mitigate for wetland and stream impacts The North Point Development project has realigned a section of the UNT immediately downstream of the proposed SR 531 widening project area to improve sinuosity in the existing ditch system and connect the stream system to the mainstem of Edgecomb Creek. We consulted on the North Point Development action including the and Edgecomb Creek realignment in 2021 (WCRO-2020-03191). The Cascade Logistics Park opinion concluded adverse effects to PS Chinook salmon and steelhead trout due to temporary effects from fish exclusion, turbidity, and wetland/stream fill. Long term adverse effects included water quality diminishment resulting from treated and untreated stormwater runoff related to the addition of 280 acres of impervious surface. The project included a complex treatment system of modular wetland ponds discharging to vegetated buffers and media filter drains for stormwater runoff. The opinion concluded that no BMP is 100% efficient and some residual contamination near the stormwater discharge locations will expose a small number of juvenile salmonids (PS steelhead and possibly PS Chinook) to lethal levels of contaminants.

Edgecomb Creek becomes Middle Fork Quilceda Creek about 1 mile downstream of the SR 531 widening project and Middle Fork Quilceda Creek flows for another 1 mile before combining with Westphal Creek. The combined system flows an additional mile before combining with Heyho Creek to become the mainstem of Quilceda Creek (a total of about 3 miles downstream of SR 531). Quilceda Creek flows for approximately 5 miles before reaching estuarine habitat and the Ebey Slough.

Critical habitat for PS Chinook salmon and PS steelhead trout is designated in Quilceda Creek from The Tulalip Tribal Reservation boundary east and upstream of Interstate 5, continuing in Middle Fork Quilceda Creek up to its confluence with Westphal Creek. The downstream portion of the action area terminates at marine waters when it reaches the Ebey Slough, within Tribal land, thus this area is not designated as critical habitat (Tribal lands are excluded from the designation).

2.5. Effects of the Action

Under the ESA, “effects of the action” are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

Effects of the proposed action include both temporary and long-term effects to the species and critical habitat. Short term effects are expected to result from the construction of the project. Long-term effects are expected from the operation of the roadway and stormwater treatment facilities.

2.5.1 Effects on Listed Species

The proposed action occurs along SR 531, a linear highway that crosses the headwaters of Quilceda Creek. The nearest documented occurrence of PS Chinook is two miles downstream of the project footprint where tributaries converge to form Middle Fork of Quilceda Creek. Due to this distance, adult and juvenile Chinook salmon are not expected to be directly exposed to construction impacts. PS steelhead trout are documented 2 miles downstream of the project footprint, but more likely to be in close proximity to the project footprint, because rainbow trout are documented in Edgecomb Creek (WSDOT 2017) (Section 2.4 Environmental Baseline) and PS steelhead interbreed with this species. The UNT is a rearing habitat system that connects to Edgecomb Creek, therefore, NMFS expects PS steelhead juveniles and potentially adults are the primary life history phases to be exposed to direct construction impacts. Spawning habitat is available in Edgecomb Creek, but no work is proposed below the OHWM, only work is proposed in the buffer of Edgecomb Creek.

Temporary effects are associated with construction activity to expand the SR 531 roadway and replace a culvert with work below the OHWM occurring between July 15 and September 30. Short term effects include effects from fish exclusion, turbidity during in-water work, temporary impacts to riparian vegetation, benthic impacts, and effects from construction stormwater runoff.

For this proposed action, temporary effects include turbid conditions during stream diversion and fish exclusion required to replace the culvert and install two new stormwater treatment outfalls along the UNT to Edgecomb Creek. Temporary effects include temporary discharges of runoff from the construction site as permitted by a National Pollution Discharge Elimination System permit. Temporary effects are more likely to affect PS Steelhead, because they have been documented in close proximity to the project work area. Temporary effects are not likely to affect PS Chinook salmon, because the nearest documented location is two miles downstream in Middle Fork Quilceda Creek.

Long term effects are associated with the presence and operation of the new roadway configuration and improved fish passage upstream in the UNT. Long-term effects are expected from ongoing exposure of PS steelhead to bank armoring associated with the proposed stormwater outfalls and exposure of PS Chinook and PS steelhead to contaminants in the effluents discharged as stormwater runoff from the project related PGIS. Long-term effects also include reduced riparian function and increased lighting in the buffer of Edgecomb Creek and the UNT, and beneficial effects from fish passage improvements upstream of the corrected fish crossing. Long-term effects of bank armoring, increased lighting, and beneficial effects from improved fish passage are likely to affect PS steelhead, because they are documented in close proximity to the work area.

Long term effects from stormwater effluents discharged to the sub-basins of Westphal, Heyho, the UNT, and Edgecomb Creek are more likely to affect PS steelhead due to their close proximity to the two proposed stormwater outfalls, thus there will be a higher likelihood of ongoing direct exposure. Long term effects are also expected downstream for PS steelhead and PS Chinook, but concentrations of effluent stormwater will be more diluted from the project, the further downstream they flow and likely result in less frequent exposure at these distances. Stormwater effects will still result in adverse effects for both PS Chinook and PS steelhead. In addition, discharge of stormwater runoff and associated contaminants will adversely affect PS Chinook and PS steelhead critical habitats.

Fish Exclusion

Steelhead trout may be present in the project construction area if flows persist in the UNT during fish removal and salvage activities. To minimize exposure of steelhead trout to construction, WSDOT will perform fish exclusion and salvage measures to ensure no fish are present in the project site before work begins.

Fish salvage is intended as a measure to minimize exposure of individual fish to detrimental project effects. However, fish handling and exclusion itself has direct consequences on fish. Fish removal would likely use a fine-mesh herding net to drive fish out from behind the isolation barrier before it is closed off. Herding is not considered capture or handling because fish remain in the water without interruption and is instead considered a short-term displacement from preferred habitat, described later in this document. Small fish that remain within the isolation barrier after multiple passes with the herding net or that become trapped in standing pools will be collected with dip nets or traps, which is considered capture. Any fish not collected in this manner will be electrofished to ensure capture. Electrofishing temporarily stuns the fish, with a small percentage being injured or killed. Fish not successfully removed will die from dewatering. After being herded or otherwise removed from the area, a temporary stream bypass will be created adjacent to the project site to redirect stream flow around the dewatered project area and the work sites will isolated with coffer dams. This would encompass an area of approximately 3,053 square feet on the UNT including the culvert footprint.

Fish exposed to electrofishing and capture would experience stress and may experience trauma and mortality. Electrofishing causes effects that range from increased respiratory action to mortality under certain conditions. Dalbey et al. (1996), Emery (1984), and Snyder (2003) describe responses that range from muscular contractions to mortality from exposure to electrofishing. Depending on the pulse train used, and the intensity and duration of exposure, muscular contractions may cause a lactic acid load and oxygen debt in muscle tissues (Emery 1984), it can cause internal hemorrhage and spinal fractures in 12 to 54% of the exposed fish, and acute mortality in about 2% (Dalbey et al. 1996). Severe interruption of motor function can stop respiration, and combinations of lactic acid load and oxygen debt may be irreversible, causing delayed mortality in apparently healthy fish. Obvious physical injuries often lead to reduced long-term growth and survival, whereas uninjured to slightly injured fish showed long-term growth and survival rates similar to unexposed fish of similar age (Dalbey et al. 1996). To reduce the effects of electrofishing, it would be used only after multiple net passes within the isolation area yield no fish. Further, the biologist and environmental staff would adhere to the guidelines for initial and maximum power settings for backpack electrofishing identified in the WSDOT Fish Removal Protocol and Standards (WSDOT 2021).

Fish can also experience physical trauma and physiological stress responses if care is not taken during the various handling and transfer processes (Moberg 2000; Shreck 2000). Contact with nets may cause scale and skin damage, and overcrowding in traps can cause stress and injury.

The primary contributing factors to stress and mortality from handling are: (1) Difference in water temperatures between the river and the holding buckets; (2) dissolved oxygen levels; (3) the amount of time that fish are held out of the water; and (4) physical trauma. Stress from handling increases rapidly if water temperature exceeds 18 ºC (64 ºF), or if dissolved oxygen is below saturation. Debris buildup in traps can also injure or kill fish. The risk of entrainment or impingement during the de-watering of the isolation area is considered extremely unlikely because very few, if any, fish would remain in the affected area, and the pump intakes would be isolated and screened in compliance with the WSDOT Fish Removal Protocol and Standards (WSDOT 2021). However, any fish that remain in the isolation area following dewatering would likely die from dehydration and asphyxiation. However, given the small numbers of juvenile steelhead that could occur in the area, the numbers of fish that may be affected by these stressors would comprise such small subsets of their respective cohorts, that their loss would cause no detectable population-level effects.

<u>Exclusion from Rearing and Migration Habitats</u>

The UNT supports rearing and migration habitat in the project reach. The substrate composition is predominantly silt with a few areas of small gravel, with low flow that do not provide adequate movement of fines nor dissolved oxygen for eggs. Spawning habitat is located 800 feet downstream of the UNT in the mainstem of Edgecomb Creek southeast of the proposed roundabout at 67 Ave NE.

PS steelhead potentially located in Edgecomb Creek would be prevented from accessing the UNT during construction, but only during the in-water work window of July 15 to September 30 of one construction season. Working during the in-water work window to replace the culvert will minimize the need for exclusion of steelhead trout from migration and rearing habitat in the UNT because fewer fish are expected to be present during low flows and often dry conditions.

If flows are present in the UNT during construction, PS steelhead upstream of the coffer dam that are prevented from continuing their downstream migration may be subjected to lower flows, exposure to warm water temperatures, low dissolved oxygen, and delayed migration as the dry season continues. This is unlikely, however, due to observations by the project biologist of the UNT being dry during the proposed in-water work window.

Reduced Streambank and Riparian Function

Two stormwater outfalls are proposed on the UNT to drain treated water from the proposed biofiltration swales. Outfalls on either side of the creek will result in a combined impact of 135 square feet of riprap below the OHWM needed for outlet protection. This immediate area will lack riparian vegetation allowing solarization of the immediate area around the outfall and fish will likely seek cover elsewhere where there is shade and cover for rearing juvenile fish when the surrounding area is replanted. This quantity of bank hardening is minor and necessary to stabilize the outflow of treated water into the UNT. The project will restore adjacent streambanks with meander, larger woody material, and streambed gravel. Habitat enhancements will encourage fish away from the outfall where they would be less likely to be directly exposed to hardened angular rock and stormwater contaminants.

Temporary impacts to 0.36 acre of riparian vegetation will temporarily reduce shade, natural cover, and decrease detrital inputs for prey until riparian vegetation recovers after replanting. Short term changes to riparian vegetation from temporary clearing are likely to be minimal over the long-term and return to baseline conditions (or improve) within three years following construction (Lawrence et al. 2014).

Permanent impacts to 0.86 acre of riparian vegetation will occur primarily adjacent to the UNT (0.80 acre) with 0.06 acre of riparian vegetation next to Edgecomb Creek to install the roundabout and move the sidewalk closer the creek will increase solar input to the streams within the action area by reducing shade, natural cover, and decreasing detrital prey inputs. Species will be exposed to these effects for several years, until replanted vegetation has attained sufficient height and canopy to cast shade. During this time, reduced shade and cover may result in increased stream temperatures and reduced cover for PS steelhead to hide from predators, such as sculpin and cutthroat trout. Due to the relatively small size of the area that would be affected, the continued input of riparian inputs upstream and downstream of the project reach, and the diluting effects of flowing water, the impacts on aquatic food webs attributable to the project (see Prey Base Diminishment) would likely be too small to cause detectable effects on the fitness or normal behaviors for any life stage of PS steelhead trout in the action area. Furthermore, some of the lost riparian input would return as more diverse, native vegetation grows to maturity. Removal of non-native and invasive species may increase the quality of riparian habitat into the future.

Permanent impacts to riparian vegetation are minor and the quality of the remaining riparian strip will be improved with weed removal and native woody plantings. Since juvenile salmon and steelhead would have access to other in-tact habitat within the reach, and the effects of the action would be primarily short-term, changes to the macroinvertebrate community is not likely to affect long-term fitness of PS steelhead trout that occupy Edgecomb Creek and the UNT.

Prey Base Diminishment

Short-term disturbance to the benthic macroinvertebrate because of dewatering and benthic disturbance (780 ft) sediment deposition within the UNT, would temporarily reduce prey for rearing or migrating juvenile steelhead trout. Changes to the abundance and composition of the macroinvertebrate community abundance and richness typically recover within weeks to months post construction (Lawrence et al. 2014) as upstream prey communities re-colonize the area. Removal of existing riparian vegetation and young trees next to Edgecomb Creek may also contribute to reduced prey for steelhead trout, and this temporary reduction will last for several years until newly planted vegetation matures. This suggests that diminished prey availability may negatively affect some fish from one cohort by increasing competition and decreasing growth, fitness, or survival in some individuals but that successive cohorts will experience less of this project-related effect as prey conditions ameliorate and riparian conditions recover. Riparian vegetation next to the UNT is currently grass, therefore, prey availability would increase with any increased woody plantings near the fish barrier correction site.

Increased Lighting Resulting in Increased Predation

The use of temporary construction lights and the addition of permanent lighting closer to the UNT and Edgecomb Creek for the proposed shared use path and sidewalk will introduce more lighting effects for PS steelhead in the project corridor. Modern science indicates that both direct lighting on adjacent waterways and more indirect, chronic increases in lighting (skyglow) have adverse effects on salmon. Tabor et al. (2004) found that direct lighting delays or stops juvenile sockeye outmigrants in the Cedar River, and the number of sockeye delayed increases with light intensity. In the same study, Tabor et al. (2004) concluded that predation by sculpins increases substantially on juvenile sockeye congregated beneath lights (45% of salmonids were consumed during bright light intensity as compared to 5% of juvenile salmonids consumed in total darkness). Celedonia et al. (2008) found that juvenile Chinook salmon are attracted to roadway lighting along the SR 520 Bridge and the Lake Washington Ship Canal, slowing or stopping their migration and potentially increasing loss to predation. Tabor et al. (2017) also found that juvenile Chinook, coho, and sockeye salmon aggregate beneath artificial lights in nearshore areas of Lake Washington and Lake Sammamish, and this effect increases with light intensity.

Skyglow can increase night brightness by orders of magnitude (Kyba et al. 2015) resulting in increased predation risk on juvenile salmonids including PS steelhead and PS Chinook juveniles (Mazur & Beauchamp 2006). Long-term studies in Lake Washington show a shift in the extent and timing of predation on juvenile fish. Thirty years ago, most predation occurred during twilight. Now predators feed throughout the night (Beauchamp 2019). Analyses of light pollution in the Lake Washington Ship Canal suggest skyglow effects have resulted in a seven-fold increase in nighttime predation risk for juvenile salmon compared to historical, pre-lightbulb conditions (Beauchamp 2019). Fortunately, studies also suggest even marginal reductions in artificial lighting at night can substantially reduce predation risk (Beauchamp et al. 1992; Hansen et al. 2013; Mazur & Beauchamp 2003; Vogel & Beauchamp 1999).

Temporary construction lights will be directed away from aquatic areas to reduce potential effects. The new permanent lighting will be a cobra lamp to reduce back lighting on the stream and focus the light on the roadway. Over time, restored vegetation next to the UNT and Edgecomb Creek will help filter/block light from reaching the stream. Fish barrier corrections in 2018 significantly improved riparian habitat quantity and quality in the adjacent reach of Edgecomb Creek. During the fish barrier corrections, two culverts were permanently removed from Edgecomb Creek and it was rerouted to the south side of SR 531. Impervious surface was removed to accommodate the new creek alignment and adjacent riparian areas were restored to function as high quality rearing habitat and reconnected the hyporheic zone of the creek to adjacent wetland to support spawning habitat. Due to the availability of high quality rearing habitat upstream of the project area and restored rearing habitat downstream of the same reach, NMFS concludes that short-term and long-term impacts to riparian vegetation and lighting next to riparian habitats in Edgecomb Creek will not reduce the long-term fitness of adult and juvenile PS steelhead that occupy Edgecomb Creek.

Construction Noise

Fish will be excluded from the work site, so exposure of any PS Chinook salmon or PS steelhead life stage to construction noise during demolition and removal of the old culverts, and construction of the new culverts, wingwalls, and retaining walls along the UNT is unlikely. The best available information to describe the in-water noise levels that may be caused by this project is a study that measured the in-water noise from excavator dredging of rocks (Reine et al. 2012). They studied the effects of construction sound on adjacent waters by placing a hydrophone at various distances in relatively shallow water (3 feet) from construction noise sources including excavation within a marine harbor. They report that the source level (sound level at 1 meter from the source; SL) for the excavator bucket scooping rocks in the water was about 179 decibel root mean squared units (dBrms). Construction noise may potentially alter fish behavior including startle responses and altered swimming (Neo et al. 2014), abandonment or avoidance of the area of acoustic effect (Mueller 1980; Picciulin et al. 2010; Sebastianutto et al. 2011; Xie et al. 2008) and increased vulnerability to predators (Simpson et al. 2016). The proposed project will use coffer dams to prevent fish access, and time the proposed work when habitat conditions are dry or any wet areas are warmer than suitable for rearing fish habitat (which leads to natural avoidance of the area). Therefore, we anticipate that very few fish of would be exposed to construction noise, or if exposed, would temporarily exhibit these responses during fish exclusion and stream diversion. Due to site isolation from flowing waters, no fish will be directly exposed to construction noise in the dry work area and adverse effects are not expected for PS steelhead.

Construction-Related (Short-Term) Water Quality Diminishment

The streambed in the UNT is characterized by a high percentage of fines, and disturbance of the stream substrate during excavation, culvert replacement, and installation and removal of the cofferdam, and riparian clearing is likely to increase turbidity downstream of the work areas.

Removal of the existing culvert on the UNT to Edgecomb Creek would require excavation of the precast concrete culvert and corrugated metal pipe using heavy equipment. While the cofferdam and streamflow bypass system are in place, construction activities are not expected to degrade water quality in the UNT to Edgecomb Creek because the work area will be dewatered and isolated from the flowing waters of the creek. Post-construction, NMFS anticipates rain on disturbed soils could briefly affect water quality in the action area in the form of small turbid pulses from runoff over newly mulched soils and short-term increases in turbidity are likely during re-watering (e.g., following removal of the cofferdam and bypass pipes). Subsequent high-flow events during the first winter storms post-construction may also cause a pulse of suspended sediment. Since the proposed action occurs during summer flows lower than 10 cfs, the turbidity mixing zone would extend no further than 100 feet from the project site, in accordance with WAC 173-201A-200. Measures will be in place to monitor and respond to water quality exceedances. Based on the best available information, work-related turbidity concentrations would be too low and short-lived to cause more than temporary, non-injurious behavioral effects such as avoidance of the plume and mild gill flaring in any Chinook salmon or steelhead that may be exposed to them. None of these potential responses, individually, or in combination would affect the fitness or meaningfully affect the normal behaviors of exposed fish.

Mobilization of anaerobic sediments can decrease dissolved oxygen levels (Hicks et al., 1991; Morton 1976). The impact on dissolved oxygen is a function of the oxygen demand of the sediments, the amount of material suspended in the water, the duration of suspension, and the water temperature (Lunz and LaSalle 1986; Lunz et al. 1988). Reduced dissolved oxygen can affect salmonid swimming performance (Bjornn and Reiser 1991), as well as cause avoidance of water with low dissolved oxygen levels (Hicks 1999). However, the small amount of sediments that would be mobilized suggests that any dissolved oxygen reductions would be too small and short-lived to cause detectable effects in exposed fish. Additionally, all demolition and construction would be done within the dewatered project area which would reduce the potential for fish exposure to waters with reduced dissolved oxygen levels related to that work.

<u>Long-term Water Quality Diminishment (Stormwater Runoff)</u>

The project increases PGIS, adds capture and treatment of road runoff equal to the new PGIS, adds some capture and treatment for the replaced PGIS, and remediates additional PGIS areas without treatment. Smaller TDAs within Heyho Creek, Westphal Creek, the UNT, and Edgecomb Creek subbasins will not receive treatment due to the minimal increases in PGIS. Much of the replaced PGIS in Heyho and Westphal Creeks will not receive treatment, although some of the replaced PGIS in Heyho Creek will drain to an existing vegetated filtration swale and receive incidental treatment. Downgradient of TDA 16, approximately 0.63 acre of stormwater runoff will collect in a dispersion trench and sheet flow over 20-50 feet of protected riparian area before reaching spawning habitat in Edgecomb Creek. This 20-50 feet of protected riparian area is the same area of riparian permanent impact (0.06 acre), and the remaining width did not meet WDOE's standard for enhanced treatment. Regardless, the dispersion trench and filtration provided by the riparian area will filter some pollutants and toxicants in stormwater. EPA (2023) identifies riparian buffers as effective to reduce stormwater runoff pollution through direct filtration of non-point source pollutants, metals, and other toxicants. Vegetative cover and composition (increased plant diversity) in this riparian area becomes paramount for protecting the adjacent habitat for PS steelhead, as it increases microbial activity in the riparian soil, which makes treatment more effective (Lange, 2015).

Biofiltration swales will be used for treatment of stormwater runoff draining to the UNT reducing the toxicity of the effluent directly to rearing habitat that connects to restoration areas in Edgecomb Creek potentially reducing overall contamination, yet runoff is being concentrated to these areas and that might contribute to a higher point source of potential contamination at the stormwater outlets creating a chronic level of exposure at each bioswale outet.

Water quality improvements are expected overall in the project area as an outcome of the project as compared to the existing baseline condition; out of 10.36 acres of existing PGIS only 0.37 acres of PGIS are currently treated in the existing highway configuration. After the project is constructed a total of 11.72 acres of PGIS will exist in the project corridor with a total of 7.32 acres of PGIS receiving treatment. In summary, there is a net new area of 1.36 acres of PGIS and a net new treatment area of 7.32 acres.

Proposed treatment methods for stormwater runoff include CAVFS, bioswales and vaults that include pre-treatment with a sand filter. CAVFS are effective at treating stormwater by incorporating compost amendment and subsurface gravel courses. CAVFS can filter and remove sediment, phosphorus, and oil (WSDOT HRM 2019). They function by infiltrating surface runoff into the BMP, where sediment is removed and chemical reactions occur to breakdown and bind to contaminants. CAVFS rely on infiltration rates in the existing soil for effectiveness . Bioswales can effectively treat stormwater runoff especially when amended with compost they can remove sediment, phosphorus, and heavy metals (WDOE 2019). Bioswales have varying methods of construction depending upon site conditions, and research is still developing to guide bioswale design application for site conditions (Sujit et. Al 2023).

Stormwater runoff, despite treatment, often contains residual contaminant and stormwater runoff is a major contributing factor to water quality impairments throughout Washington State (EPA 2020). Water quality would be affected by increased turbidity from roadway runoff and also be affected by the introduction of toxic materials from pollution generating impervious surfaces. Exposure to roadway-related degraded water quality is likely to adversely affect PS Chinook salmon and PS steelhead.

Stormwater effects to ESA-listed species will occur during and after each discharge of treated and untreated runoff that will occur throughout the design life of the proposed project. Since the project would treat the stormwater produced by the proposed new PGIS, and a portion of the replaced PGIS, but leave some of the PGIS untreated, it is highly likely that untreated stormwater will enter creeks within the action area, and that contaminants will move downstream, where concentrations will be diluted, but would introduce chronic low levels of contamination from the discharge points into freshwater streams that drain through the Quilceda Creek system to the Ebey Slough. The duration and severity of effects will vary with site and event-specific characteristics, such as average traffic volume in the project area (amount of pollutant to be carried by stormwater), precipitation volume (concentration of pollutant in the stormwater), and the volume of stream flow in Edgecomb Creek and the UNT (rate of dilution of the stormwater). Traffic-related contaminants include PAHs, heavy metals, and a growing list of contaminants, including tire wear particles containing 6PPD-quinone (Peter et al. 2018; Tian et al. 2020).

Pollutant effects

These pollutants will become more concentrated on impervious surfaces until they either degrade in place or are transported by wind, precipitation, or active site management. Stormwater contaminants that accumulate on roadway surfaces are prevalent in higher concentrations in urban creeks during the initial phase (“first flush”) of rain events, but contaminants continue to be present throughout the duration of and immediately following such storms (Peter et al. 2020).

Zinc: A common component of road surface runoff (vehicle emissions, motor oils, lubricants, tires, and fuel oils), several species of zinc are highly mobile in aquatic environments, are often transported many miles downstream, and eventually load to sediments. Zinc interacts with many chemicals and aquatic conditions of reduced pH and dissolved oxygen, low DOC, and elevated temperatures increase zinc toxicity, causing altered patterns of accumulation, metabolism, and toxicity (Eisler 1993; Farag et al. 1998). Many aquatic invertebrates (prey) and some fish may be adversely affected from ingesting zinc-contaminated particulates (Farag et al. 1998). In freshwater fish, excess zinc affects the gill epithelium, which leads to internal tissue hypoxia, reduced immunity, and may acutely include osmoregulatory failure, acidosis, and low oxygen tensions in arterial blood (Eisler 1993). Toxicity of zinc mixtures with other metals is mostly additive; however, toxicity of zinc-copper mixtures is more than additive (or synergistic) for freshwater fish and amphipods (Skidmore 1964; de March 1988).

Copper: Copper from automobiles is one of the most common heavy metals contaminating stormwater, especially stormwater originating from parking lots. Copper is highly toxic to aquatic biota and toxic effects across salmonid species including PS Chinook salmon and PS steelhead trout, which can experience a variety of acute and chronic lethal and sub-lethal effects (Baldwin et al. 2011). Copper bio-accumulates in invertebrates and fish (Feist et al. 2005; Layshock et al. 2021), is redox-active, and interacts with or alters many compounds in mixtures (Gauthier et al. 2015). Copper-PAH mixtures, which synergistically interact are highly toxic through several exacerbating mechanisms: copper weakens cell membranes increasing absorption of PAHs, copper chelates or hastens and preserves the bio-accumulative toxicity of PAHs; and PAHs in turn increase the bio-accumulative and redox properties of Copper (Gauthier et al. 2015). Sub-lethal effects of copper include avoidance at very low concentrations (Hecht et al. 2007) and reduced chemosensory function at slightly higher concentrations, which in turn causes maladaptive behaviors, including inability to avoid copper or to detect chemical alarm signals (McIntyre et al. 2012). Sandahl et al. (2007) demonstrated that copper concentration as low as 2 micrograms/liter can significantly impair the olfactory system of salmonids and hinder their predator avoidance behavior. Thus, any fish that are exposed to stormwater containing high concentrations of copper may experience diminishment of predator avoidance ability and would be at greater risk of predation. Appreciable adverse effects among fishes can be expected with increases as small as 0.6 μg/L above background concentrations (NMFS 2014).

Polycyclic Aromatic Hydrocarbons (PAHs): Petroleum-based contaminants are usually in the form of two or more condensed aromatic carbon rings, include more than 100 different chemicals, and usually occur as complex mixtures in the environment. Major human-related sources released to the environment are from wood stoves, creosote treated wood, and vehicle emissions, plastics including tire wear particles, improper motor oil disposal, leaks, and asphalt sealants (WDOE 2023). PAHs are lipophilic, persistent, interact synergistically with bio-accumulative and redox-active metals and other contaminants, and may disperse long-distances in water (Arkoosh et al. 2011; Gauthier et al. 2014, 2015; WDOE 2023). Metabolites are commonly more toxic than the parent, some are carcinogenic, neurotoxic, and cause genetic damage. Although biotransformation of PAHs causes oxidative stress with subsequent cellular damage and increased energy is required at the cost of growth, many organisms (including salmon) can eliminate at least the lower density PAHs from their bodies as part of metabolism and excretion (Arkoosh et al. 2011). However, plants and some aquatic organisms, such as mussels and lamprey, have limited ability to metabolize or degrade PAHs, which may bioaccumulate over several years (Tian et al. 2019; Nilsen et al. 2015). The environmental fate of each type of PAH depends on its molecular weight. In surface water, PAHs can volatilize, photolyze, oxidize, biodegrade, bind to suspended particles or sediments, or accumulate in aquatic organisms, with bioconcentration factors often in the 10-10,000 range. In sediments, PAHs can biodegrade or accumulate in aquatic organisms or non-living organic matter. Some evaporate into the air from the surface but most do not easily dissolve in water, some evaporate into the air from surface waters, but most stick to solid particles and settle into sediments.

Changes in pH and hardness may increase or decrease the toxicity of PAHs, and the variables of organic decay further complicate their environmental pathway (Santore et al. 2001). Many of the pollutants that may enter the water column due to project activities can cause effects in exposed fish that range from avoidance of an affected area, to reduced growth, altered immune function, and immediate mortality in exposed individuals. The intensity of effects depends largely on the pollutant, its concentration, and/or the duration of exposure (Brette et al. 2014; Feist et al. 2011; Gobel et al. 2007; Incardona et al. 2004, 2005, and 2006; Mcintyre et al. 2012; Meadore et al. 2006; Sandahl et al. 2007; Spromberg et al. 2016). PAHs and metabolites are acutely toxic to salmonids and may cause narcosis at low levels of exposure, can in some cases bioaccumulate through food webs (water, groundwater, soil, and plants; Bravo et al. 2011; Zhang et al. 2017), and can also cause chronic sub-lethal effects to aquatic organisms at very low levels (Neff 1985; Varanasi et al. 1985; Meador et al. 1995). PAHs can affect DNA within the nucleus of cells, cause genetic damage, and are classified as carcinogens (Collier et al. 2014). These ubiquitous pollutants (PAHs) are a source of potent adverse effects to salmon and steelhead, even at ambient levels (Johnson et al. 2007; Loge et al. 2006; Sandahl et al. 2007; Spromberg and Meador 2006).

<u>6PPD-quinone:</u> After years of forensic investigation, the urban runoff coho mortality syndrome has now been directly linked to motor vehicle tires, which deposit the compound 6PPD and its abiotic transformation product 6PPD-q onto roads. 6PPD or [(N-(1, 3-dimethylbutyl)-N'-phenyl-p-phenylenediamine] is used to preserve the elasticity of tires. 6PPD can transform in the presence of ozone (O3) to 6PPD-q. 6PPD-q is ubiquitous to roadways (Sutton et al. 2019) and was identified by Tian et al. (2020) as the primary cause of urban runoff coho mortality syndrome described by Scholz et al. (2011). Laboratory studies have demonstrated that juvenile coho salmon (Chow et al. 2019), juvenile steelhead, and juvenile Chinook salmon are also susceptible to varying degrees of mortality when exposed to urban stormwater (French et al. 2022). Fortunately, recent literature has also shown that mortality can be prevented by infiltrating road runoff through soil media containing organic matter, which removes 6PPD-q and other contaminants (Fardel et al. 2020; Spromberg et al. 2016; McIntyre et al. 2015; McIntyre et al. 2023). Research and corresponding adaptive management surrounding 6PPD is rapidly evolving. Nevertheless, key findings to date include:

- 6PPD/6PPD-q has been killing coho in Puget Sound urban streams for decades, dating back to at least the 1980s, likely longer (McCarthy 2008; Scholz 2011).

- Wild coho populations in Puget Sound are at a very high risk of localized extinction, based on field observations of adult spawner mortality in > 50 spawning reach stream segments (Spromberg 2011).
- Source-sink metapopulation dynamics (mediated by straying) are likely to place a significant drag on the future abundances of wild coho salmon in upland forested watersheds (the last best places for coho conservation in Puget Sound). In other words, urban mortality syndrome experienced in one part of the watershed could lead to abundance reductions in other populations because fewer fish are available to stray (Spromberg 2011)
- Coho are extremely sensitive to 6PPD-q, more so than most other known contaminants in stormwater (Scholz 2011; Chow 2019; Tian 2020).
- Coho juveniles appear to be similarly susceptible to the acutely lethal toxicity of 6PPD/6PPD-q (McIntyre 2015; Lo et al. 2023).
- The onset of mortality is very rapid in coho (i.e., within the duration of a typical runoff event) (French et al. 2022).
- Once coho become symptomatic, they do not recover, even when returned to clean water (Chow 2019).
- It does not appear that dilution will be the solution to 6PPD pollution, as diluting Puget Sound roadway runoff in 95% clean water is not sufficient to protect coho from the mortality syndrome (French et al. 2022).
- Preliminary evidence indicates an uneven vulnerability across other species of Puget Sound salmon and steelhead, and a need to further investigate sublethal toxicity to steelhead and Chinook salmon. For example, McIntyre et al. (2018) indicate that chum do not experience the lethal response to stormwater observed in coho salmon.
- Effects from 6PPD-q on Chinook salmon and steelhead trout are more recently studied by French (2022) who demonstrated that relative to coho salmon, the progressions of symptoms on Chinook salmon and steelhead trout were qualitatively the same, where they exhibited surface swimming and gaping, loss of equilibrium albeit with a delayed onset and longer window for mortality, once exposed to 6PPD-q.
- Following exposure, the onset of mortality is more delayed in steelhead and Chinook salmon (French et al. 2022).
- The mechanisms underlying mortality in salmonids is under investigation, but are likely to involve cardiorespiratory disruption, consistent with symptomology. Recently, Greer (2023) has demonstrated that 6ppd-quinone induces mortality and disrupts vascular permeability pathways in developing coho salmon. Therefore, special consideration should be given to parallel habitat stressors that also affect the salmon gill and heart, and nearly always co-occur with 6PPD such as temperature (as a proxy for climate change impacts at the salmon population-scale) and PAHs.
- Simple and inexpensive green infrastructure mitigation methods are promising in terms of the protections they afford salmon and stream invertebrates, but much more work is needed (McIntyre 2014, 2015, 2016; Spromberg 2016).

Recent evaluations demonstrate that the toxic effect of 6PPD-q does not just occur to adult and juvenile coho salmon, but stormwater runoff is toxic to coho alevins (McIntyre et al. 2023). When coho salmon eggs were exposed intermittently to untreated stormwater runoff, embryo survival in runoff was high (>90%) but 87% of alevins died at hatch. Surviving alevins showed reduced body and eye size when developed. The study represents the importance of evaluating losses over the entire coho salmon life cycle. Bioretention filtration was shown to prevent all mortality and reduce sublethal toxicity.

Biofiltration of roadway runoff prevented acute mortality of coho alevins, similar to studies with older coho juveniles (McIntyre et al., 2015) and adults (Spromberg et al., 2016). This is consistent with bioretention media retaining the majority of applied 6PPD-quinone during stormwater treatment (Rodgers et al., 2023). Bioretention treatment also prevented most induction of the cardiac injury biomarker nppb and all induction of the aromatic hydrocarbon exposure biomarker cyp1a. The lack of response of exposure and cardiac injury biomarkers in filtered water agrees with effective elimination (>93 % reduction) of PAHs by bioretention treatment, similar to previous studies of PAH containing stormwater treated by bioretention (McIntyre et al., 2016a, 2016b). Filtration through bioretention does not prevent all effects for coho embryos; the smaller length and eye area noted for embryos exposed to runoff were only partially prevented by filtering stormwater.

Repeated and chronic exposures, even of very low levels of toxins in stormwater, are still likely to injure or kill individual fish, by themselves and through synergistic interactions with other contaminants already present in the water (Baldwin et al. 2009; Feist et al. 2011; Hicken et al. 2011; Spromberg and Meador 2006; Spromberg and Scholz 2011). Santore et al. (2001) indicates that the presence of natural organic matter and changes in pH and hardness affect the potential for toxicity (both increase and decrease). Additionally, organics (living and dead) can adsorb and absorb other pollutants such as PAHs. The variables of organic decay further complicate the path and cycle of pollutants in the freshwater environment.

We cannot estimate the number of individuals that would experience adverse effects from exposure to stormwater with any meaningful level of accuracy. We cannot predict the number or duration of each pulse of discharge events, nor the number of individual fishes that would be exposed during those events. However, it is very likely given the permanent and episodic nature of stormwater discharges and their ability to travel far downstream, most fish using Heyho Creek, Westphal Creek, Edgecomb Creek and the UNT will be exposed to some level of contamination both as adult fish migrating to upstream natal sites, or as migrating and rearing juveniles. Not all exposed individuals would experience immediate adverse effects, and latent health effects are difficult to discern and document. Moreover, the proposed treatment design does not propose to treat smaller TDAs in Heyho or Westphal Creek, but treat near-equivalent areas that drain to the UNT. Increased pollutants in these watersheds will converge downstream at the mainstem of Quilceda Creek and Middle Fork Quilceda Creek where critical habitat for PS Chinook salmon and PS steelhead trout is located. The riparian buffer next to Edgecomb Creek will be further burdened with filtering stormwater sheet flowing from the new roundabout southeast of 67 Ave NE, where additional temporary and permanent riparian impacts would occur, likely reducing the ability of the riparian area to filter of pollutants from runoff before reaching spawning habitat.

Many stormwater pollutants travel long distances in rivers either in solution, adsorbed to suspended particles, or else they are retained in sediments, particularly clay and silt, which can only be deposited in areas of reduced water velocity, such as behind dams or backwater and off-channel areas, until they are mobilized and transported by future sediment moving flows (Alpers et al. 2000a; Alpers et al. 2000b; Anderson et al. 1996). Wagner et al. (2018) reported that the fate and downstream transport of tire wear particles is dependent upon the density and composition of the mixture. Since tire wear particles are composed of lower density materials (rubber and carbon black) than those in asphalt or other particulate matter suspended in runoff (gravel, plastics, etc.), it is likely that tire wear particles remain in suspension and travel further downstream (Wagner et al. 2018). Further, the main components of tire wear particles are anticipated to resist biodegradation and persist in the environment, potentially contributing toxins over extended periods of time (Wagner et al. 2018). Recent studies indicated that the use of compost-amended bioswales was effective at removing a variety of contaminants from runoff, including PAHs and heavy metals (Fardel et al. 2020; McIntyre et al. 2015). Unlike traditional stormwater collection and conveyance practices, such as storm drain systems with direct outfalls to waterways, vegetated filter strips at the edges of paved surfaces or vegetated swales (i.e., bioswales) can collect and convey stormwater in ways that infiltrate into soils with large amounts of organic matter that bind or otherwise remove contaminants from the stormwater before it reaches a stream (McIntrye et al. 2015).

We expect that every year some individual PS Chinook salmon (juvenile and adult) and PS steelhead (juvenile and adult), would experience sublethal effects such as stress and reduced prey consumption, some may respond with avoidance behaviors that disrupt feeding and migratory behavior, and some experience reduced growth, impairment of essential behaviors related to successful rearing and migration, cellular trauma, physiological trauma, reproductive failure, and mortality. These effects reduce fitness and likelihood of survival among some individuals in all exposed cohorts for the foreseeable future.

Stormwater-related Prey Base Diminishment

Short-term changes to the composition of the macroinvertebrate community abundance and richness within the action area may occur following the roadway improvements and increase in roadway runoff. Increased levels of contaminants from roadway-related runoff will expose prey to pollutants including metals, PAHs, and other toxins (Spromberg et al. 2016) which is expected to diminish the number, size, and species diversity of prey types available to foraging juvenile salmonids. Salmonid prey would be reduced in quantity and quality by and rearing or migrating juvenile salmon and steelhead will be exposed to this reduction. Also, amphipods and copepods can uptake PAHs from contaminated sediments (Landrum and Scavia 1983; Landrum et al. 1984; Neff 1982), and pass them to juvenile Chinook salmon and other small fish through the food web. When juvenile fish encounter areas of diminished prey, competition for those limited resources increases, and less competitive individuals are forced into suboptimal foraging areas (Auer et al. 2020). Further, individuals with an inherently higher metabolism tend to be bolder and competitively dominant, and may outcompete other individuals for resources within a microhabitat, potentially increasing interspecific mortality (Biro and Stamps 2010).

It is uncertain and impossible to predict the amount of contaminated prey that any individual fish may consume, the number of fish that would be undernourished or outcompeted for available prey, nor the intensity of any response that an exposed individual may experience. Based on the best available information, the NMFS expects that over the decades-long life of the repaired roadway, some individual juvenile PS Chinook salmon and juvenile PS steelhead from all future cohorts are likely to be exposed to reduced forage or contaminated forage, with likely effects including some combination of reduced growth, increased susceptibility to infection, and increased mortality. However, due to the latent quality of these effects on individual health, the numbers of juvenile PS Chinook salmon and juvenile PS steelhead annually exposed will be difficult to discern as reductions in abundance and productivity when the cohorts return as adult fish.

2.5.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected PBFs from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely last for weeks, and long-term effects are likely to last for months, years or decades. The proposed action is likely to adversely affect PBFs of PS Chinook salmon and PS steelhead trout over the long term in freshwater portions of the action area two miles downstream of the project footprint due to water quality degradation.

The project construction footprint is not located within designated critical habitat, thus described habitat impacts are outside of the designed critical habitat unit. Stormwater runoff from the constructed project would continue to drain into the UNT, Edgecomb Creek, Westphal Creek, and Heyho Creek and the combined stormwater runoff will discharge into designated critical habitat two miles downstream of the project resulting in long-term degradation of water quality. These streams converge about 2 miles downstream at the confluence with Middle Fork Quilceda Creek where critical habitat is designated for PS Chinook and PS Steelhead. Our effects analysis includes effects of the proposed action on water quality in the critical habitat in Quilceda Creek, and the resulting water quality degradation will extend downstream to marine waters of the Puget Sound.

Water Quality Diminishment

Stormwater runoff is certain to continue to deliver toxic and potentially lethal contaminants from urban and rural areas if left untreated, degrading water quality, a feature of designated critical habitat for all ESA listed species, serving multiple conservation values depending on location (e.g., for salmonids - spawning in upstream reaches; rearing and migration lower in the riverine system; growth and maturation in estuarine and nearshore areas). Exposure to untreated, and to insufficiently treated, stormwater causes adverse effects to ESA-listed salmonids. Similarly, prey communities in fresh and estuarine waters are an additional feature of designated critical habitat that can be impaired by stormwater; prey communities exposed to the various contaminants in stormwater may be reduced in quantity, composition, and in quality if they accumulate toxins. This creates a second, indirect pathway of exposure among ESA-listed species.

Stormwater runoff is a major contributing factor to water quality impairments throughout Washington State (EPA 2020). Impervious surfaces, such as roads and parking lots, alter the natural infiltration of vegetation and soil, and accumulate many diverse pollutants. During heavy rainfall or snowmelt events, accumulated pollutants are mobilized and transported in runoff from roads and other impervious surfaces. Individual stormwater outfalls ultimately discharge to streams, rivers, lakes, and marine waters. In chemical terms, runoff from roadways, parking lots, and other hardscaped elements of the transportation grid represents an extraordinarily complex mixture, consisting of thousands of distinct compounds, the vast majority of which have not been identified or characterized in terms of adverse environmental effects (Du et al. 2017, Peter et al. 2018).

The incremental addition of small amounts of these pollutants over time are a source of adverse effects on critical habitat, and to salmon and steelhead that utilize those critical habitats. Adverse effects occur even when the source load cannot be distinguished from ambient levels because many pollutants bioaccumulate in the tissues of aquatic organisms and in benthic sediments. Contaminants accumulate in both the tissues and prey of salmon and steelhead and can cause a variety of lethal and sublethal effects (Hecht et al. 2007). Repeated and chronic exposures, even at very low levels, are likely to injure or kill individual fish, by themselves and through synergistic interactions with other contaminants already present in the water (Baldwin et al. 2009; Feist et al. 2011; Hicken et al. 2011; Spromberg and Meador 2006; Spromberg and Scholz 2011).

The proposed action intends to capture and treat stormwater runoff prior to discharge into Puget Sound. The proponent would use two biofiltration swales, compost amended vegetated filter strips, and detention vaults for treatment. Despite water quality standards and treatment, environmental monitoring has documented pollution-driven degradation in nearly all aquatic habitats (freshwater, estuarine, and marine) for NOAA trust resources, including those presently listed for protection under the ESA. The agency must consider potential direct and indirect (and/or delayed in time) impacts of toxics on species and their habitats, including critical habitat (under the ESA) and essential fish habitat (under the MSA, considered in Section 3 of this document). The physical, biological, and chemical dimensions of habitat quality, including aquatic food webs, encompass the abundance and productivity of freshwater macroinvertebrates (as prey for juvenile salmon),

Recent research by NMFS' science team (Northwest Fisheries Science Center, Ecotoxicology and Environmental Chemistry Programs) has shown that untreated stormwater is highly toxic to aquatic species, including Pacific salmon. Conversely, parallel studies have shown that clean water/green infrastructure treatment methods can remove pollutants from stormwater. We expect that despite treatment to be performed in constructed stormwater treatment facilities, the effluent will still contain some contaminants, such as PAHs and 6PPD/6PPD-quinone (6PPD-q). Water quality will improve, but discharges will still adversely affect water quality due to uncaptured contaminants. Stormwater may also include an array of contaminants depending on the surrounding land use and proximity to industrial facilities (Table 6).

Stormwater can discharge at any time of year. However, first-flush rain events after long dry periods typically occur in September in western Washington. As with stormwater runoff globally, the leading edge of hydrographs (the first flush) in Puget Sound have proportionally higher contractions of contaminants, including those long known to resource managers (as evidenced by existing aquatic life criteria under the Clean Water Act), as well as many chemicals of emerging concern, so-called because they were largely unknown a decade ago (Peter et al. 2020). Higher concentrations of pollutants occur less frequently between March and October as longer dry periods exist between storm events. In western Washington, most stormwater discharge occurs between October and March, when the region receives the most rain.

Stormwater negatively impacts critical habitat of the ESA listed fishes and SRKW by degrading water quality, (water quality is also a feature of essential fish habitat, see the EFH analysis presented in section 3 of this document). Contaminants in stormwater can be transported far downstream to estuaries and the ocean dissolved in surface waters, attached to suspended sediments, or via aquatic food webs (e.g., bioaccumulation). Aquatic organisms including ESA-listed fish and marine mammals may take up contaminants from their surrounding environments by direct contact with water and sediments, or ingestion of contaminated plankton, invertebrates, detritus, or sediment, indicating that prey and substrate are also adversely affected features of critical habitat.

We anticipate water quality to be degraded by the discharge of stormwater effluent from the proposed project location. Although the project would provide treatment, significantly reducing toxins in stormwater effluent, we expect some degradation of the water quality PBF of critical habitat for PS Chinook salmon and steelhead trout. However, given that discharges from project area PGIS would contain less contaminant within the effluent than is currently discharged due to treatment of existing PGIS, we believe that water quality, sediment quality, and prey communities would continue to support the conservation role for each of the designated species.

2.6. Cumulative Effects

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

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

The project includes a widening of the existing highway along the SR 531 corridor within an area zoned for Industrial development known as the Cascade Industrial Complex (Figure 4). The project will expand the highway capacity to address existing congestion and respond to this planned growth, with additional capacity that will extend the life of the highway in the project area. City of Arlington website shows the corridor plans for the widening of SR 531 (2023) and WSDOT has a corridor plan for the project area (2019).

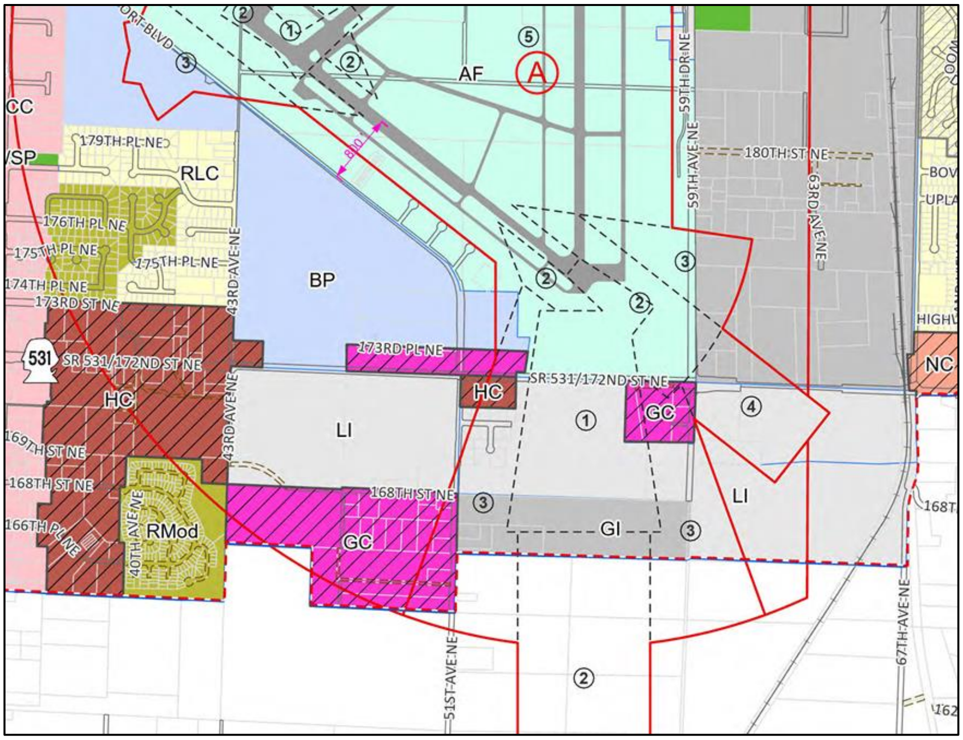

Figure 4. Zoning in the project corridor

The SR 531 project is paving access points in the highway corridor to extend the life of the access points for motor vehicles to existing developed land and agricultural land. WSDOT is also likely to issue access permits for future businesses and Industrial developments in the SR 531 corridor. The project proposes to pave five existing access points to existing businesses in the project corridor, extending the life of the business access. Undeveloped land in the action area includes two agricultural fields measuring a total of approximately 38 acres on the south side of SR 531 between 51 Ave NE and 59 Ave NE (Figure 5).

The SR 531 widening project will pave the access point between these two roads, which connects via a planned roadway network to 51 Ave NE. These two agricultural fields are not located in wetlands or streams and will be private developments; thus, they would not have a federal nexus. It is estimated that final build outs of these areas would result in approximately 85% of new PGIS across these areas totaling approximately 32 acres, as measured on google earth. Stormwater treatment would be required by the cities of Arlington or Marysville for these developments, and NMFS concludes that similar treatment methods and outcomes would be required for these developments. If treated with biofiltration, acute mortality to adult, juvenile and alevin stages of salmonids would be significantly reduced. If areas of new PGIS remain untreated, acute mortality of salmonids at all life stages will be more impacted. The developed land and treated stormwater runoff would drain to Westphal Creek.

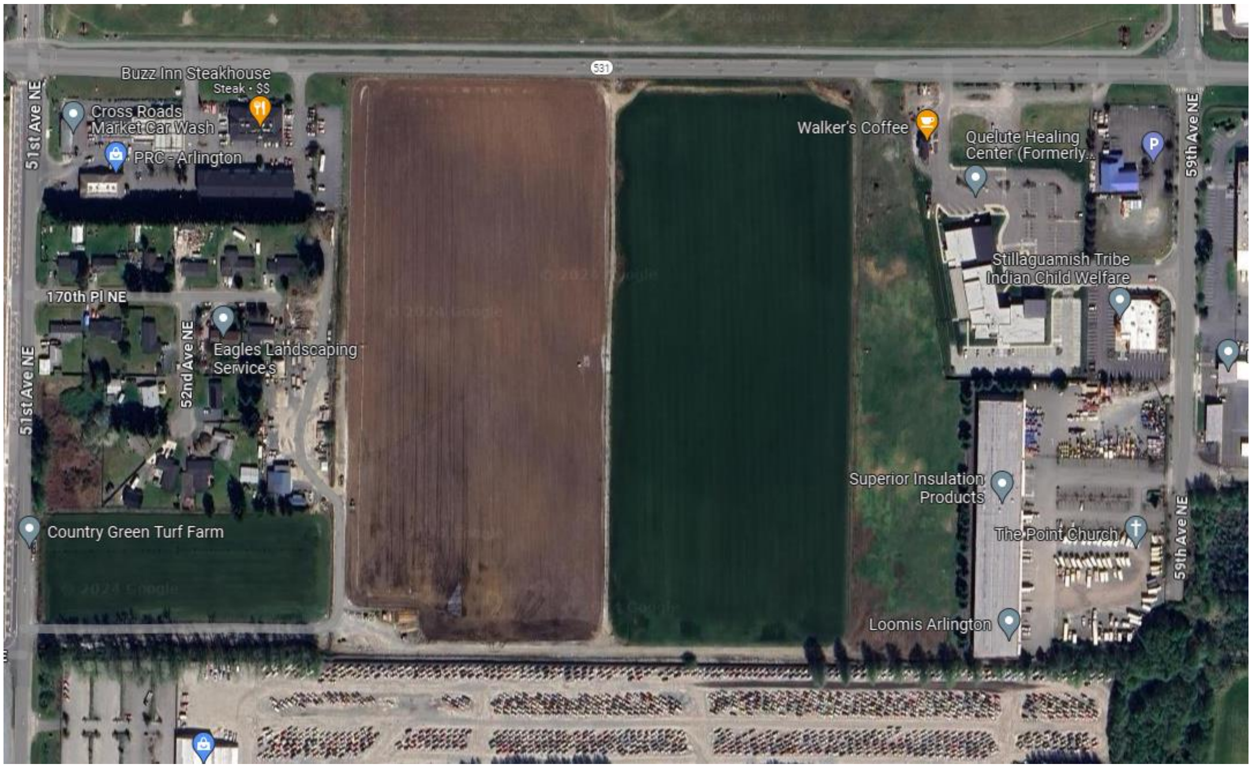

Figure 5. Proposed paved access to undeveloped land and existing roadway network in the project corridor.

2.7. Integration and Synthesis

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

Overall, PGIS in the TDAs that discharge to the UNT and Edgecomb Creek will be increased by 1.068 acres, while stormwater treatment increases from 0.372 acres to 7.32 acres.
The project approaches stormwater with an "in lieu approach" meaning areas of the existing highway will be treated in lieu of treating some of the new PGIS footprint and approximately 4.40 net acres of PGIS will be left without treatment. Subbasins draining to Westphal Creek, Heyho Creek, and Edgecomb Creek have smaller area TDAs with no proposed treatment. Therefore, untreated stormwater contaminants will be released into the system from the project. The project will provide paved access to undeveloped land within an area zoned and planned for industrial development, thus causing increased PGIS stormwater runoff and capture in the related are identified for cumulative effects.

The status of each ESA species considered in this opinion is threatened. The status of all species is based in low abundance relative to historic numbers, with reduced productivity, spatial structure, and diversity. This depressed condition is a function of many factors, including reductions in the amount or quality of habitat throughout their range, and overharvest in previous years. Baseline conditions in the action area, which were described earlier in this document reflect habitat degradation typical of freshwater environments in the Puget Sound. To this status, we add the effects of the proposed action.

Some of the effects of the proposed action are spatially very constrained including minor bank modifications for stormwater outfalls, sediment and turbidity, and riparian impacts that will have (bank modifications for stormwater outfalls and the area of increased suspended sediment) with very limited effect on PS steelhead. These effects would not impact Chinook salmon due to their relative absence from the UNT and Edgecomb Creek next to the project corridor. The exception is the discharge of effluent stormwater runoff from the new and replaced PGIS surfaces proposed in the project corridor. The proposed action's discharge would create a chronic area of exposure for PS steelhead trout in the vicinity of the outfalls. Downstream effects would combine with other toxins currently in the system, adding to the bioaccumulation of pollution loadings into the freshwater streams in Quilceda Creek for both PS steelhead and Chinook salmon all the way downstream to marine waters of Ebey Slough, part of the Snohomish River estuary of the Puget Sound.

Contaminants in this discharge are likely to produce a range of adverse health effects – both acute and latent, particularly among juvenile steelhead trout, because they are more likely to be present at the base of the outfall, because the habitat is primarily used by rearing steelhead trout. However, it remains important to note that the discharges are of treated stormwater runoff the purpose of which is to capture and improve the treatment of currently untreated stormwater and reduce contaminants prior to discharge. For this reason, we expect harm or death associated with the proposed action to occur at a lower rate than at the baseline (pre-project) level.

In future industrial areas expected to be developed in the action area, as identified in Section 2.6 (Cumulative Effects), additional stormwater runoff will be created but treatment will be required. The quality and quantity of this treatment will determine the consequences of additional effects to salmon. Given the amount of space provided to industry and pre-planning efforts to cite development facilities, biofiltration is expected to be the preferred option for stormwater treatment in these areas. We expect that harm or death from treated stormwater runoff may occur at a slightly higher rate compared to baseline, as industrial development occurs on agricultural lands.

2.7.1 ESA Listed Species

PS Chinook salmon and PS steelhead trout are both listed as threatened, based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and an array of limiting factors in habitats. All Puget Sound Chinook salmon populations continue to remain well below the TRT planning ranges for recovery escapement levels. Most populations also remain consistently below the spawner–recruit levels identified by the TRT as necessary for recovery. Across the ESU, most populations have increased somewhat in abundance since the last status review in 2016, but have small negative trends over the past 15 years (Ford, 2022).

The viability of the PS steelhead DPS has improved somewhat since the PSTRT concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 DIPs (Hard et al. 2015). Improvements in abundance were not as widely observed in the Northern Cascades MPG. Foremost among the declines were summer- and winter-run populations in the Snohomish River basin (Ford 2022).

To this context we add the project effects, which will affect individuals from two populations of PS Chinook Salmon and one population of PS steelhead. All three populations are performing poorly with a 29% decline in natural spawners of steelhead in the 2015-2019 reporting period and less than 1% increase in the two Chinook populations in the same period (see Figure 91 in Ford 2022).

Both species will be affected over time by cumulative effects, some positive, as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative, such as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that habitat trends are negative, the effects on viability parameters of each species are also likely to be negative. In this context we consider how the proposed action’s impacts on individuals would affect the listed species at the population and ESU/DPS scales.

Project effects include possible death, injury, and sublethal responses in a small number of fishes from construction work in one cohort of PS steelhead populations, and among many individuals of all foreseeable future cohorts of PS Chinook salmon and PS steelhead from chronic exposure to degraded water quality (stormwater contaminants), including latent health effects decreasing fitness and survival.

The annual number of adults and juveniles of PS steelhead trout and PS Chinook salmon that are likely to be injured or killed by action-related stressors is unknown. However, the fraction of any annual cohort affected by latent health effects (reduced fitness) is not documentable as an effect on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) because of the delayed nature of its consequences (death, failure in homing, reproductive failure).

When we consider cumulative effects associated with increasing human population growth and resource demands (including increasing urban and industrial runoff) and climate change effects that will overlap with the project effects over coming decades, population declines are likely, though it will be impossible to attribute any portion of the decline directly to the proposed action.

2.7.2 Critical Habitat

Critical habitat was designated for Chinook salmon to ensure that specific areas with PBFs that are essential to the conservation of that listed species are appropriately managed or protected. The critical habitat for Chinook salmon will be affected over time by cumulative effects, some positive – as restoration efforts and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that trends are negative, the effects on the PBFs of critical habitat for Chinook salmon are also likely to be negative. In this context we consider how the proposed action's impacts on the attributes of the action area's PBFs would affect the designated critical habitat's ability to support the conservation of PS Chinook salmon as a whole.

Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. Hydropower and water management activities have reduced or eliminated access to significant portions of historic spawning habitat. Timber harvests, agriculture, industry, urbanization, and shoreline development have adversely altered floodplain and stream morphology in many watersheds, diminished the availability and quality of estuarine and nearshore marine habitats, and reduced water quality across the region.

Global climate change is expected to increase in-stream water temperatures and alter stream flows, possibly exacerbating impacts on baseline conditions in freshwater habitats across the region. Rising sea levels are expected to increase coastal erosion and alter the composition of nearshore habitats, which could further reduce the availability and quality of estuarine habitats. Increased ocean acidification may also reduce the quality of estuarine habitats.

In the future, non-federal land and water use practices and climate change are likely to increase. The intensity of those influences on salmonid critical habitat is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, by the implementation of non-federal plans that are intended to benefit salmonids, and by efforts to address the effects of climate change.

The PBFs of salmonid critical habitat that would be affected by the proposed action are freshwater spawning sites, rearing sites, and migration corridors free of obstruction and excessive predation. As described above, the proposed action would cause short term low level adverse effects on water quality, substrate, forage, natural cover, and obstruction to habitat during construction and long term chronic low-level degradation of water quality degrading rearing and migration habitats.

Based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, habitat degradation will reduce the potential for the habitat to support recovery, but the project effects themselves would be too small to attribute in that reduction. Therefore, the overall effect of the project on critical habitat, while adverse, and chronic, cannot be considered to reduce the conservation role of migration and rearing in the action area, nor reduce conservation potential for critical habitat overall.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon and PS steelhead trout, and will not destroy or adversely modify their designated critical habitats.

2.9. Incidental Take Statement

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

2.9.1 Amount or Extent of Take

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

Harm of PS Chinook salmon from exposure to:

- Long-term water quality reductions from stormwater runoff (adults and juveniles)
- Long-term prey reductions from stormwater runoff (adults and juveniles)

Harm of PS steelhead from exposure to:

- Short-term construction-related harm from fish exclusion and salvage (juveniles)
- Short-term construction-related harm from benthic disturbance, turbidity, and migratory delay (juveniles)
- Long-term water quality reduction and prey reductions from stormwater runoff (adults and juveniles)
- Long-term harm from reduced prey, cover, and habitat availability from riparian impacts and streambank hardening (adults and juveniles)
- Long-term harm from increased predation as a result of lighting next to UNT and Edgecomb Creek (adults and juveniles)

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

The USACE and WSDOT shall:

1. Minimize the incidental take of PS steelhead associated with construction effects.

2. Minimize incidental take of PS Chinook salmon and PS steelhead associated with operational effects from stormwater.

3. Ensure participation in a monitoring and reporting program as required by WDOE's Stormwater Action Monitoring (SAM), which monitors stormwater pollutants. Participation enables USACE and WSDOT to confirm this opinion is meeting its objective to limit the extent of take from permitted activities.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The USACE or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:
    a) Perform fish exclusion (capture and handling) in accordance with WSDOT Fish Exclusion Protocols (2021). Ensure that herding, dip netting, seining, and all other means of manual capture are used prior to electrofishing.
    b) Use silt fence as a BMP next to the riparian zone of Edgecomb Creek to prevent construction stormwater from entering potential spawning habitat for PS steelhead.
    c) Replant all riparian vegetation with native woody and herbaceous species to fully recover riparian functions in the UNT and Edgecomb Creek. Increase vegetation density in the buffer of Edgecomb Creek where stormwater will discharge south from SR 531 and where lighting will be installed. Improvements shall include increased species density and species richness of native woody trees and shrubs to filter light as well as native forbs and grasses in the understory to improve buffer functions to filter runoff.

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

    a) Ensure the project does not exceed the design specifications and creates no more than 10.91 acres of new and replaced PGIS.
    b) Construct and maintain stormwater treatment facilities to maximize the removal of stormwater pollutants (WSDOT, FHWA 2000).

c) Plant woody species to shade any proposed bioswale outfall locations to reduce solarization of outflow and reduce potential conversion of 6ppd to 6ppd-q.
d) Participate in WDOE's Stormwater Action Monitoring Program (SAM).
e) Use monitoring results from SAM to inform BMP effectiveness in the project area and inform the need for a future stormwater retrofit, as necessary.

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

a) Use the results from SAM to inform BMP performance of the two compost amended biofiltration swales that will drain to the UNT and their ability to remove stormwater contaminants, including 6ppd-q. A site from the SAM program with similar bioswale construction (continuous inflow, compost amended, and/or underdrain, etc.) and similar site constraints as the project shall be used to compare BMP effectiveness. Site constraints (for a comparable SAM site) should include a high water table as a natural condition, soils not conducive to infiltration, and limited space for treatment options. A comparable site should be located in an area with increasing industrial development.
b) If SAM results show that BMP effectiveness is not meeting WDOE's goals for removal of stormwater pollutants, use the data to inform a future retrofit for stormwater treatment in the project location. WSDOT currently submits annual stormwater monitoring reports to NMFS and USFWS as part of its programmatic stormwater monitoring agreement with the Services. WSDOT stormwater monitoring reports (WSDOT 2023) and SAM monitoring reports (WDOE 2024) are available online.

We require implementation of item b) to further research of BMP effectiveness in preventing discharge of pollutants including 6ppd-q when biofiltration swales are installed in areas with a high water table, limited space for treatment BMPs, and are located within an area of increasing industrial development.

2.10. Conservation Recommendations

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

1. Size the stormwater treatment system to accommodate and treat runoff from the total area of existing, new, and replaced roadway and any other existing PGIS that would deliver runoff to the system.

2.11. Reinitiation of Consultation

This concludes formal consultation for SR 531-43rd Avenue NE to 67th Ave NE Widening and Fish Passage project.

Under 50 CFR 402.16(a): “Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action.”

2.12. “Not Likely to Adversely Affect” Determinations

This assessment was prepared pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402 and agency guidance for preparation of letters of concurrence.

Southern resident killer whale (SRKW) was listed as Endangered under the ESA on November 11, 2005 (NMFS 2022). The SRKW DPS is composed of a single population that ranges as far south as central California and as far north as southeast Alaska. While some of the downlisting and delisting criteria have been met, the biological downlisting and delisting 63 criteria, including sustained growth over 14 and 28 years, respectively, have not been met. The SRKW DPS has not grown; the overall status of the population is not consistent with a healthy, recovered population. Considering the status and continuing threats, the SRKWs remain in danger of extinction. Threats to extinction include:

- Quantity and quality of prey
- Exposure to toxic chemicals
- Disturbance from sound and vessels
- Risk from oil spills

Critical habitat for SRKW was designated on August 2, 2021 in the Federal Register (86 FR 41668) (NMFS 2021). Critical habitat includes approximately 2,560 square miles of marine inland waters of Washington: 1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; 2) Puget Sound; and 3) the Strait of Juan de Fuca. Six additional areas include 15,910 square miles. of marine waters between the 20-feet (ft) (6.1-meter (m)) depth contour and the 656.2-ft (200-m) depth contour from the U.S. international border with Canada south to Point Sur, California. We have excluded the Quinault Range Site. Based on the natural history of the Southern Residents and their habitat needs, NMFS identified three PCEs, or physical or biological features, essential for the conservation of Southern Residents: 1) Water quality to support growth and development; 2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and 3) passage conditions to allow for migration, resting, and foraging.

Water quality in Puget Sound, in general, is degraded. Some pollutants in Puget Sound persist and build up in marine organisms including Southern Residents and their prey resources, despite bans in the 1970s of some harmful substances and cleanup efforts. The primary concern for direct effects on whales from water quality is oil spills, although oil spills can also have longlasting impacts on other habitat features In regards to passage, human activities can interfere with movements of the whales and impact their passage. In particular, vessels may present obstacles to whales' passage, causing the whales to swim further and change direction more often, which can increase energy expenditure for whales and impacts foraging behavior. Reduced prey abundance, particularly Chinook salmon, is also a concern for critical habitat.

As described below, the NMFS has concluded that the proposed action is not likely to adversely affect adversely affect SRKW and their designated critical habitat. Detailed information about the biology, habitat, and conservation status and trends of SRKW can be found in the listing regulations and critical habitat designations published in the Federal Register, as well as in the recovery plans and other sources at: https://www.fisheries.noaa.gov/species-directory/threatened-endangered, and are incorporated here by reference.

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. The effects analysis in this section relies heavily on the descriptions of the proposed action and project site conditions discussed in Sections 1.3 and 2.4, and on the effect analyses presented in Section 2.5.

Species

SRKWs are limited to marine water habitats, and may be directly exposed to any construction-related or stormwater effects that drain to marine waters, yet contaminant concentrations would be extremely diluted once they reach the marine environment of the Snohomish River estuary. Direct exposure of SRKW to stormwater is expected to be insignificant because of this dilution, and while SRKWs enter locations in close proximity to the action area where the Snohomish River enters Puget Sound, their duration of presence is unlikely to create prolonged or intense exposure. SRKW could be exposed indirectly through the trophic web, since contaminants have an adverse effect on Chinook salmon. Effects would be highly unlikely to affect the availability of prey for SRKW, because the likelihood that the small number of adults and juveniles affected by the project would be available as SRKW forage is exceedingly low.

As described in Section 2.1, the PS Chinook salmon populations that would be affected by the proposed action are very small. Further, as described in Section 2.5, the proposed action would annually affect too few individuals to cause detectable population-level effects on the affected Chinook salmon populations. Therefore, any project-related reduction in Chinook salmon availability for SRKWs would be undetectable and immeasurable. Although some salmonids could be exposed to adverse effects from fish salvage activities, Chinook salmon are not documented in the UNT or in Edgecomb Creek and are unlikely to be harmed by such activities during the in-water work window. Such adverse effects to Chinook salmon including reduced forage would affect only one cohort, and would be insufficient to impair the abundance of adult fish which SRKWs prey upon.

In summary, effects from stormwater contaminants draining downstream, individual levels of harm from fish handling, as well as the total numbers of annually exposed individuals would be too low to cause any detectable trophic link between the effects of the action and SRKW. Therefore, the action's effects on SRKWs is expected to be insignificant.

Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected PBFs from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely to last for weeks, and long-term effects are likely to last for months, years or decades.

SRKW Critical Habitat: Designated critical habitat for SRKW includes marine waters of the Puget Sound that are at least 20 feet deep. The expected effects on SRKW critical habitat from completion of the proposed action, including full application of the conservation measures and BMP, would be limited to the impacts on the PBFs as described below.

1. Water quality to support growth and development: Long-term effects on water quality downstream of the project would be diluted once they reach Puget Sound, thus effects to critical habitat would be insignificant. Project-related turbidity will not travel downstream as far as the Puget Sound; thus, this feature will not affect critical habitat.
2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth: The proposed action would cause long-term, but insignificant effects on prey availability and quality. Action-related impacts would annually injure or kill extremely low numbers of individual adult and juvenile Chinook salmon (primary prey). However, their numbers and levels of contamination would be too small to cause detectable effects on prey availability, or to create any detectable trophic link between project-related contaminants and SRKWs. Therefore, it would result in an insignificant reduction in prey quality and availability for SRKW critical habitat.
3. Passage conditions to allow for migration, resting, and foraging: The project is located several miles upstream of mapped critical habitat. There will be no structures or facilities installed where SRKW occur. Therefore, no effects will occur to passage conditions for SRKW critical habitat.

As described above, all potential effects are discountable, insignificant, or entirely beneficial; therefore, the project is not likely to adversely affect SRKW or their designated critical habitat.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the USACE and descriptions of EFH for Pacific Coast salmon (PFMC 2014); and highly migratory species (HMS) (PFMC 2007)] contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The project site is located in city of Arlington and south of the SR 531 corridor is city of Marysville within the action area (Figure 1). Four sub-basins cross the project corridor, which all converge at Quilceda Creek downstream from the project area within the Quilceda watershed. Heyho and Westphal Creeks do not directly cross the project corridor so runoff has an indirect connection (overland flow of runoff to surface water in ditches) to EFH habitats in these creeks downstream of SR 531. The waters and substrate of the UNT and Edgecomb Creek are located within the project action area and are designated as freshwater EFH for various life-history stages of Pacific Coast Salmon, which include Chinook salmon and coho salmon in the Quilceda watershed. Edgecomb Creek supports spawning and rearing habitat for coho salmon and connects with habitat for Chinook salmon spawning documented two miles downstream at its confluence with Middle Fork Quilceda Creek and Quilceda Creek. Heyho Creek and Westphal Creeks are more commonly populated with coho salmon; and Chinook salmon straying into these systems is uncommon.

Due to trophic links between PS Chinook salmon and SRKW, the project’s action area also overlaps with marine waters that have been designated, under the MSA, as EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. However, the action would cause no detectable effects on any components of marine EFH. Therefore, the action’s effects on EFH would be limited to impacts on freshwater EFH for Pacific Coast Salmon, and it would not adversely affect marine EFH for Pacific Coast Salmon, or EFH for Pacific Coast groundfish and coastal pelagic species.

Freshwater EFH for Pacific salmon is identified and described in Appendix A to the Pacific Coast salmon fishery management plan, and consists of four major components: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat. The action area provides migration corridors, juvenile rearing and spawning habitat for coho salmon and Chinook salmon.

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

As part of Pacific Coast Salmon EFH, five Habitat Areas of Particular Concern (HAPCs) have been defined: 1) complex channels and floodplain habitats; 2) thermal refugia; 3) spawning habitat; 4) estuaries; and 5) marine and estuarine submerged aquatic vegetation. The action area provides complex channels and floodplain habitats; thermal refugia; and spawning for PS coho salmon in Edgecomb Creek, which is an important HAPC habitat feature. The action area provides downstream habitats including complex channels and floodplain habitats, thermal refugia, and spawning habitat for coho salmon and Chinook salmon in the mainstem of Middle Fork Quilceda Creek, Quilceda Creek, and its tributaries.

3.2. Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the proposed action and its adverse effects on ESA-listed species and critical habitat, and is relevant to the effects on EFH for Pacific Coast Salmon. Based on the analysis of effects presented in Section 2.5 the proposed action will cause minor short- and long-term adverse effects on EFH for Pacific Coast Salmon as summarized below.

1. Water quality: – The proposed action would cause short- and long-term incremental adverse effects on this attribute. Over the life of the improved roadway, treated and untreated stormwater would discharge residual levels of petroleum-based pollutants, metals, and other contaminants into Heyho, Westphal, the UNT, and Edgecomb Creeks. Construction to replace the culvert on the UNT would disturb stream sediment and riparian vegetation, creating temporary turbidity plumes within 100 feet downstream in the action area. The action would cause no measurable changes in water temperature or salinity. Untreated stormwater will be discharged to a dispersion trench to filter through the riparian area next to Edgecomb Creek, which is expected to remove some, but not all of stormwater contaminants to spawning habitat for coho salmon.

2. Water quantity, depth, and velocity: No changes expected.

3. Riparian-stream-marine energy exchanges: No changes expected.

4. Channel gradient and stability: No changes expected.

5. Prey availability: The proposed action would cause short- and long-term low level but chronic adverse effects on this attribute. Over the life of the repaired roadway, untreated stormwater would provide a persistent source of contaminants that could be taken up by benthic invertebrates that are forage resources for juvenile Chinook salmon and coho salmon. Prey communities exposed to the various contaminants in stormwater may be

reduced in quantity, composition and quality if they accumulate toxins. Benthic invertebrates would also be displaced or killed during demolition of old and construction of new culvert.

6. Cover and habitat complexity: The proposed action would cause short and long-term minor adverse effects on this attribute. Construction would cause temporary and permanent impacts to riparian habitats next to the UNT and Edgecomb Creek. Temporary impacts are expected to recover or improve riparian functions in these areas within three years (80% survival). Permanent impact areas will no longer function, thus recovering functions for salmonids by improving vegetation in the buffer of the UNT and next to Edgecomb Creek will be the most important step to providing a functional lift for existing buffer areas to recover what functions were lost in the permanent impact areas.
7. Space: No changes expected.

8. Habitat connectivity from headwaters to the ocean: The proposed action would cause short-term adverse and long-term beneficial effects on this attribute. During stream realignment and dewatering, habitat connectivity may be reduced, temporarily blocking fish access to upstream habitats in the UNT. However, the replacement of the undersized and ineffective culvert would increase connectivity of upstream and downstream freshwater spawning and rearing habitats.

9. Groundwater-stream interactions: No changes expected.

10. Connectivity with terrestrial ecosystems: No changes expected.

11. Substrate composition: No changes expected.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

To reduce adverse impacts from construction-related effects and roadway stormwater, the USACE and WSDOT shall:

1. Perform fish exclusion (capture and handling) in accordance with WSDOT Fish Exclusion Protocols (2021). According to those guidelines, ensure that herding, dip netting, seining, and all other means of manual capture are used prior to electrofishing.
2. Use silt fence as a preferred BMP within the buffers of the UNT and Edgecomb Creek to protect intact riparian areas.
3. Plant woody species to shade any proposed bioswale outfall locations to reduce solarization of outfalls and reduce potential presence of 6ppd conversion to 6ppd-quinone.
4. Replant all riparian vegetation with native woody and herbaceous species to fully recover riparian functions in the UNT and Edgecomb Creek. Increase vegetation density in the buffer of Edgecomb Creek where stormwater will discharge south from SR 531 and were

lighting will be installed. Improvements shall include increased species density and species richness of native woody trees and shrubs to filter light as well as native forbs and grasses in the understory to improve buffer functions to filter runoff.

5. Participate in stormwater monitoring (SAM) program with WDOE to glean results from stormwater treatment provided by biofiltration swales and their ability to remove contaminants including 6ppd-q. Use a comparable site from the SAM program or nominate the biofiltration swales within the project site to WDOE for monitoring. A comparable site should include one where the treatment location has a high water table, limited treatment areas, and increasing industrial development. A comparable site should measure BMP effectiveness for biofiltration swales of similar construction type to filter stormwater runoff from associated contaminants, including 6ppd-q. If monitoring results indicate that stormwater pollutant discharges from biofiltration swales do not meet WDOE requirements, then use the results to inform the need for a future stormwater retrofit in the project area.

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

3.4. Statutory Response Requirement

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

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

3.5. Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the USACE. Other interested users could include the WSDOT (applicant), Washington Department of Fish and Wildlife, City of Arlington, City of Marysville, Snohomish County, and Native American Tribes. Individual copies of this opinion were provided to the USACE and WSDOT. The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

5. REFERENCES

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