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 Consultation No.:
WCRO-2019-03505

March 24, 2020

Amy Changchien
Director, Office of Planning and Program Development
U.S. Department of Transportation
Federal Transit Administration
915 Second Avenue, Suite 3142
Seattle, Washington 98174-1002

Re: Reinitiation of Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Sound Transit Downtown Redmond Link Extension, King County, Washington, (171100120400 6th Field HUC Lake Washington-Sammamish River)

Dear Ms. Changchien:

Thank you for your electronic request of November 21, 2019, requesting re-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 Sound Transit Downtown Redmond Link Extension Project. In the enclosed biological opinion, NMFS concludes that the proposed actions are not likely to jeopardize the continued existence of Puget Sound Chinook salmon. In Section 2.12 of the biological opinion, we concur with your conclusion that the proposed action is not likely to adversely affect Puget Sound steelhead.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1855(b)) for this action. This document also contains the results of the MSA Essential Fish Habitat (EFH) consultation. The Federal Transit Administration (FTA) determined that the project will adversely affect Pacific salmon EFH. NMFS concurs with that determination and is, therefore, providing conservation recommendations pursuant to the MSA (Section 305(b)(4)(A)). The FTA must respond to those recommendations within 30 days (MSA Section 305(b)(4)(B)).

Please contact Jennifer Quan at 360-753-6054 or by e-mail at Jennifer.Quan@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: Mark Assam, FTA
Ellie Ziegler, Sound Transit
Lauren Swift, Sound Transit
George Ritchotte, Herrera, Inc.

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

Sound Transit Downtown Redmond Link Extension Project

NMFS Consultation Number: WCRO-2019-03505

Action: Federal Transit Administration

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 Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	No	No
Puget Sound steelhead (*O. mykiss*)	Threatened	No	No	No	No

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: March 24, 2020

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1. INTRODUCTION

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

1.1 Background

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

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

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

Sound Transit proposes to extend the East Link Light Rail Project into downtown Redmond. The Central Puget Sound Regional Transit Authority (Sound Transit) will carry out the project. The Federal Transit Administration (FTA) is the lead federal agency and will fund the project. The U.S. Army Corps of Engineers (COE) will issue a permit under Section 404 of the Clean Water Act.

1.2 Consultation History

On November 12, 2010, the FTA submitted a biological assessment (BA) to NMFS for the East Link Light Rail construction between Seattle and Redmond and requested consultations under both ESA and MSA. On December 7, 2010, NMFS issued a concurrence letter for the determination that actions "may affect but are unlikely to adversely affect" listed Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) and Puget Sound steelhead (*O. mykiss*), and Puget Sound Chinook salmon critical habitat (NMFS Tracking No. NWR-2010-05547).

Since the concurrence letter was issued, Sound Transit proposed extending the East Link Light Rail Project into downtown Redmond. The Downton Redmond Link Extension will add 3.4 miles of light rail and two new light rail stations from the interim terminus of the Redmond Technology Center Station (formerly called the Overlake Transit Center Station) to downtown Redmond and will involve in-water work in Bear Creek and the Sammamish River, which was not accounted for in the initial consultation.

The FTA requested reinitiation of the consultation on January 31, 2018. NMFS submitted a request for additional information on February 2, 2018, and received additional information between February 2 and February 19, 2018. Upon receiving the additional information, NMFS initiated formal consultation on February 20, 2018, under tracking number WCR-2018-8825. NMFS's consultation included a concurrence with FTA's "not likely to adversely affect" determination for Puget Sound steelhead, presented in Section 2.12 of this document.

During a teleconference on April 24, 2019, Bonnie Shorin of NMFS advised Ellie Ziegler of Sound Transit and Mark Assam of FTA that additional updates to the project design, including the inability to meet one term and condition of the prior formal consultation, will again trigger reinitiation of ESA Section 7 consultation.

Consistent with that advice, on November 21, 2019, NMFS received a request for re-initiation with a BA evaluating the effects associated with (1) modifications to the design and construction methodology for the habitat improvements in Bear Creek and (2) the infeasibility of installing a grated surface on the pedestrian bridge over Bear Creek (a requirement that was included in the terms and conditions in NMFS' biological opinion issued on June 15, 2018). The consultation was initiated on December 6, 2019.

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 (50 CFR 402.02).

Under the 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)

We considered whether or not the proposed action would cause any other activities and determined that it would not cause any activities not previously considered in consultation number WCR 2018-8825.

In the prior consultation, Sound Transit proposed to add 3.4 miles of light rail and two new light rail stations from the interim terminus of the Redmond Technology Center Station (formerly called the Overlake Transit Center Station) to downtown Redmond. Except for the in-water work and the placement of structures below the ordinary high water mark (OHWM) of Bear Creek and the Sammamish River, construction methods and structures will generally be as described in the 2010 East Link BA (Sound Transit 2010). Timing of the work indicates that no structures will be placed in the wetted portion of the channel. In addition to the in-channel placement of structures to support the light rail, several improvements to Bear Creek in the project corridor are proposed: the existing creosote-treated wood bridge at the former BNSF railroad crossing will be removed from the stream, and the channel and floodplain of Bear Creek will be widened where the existing stream channel and floodplain are currently constricted by the bridge and fill.

1.3.1 Project Changes

Project elements that differ from what was described and analyzed in the 2018 re-initiation are the following:

- Excavation of a new backwater channel to provide additional aquatic habitat downstream of the guideway crossing (Attachment A, sheet 2). Approximately 3,800 square feet of new back-channel habitat area will be engaged at normal baseflows and will provide accessible off-channel rearing habitat for fish in Bear Creek. The new feature overlaps with an existing floodplain channel below the discharge point of two existing flow diversion culverts that will be removed (see next bullet). The existing channel receives only intermittent flow and does not provide substantive off-channel rearing opportunities for juvenile fish.

- Removal of two existing flow diversion culverts that extend through the existing fill prism east of the existing treated wood bridge at the former BNSF railroad crossing. These culverts are engaged only during high flows; the discharge from them is intermittent and does not create accessible off-channel habitat downstream of the culverts.
- Laying back steep stream banks and removing material to create floodplain benches on the inside bends of the stream channel.
- Stream substrate enhancement and placement of large woody debris in the stream channel.
- Removal of riprap armoring and other rubble and debris from the stream channel.
- Minor grading to remove additional floodplain and streambank materials upstream and downstream of the alignment to provide the necessary clearance for the new bridge structures and ensure the Project is compliant with the City of Redmond's floodplain and floodway requirements, including assuring a zero-rise flood condition.

Also, new details have become available about the extent of vegetation restoration work that was described in the 2018 BA as "planting native trees and shrubs in riparian and floodplain areas." Approximately 83,500 square feet of riparian and floodplain areas disturbed for construction will be replanted with native trees and shrubs. Vegetation enhancement will be performed in an additional 82,250 square feet within the Bear Creek corridor.

Currently functioning native vegetation within the enhancement areas will remain but will be interplanted with native trees to increase species and structural diversity. About half of the designated enhancement areas contain large patches of invasive species, primarily Himalayan blackberry and reed canarygrass. These areas will be cleared of invasive species and replanted with native vegetation to establish forested conditions, resulting in long-term improvements in riparian and wetland habitat functions along Bear Creek. Vegetation enhancement work is not expected to require the use of heavy equipment. Table 1 summarizes the areas of habitat disturbance, restoration, and enhancement that were reported the 2018 BA, compared to the current estimates (based on the Final Concept design).

Table 1. Areas of Habitat Disturbance, Restoration, and Enhancement (square feet)

Project Element	Basis of 2018 Analysis	Current Value
Riparian vegetation disturbance	115,500a	110,500a
Riparian replanting	91,100b	83,500c
Riparian vegetation enhancement	N/Ad	82,250
Back-channel habitat creation	0	3,800
Permanent riparian vegetation loss	24,400e	23,700f
Bear Creek dewatering	11,250g	21,500h

a Extent of temporary disturbance and permanent vegetation loss or modification within 200 feet of Bear Creek.

b The 2018 BA did not quantify replanting areas, but it did include a commitment to replant all temporarily disturbed areas. As the difference between the total area of riparian vegetation disturbance and the area of permanent riparian vegetation loss, 91,100 square feet represents a reasonable estimate of the temporary impact area.

c Temporarily disturbed areas that will be restored via tree planting.

d The 2018 BA did not quantify vegetation enhancement areas.

e As reported in NMFS' biological opinion.

f Includes both wetland and non-wetland habitats in riparian areas.

g During one year's in-water work window only.

h During the in-water work windows of two years. The actual impact area may be smaller because the design/build contractor may not need to dewater this full area in one or both years.

The Incidental Take Statement in NMFS' June 2018 biological opinion was based in part on the expectation that 11,250 square feet of the Bear Creek channel would be dewatered during project construction. Following a multi-agency workshop conducted in January 2019 and as a result of ongoing coordination with the Muckleshoot Indian Tribe, City of Redmond, and other agencies, Sound Transit has expanded the linear extent of stream habitat and the area of riparian habitat that will be enhanced and restored. The proposed stream restoration and enhancement will extend farther downstream and upstream, increasing the area of the wetted portion of the stream channel affected by dewatering in order to construct the proposed habitat improvements. Sound Transit has also expanded the extent of riparian restoration, specifically adding, at the request of the City of Redmond, a new off-channel habitat feature downstream of the guideway alignment. The additional stream and riparian restoration and enhancement have increased the scale and complexity of the coordinated facility and restoration construction, which will now require portions of Bear Creek to be dewatered during the in-water work windows of two years instead of the one year described in the 2018 BA.

Additionally, one of the reasonable and prudent measures in NMFS' biological opinion requires FTA to minimize incidental take of Puget Sound Chinook salmon from the presence of overwater structures. The non-discretionary terms and conditions for implementing that measure are as follows:

"Use grated decking material on the pedestrian footbridge deck over Bear Creek with at least 60 percent open area."

This requirement was evaluated during preliminary design and found to be infeasible, due to structural and operational requirements by King County, which will own and maintain the bridge and trail following construction. King County has determined that a smooth concrete surface on the footbridge, rather than grated decking, will be needed in order to safely accommodate trail use and provide ongoing maintenance access. Best practice guidelines issued by the American Association of State Highway and Transportation Officials specify that shared-use paths, such as the trail that will cross the new footbridge, should have a smooth surface. Grooves or openings reduce braking ability and may trap small wheels or create a channeling effect that can cause bicyclists to lose control. A copy of a letter from the County, with more detailed discussion of the needs for the bridge design, is provided in Attachment B.

Through the development of the Final Concept design, Sound Transit has determined that constructing the pedestrian bridge with a grated deck is not practical and is not likely to achieve the desired conservation goals. The pedestrian bridge is being constructed by Sound Transit but will be owned and operated by King County Parks as an element of their East Lake Sammamish Trail system. During the completion of the Final Concept design, Sound Transit worked closely with King County Parks to identify the design standards for the proposed pedestrian bridge structure.

A primary change that has occurred following completion of the 2018 BA was the determination that the new bridge structure must meet H-20 Loading requirements. H-20 Loading is defined by the American Association of State Highway Transportation Officials as consisting of truck axle loading of 32,000 pounds or wheel loading of 16,000 pounds. In addition, the new structure must (1) meet King County Parks trail standards, (2) comply with accessibility standards established in the Americans with Disabilities Act (ADA), and (3) be useable by pedestrians and cyclists. Sound Transit, in conjunction with King County Parks, has determined that it is infeasible to construct a bridge structure with a grated decking that allows substantial light transmission while also meeting requirements for H-20 loading, ADA compliance, and functionality for all trail users. A grated structure that was thick enough to meet the loading requirements and also had openings small enough to meet accessibility and other use requirements would provide practically no light transmission, even under optimal conditions. And in this situation the pedestrian bridge is located immediately adjacent to and northeast of the adjacent elevated guideway. The pedestrian bridge will likely be within the shadow of the guideway structure for extended periods. As a result of these factors, Sound Transit is requesting that NMFS remove the condition to construct the pedestrian bridge with a grated decking.

Although the Final Concept design does not increase or substantively change the assessment presented in the 2018 BA, Sound Transit recognizes that removing this conservation measure may change the basis for NMFS' analysis of project impacts included in the 2018 Biological Opinion. Other agencies have also identified the increase in overwater structure that would result from the new guideway structure and pedestrian bridge as a potential impact that would require mitigation under their respective codes and authorities. In addition, the Tribe requested that Sound Transit include additional mitigation as part of the Project to offset anticipated impacts from the new structures. One of the primary reasons Sound Transit has expanded both the area and scope of the proposed Bear Creek habitat improvements that are part of this project is to provide additional mitigation to compensate for the anticipated impacts associated with the construction of the new guideway and solid-decked pedestrian bridge. Specifically, in addition to removing the existing derelict timber trestle, Sound Transit has increased the proposed linear extent of the stream restoration and increased the size and density of large woody material to be included as part of the Project to offset impacts associated with the new overwater structures.

The 2018 biological opinion addressed the impacts of installation and permanent presence of stormwater outfalls and associated dispersal pads in the floodplain and in the active channel of the Sammamish River. In the Final Concept design, the outfalls and their dispersal pads are above the OHWM of the river but still within the floodplain.

The Incidental Take Statement in NMFS' June 2018 biological opinion was also based on the expectation that 1,650 square feet of the Sammamish River channel would be dewatered for construction of dispersion pads downslope of the new stormwater outfalls. This estimate was based on the assumption that at least one of the outfalls and portions of both dispersion pads would be below the river's OHWM, and that a 15-foot area beyond the edge of each dispersion pad would need to be isolated from the river, to provide maneuvering space for equipment. The relocation of the outfalls to a higher elevation will likely reduce the amount of river channel area requiring isolation. To provide a conservative estimate of potential impacts, however, and to allow for the possibility of additional modifications through the design-build process, the previous estimate of 1,650 square feet remains unchanged.

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

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

The FTA originally determined the proposed action is not likely to adversely affect Puget Sound steelhead or their critical habitat. Following project revisions and our re-inititation of consultation, our concurrence with this determination is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12). The proposed action is likely to adversely affect Chinook salmon (*O. tshawytscha*). That species is addressed in Sections 2.1 through 2.11. No critical habitat is identified for Puget Sound Chinook salmon in the action area.

2.1 Analytical Approach

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

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

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.

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

2.2 Rangewide Status of the Species and Critical Habitat

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

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote *et al.* 2014; Mote *et al.* 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague *et al.* 2013; Mote *et al.* 2014). Bear Creek and the Sammamish River are rain-dominated watersheds (Coffin *et al.* 2011; NIFC 2016).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1 degree Fahrenheit (°F) to 1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Kunkel *et al.* 2013; Abatzoglou *et al.* 2014). Warming is likely to continue during the next century as average temperatures are projected to increase another 3° to 10°F, with the largest increases predicted to occur in the summer (Mote *et al.* 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote *et al.* 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote *et al.* 2013; Mote *et al.* 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote *et al.* 2014). Models consistently predict increases in the frequency of severe winter precipitation events (*i.e.*, 20-year and 50-year events), in the western United States

(Dominguez *et al.* 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote *et al.* 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua *et al.* 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua *et al.* 2010; Isaak *et al.* 2012). The Sammamish River and Bear Creek are already experiencing high water temperatures (Coffin *et al.* 2011; Ecology 2018), which affects adult upstream migration and likely juvenile survival. Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic food webs (Winder and Schindler 2004; Crozier *et al.* 2011; Tillmann and Siemann 2011). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al.* 1999; Winder and Schindler 2004; Raymondi *et al.* 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier *et al.* 2008; Raymondi *et al.* 2013; Wainwright and Weitkamp 2013).

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

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

2.2.1 Status of Critical Habitat

There is no critical habitat for Puget Sound Chinook salmon designated in the action area (Figure 1).

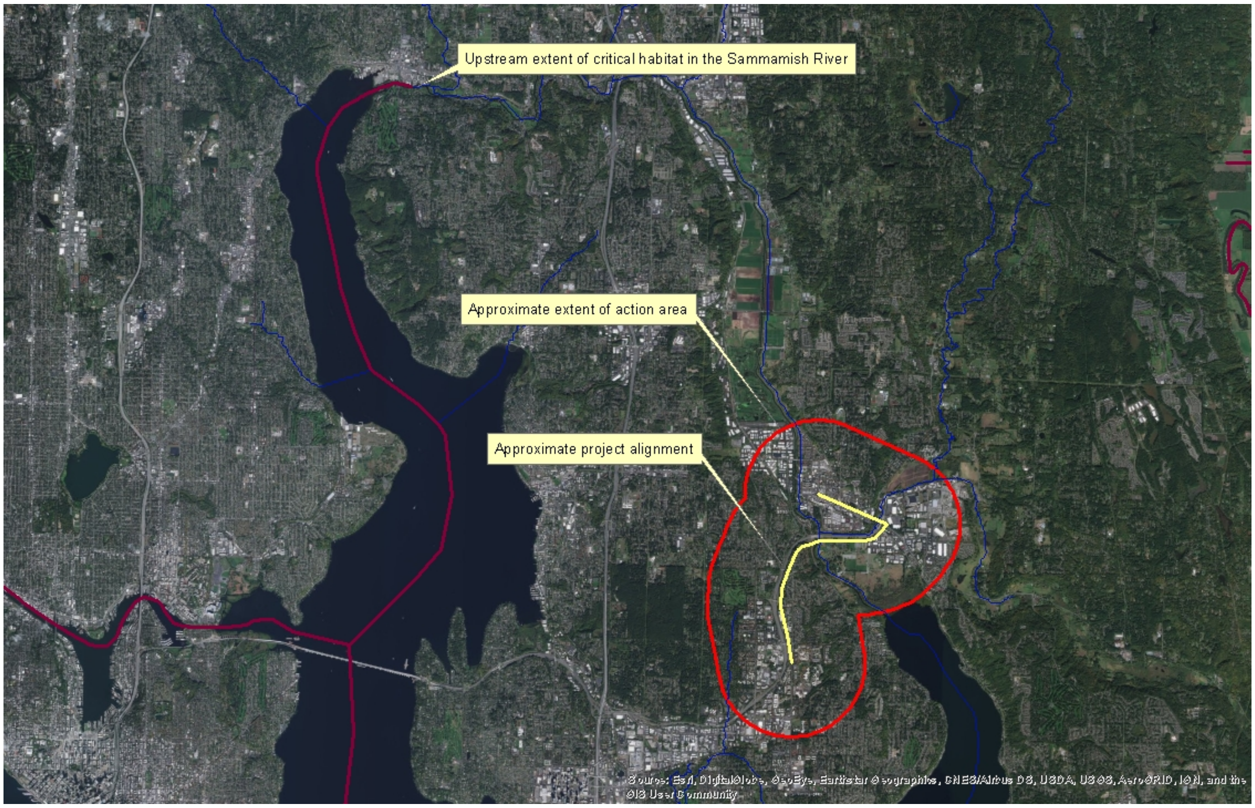

Figure 1. Extent of Puget Sound Chinook Critical Habitat in the Project Vicinity.

2.2.2 Status of the Puget Sound Chinook Salmon

The Puget Sound Chinook salmon Evolutionarily Significant Unit (ESU) was listed as a threatened species in 1999; its threatened status was reaffirmed in 2005. The NMFS issued results of a 5-year review on May 26, 2016 (81 FR 33468), and concluded that the species should remain listed as threatened.

The NMFS adopted the recovery plan for Puget Sound Chinook in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (Shared Strategy 2007) and a supplement by NMFS (2006). The recovery plan adopts ESU- and population-level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus *et al*. 2002). The PSTRT's biological recovery criteria will be met when the following conditions are achieved: 1) all watersheds improve from current conditions, resulting in improved status for the species; 2) at least two to four Chinook salmon populations in each of the five biogeographical regions of Puget Sound attain a "low" risk status over the long-term; 3) at least one or more populations from major diversity groups historically present in each of the five Puget Sound regions attain a "low" risk status; 4) tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-wide recovery scenario; and 5) production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery. The listing unit and status of the 22 independent populations are described in Ford (2011).

For Pacific salmon, steelhead, and other relevant species, NMFS commonly uses four parameters to assess the viability of the populations that, together, constitute the species: spatial structure, diversity, abundance, and productivity (McElhany *et al.* 2000). The "viable salmonid population" (VSP) criteria for those four parameters, therefore, encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When the parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. The parameters are influenced by survival, behavior, and experiences throughout a species' entire life cycle, and those characteristics, in turn, are influenced by habitat and other environmental conditions.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends fundamentally on habitat quality and spatial configuration and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation at single genes to complex life history traits (McElhany *et al.* 2000).

"Abundance" generally refers to the number of naturally-produced adults (*i.e*., the progeny of naturally-spawning parents) in the natural environment (*e.g*., on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle; *i.e*., the number of naturally-spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany *et al.* (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

For species with multiple populations, once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany *et al.* 2000).

Spatial Structure and Diversity. The Puget Sound Chinook ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington, and progeny of 26 artificial propagation programs (USDC 2014). The PSTRT identified 22 independent populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity.

Spatial structure can be measured in various ways, but here we assess the proportion of natural-origin spawners (wild fish) versus hatchery-origin spawners on the spawning grounds. We can see a declining trend in the proportion of natural-origin spawners across the ESU during the entire time period 1990–2014. The populations with the highest fractions of natural-origin spawners across the entire 1980 to 2014 time period are the six Skagit populations, and also the South Fork Stillaguamish population in the Whidbey Basin MPG. All other populations vary considerably across the whole time period, and 12 (North Fork Stillaguamish, Snoqualmie, Mid Hood Canal, Skokomish, North Fork Nooksack, South Fork Nooksack, Elwha, Nisqually, Puyallup, Sammamish and White) show declining trends in the fraction wild estimates. Skykomish, Dungeness, Cedar are the only populations that show more recent trends of an increasing fraction of natural-origin spawner abundances.

Abundance and Productivity. NMFS NWFSC (2015) reports that the abundance of the 22 extant natural spawning populations of Chinook salmon in the Puget Sound ESU has varied considerably between populations. Total abundance in the ESU over the entire time series shows that individual populations have varied in increasing or decreasing abundance, with some being dominated by hatchery returns. Generally, many populations experienced an increase in abundance from during the years 2000–2008 and then declining in the last 5 years. Abundance across the Puget Sound ESU has generally decreased since the last status review, with only 6 of 22 populations (Cascade, Cedar, Mid-Hood Canal, Nisqually, Suiattle, and Upper Sauk) showing a positive percent change in the 5-year geometric mean natural-origin spawner abundances since the prior status review. However, all six of these populations have relatively low natural spawning abundances of fewer than 1000 fish, so these increases represent small changes in total abundance. While the previous status review in 2010 (Ford *et al*. 2011) concluded there was no obvious trend for the total ESU escapements and trends for individual populations were variable, addition of the data to 2014 now does show widespread negative trends in natural-origin Chinook salmon spawner population abundances.

NWFSC 2015 also reports that Chinook salmon productivity in the Puget Sound ESU across the time period (1980–2015) has been variable. Across the Puget Sound ESU, 8 of 22 Puget Sound populations show natural productivity below replacement in all years since the mid-1980s. In recent years, only eight populations have been above zero. These are Cascade, Lower Sauk, Lower Skagit, Suiattle, Upper Sauk, Upper Skagit in the Whidbey Basin MPG, and Mid-Hood Canal and Cedar River in the Hood Canal and Central/South Puget Sound MPGs, respectively. This is consistent with the 2010 Status Review (Ford *et al*. 2011), and continues the decline reported in that document.

Limiting Factors. Limiting factors for this species include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation 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

Summary. The current status of the Puget Sound ESU is threatened and its overall ability to meet recovery goals appears poor. The ESU is split into five Major Population Groups (MPGs). The Lake Washington populations (Cedar River and Sammamish River populations) are within the South MPG along with the Green, White, Puyallup, and Nisqually River populations. Recovery criteria for the ESU includes a stipulation that two to four Chinook populations in each of the MPGs within the ESU achieve viability and that the populations that do not meet the viability criteria for all four VSP parameters are sustained in order to provide ecological functions and preserve options for ESU recovery. Given the extensive and intense development in the Lake Washington watershed, the Lake Washington populations are the least likely in the South MPG to achieve viability (NWFSC 2015).

2.3 Action Area

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

The action area for this project includes all terrestrial habitats within an approximately 1-mile radius of the project footprint, and aquatic habitats extending from the upstream extent of the project footprint, downstream to points 200 feet from the project footprint in each water body. The action area encompasses the extent of all environmental effects, including turbidity due to construction; modifications to aquatic, riparian, and floodplain habitats; and habitat disturbance including temporary channel constriction and flow diversion.

The aquatic portion of the action area is defined by the downstream extent of sediment and turbidity above background levels, and stormwater discharge from project outfalls. Water quality effects will be limited by using BMPs outlined in the contract specifications for the project and described earlier in this document. The project will maintain compliance with state water quality regulations in WAC 173-201A. Suspended sediment and turbidity from in-water construction is expected to extend 200 feet downstream from the source of sediment and turbidity in both the Sammamish River and Bear Creek, and 200 feet downstream of ground-disturbing activities along the river and stream bank (Figure 2). Beyond 200 feet, the suspended sediment, turbidity, and stormwater discharge will decrease to background levels.

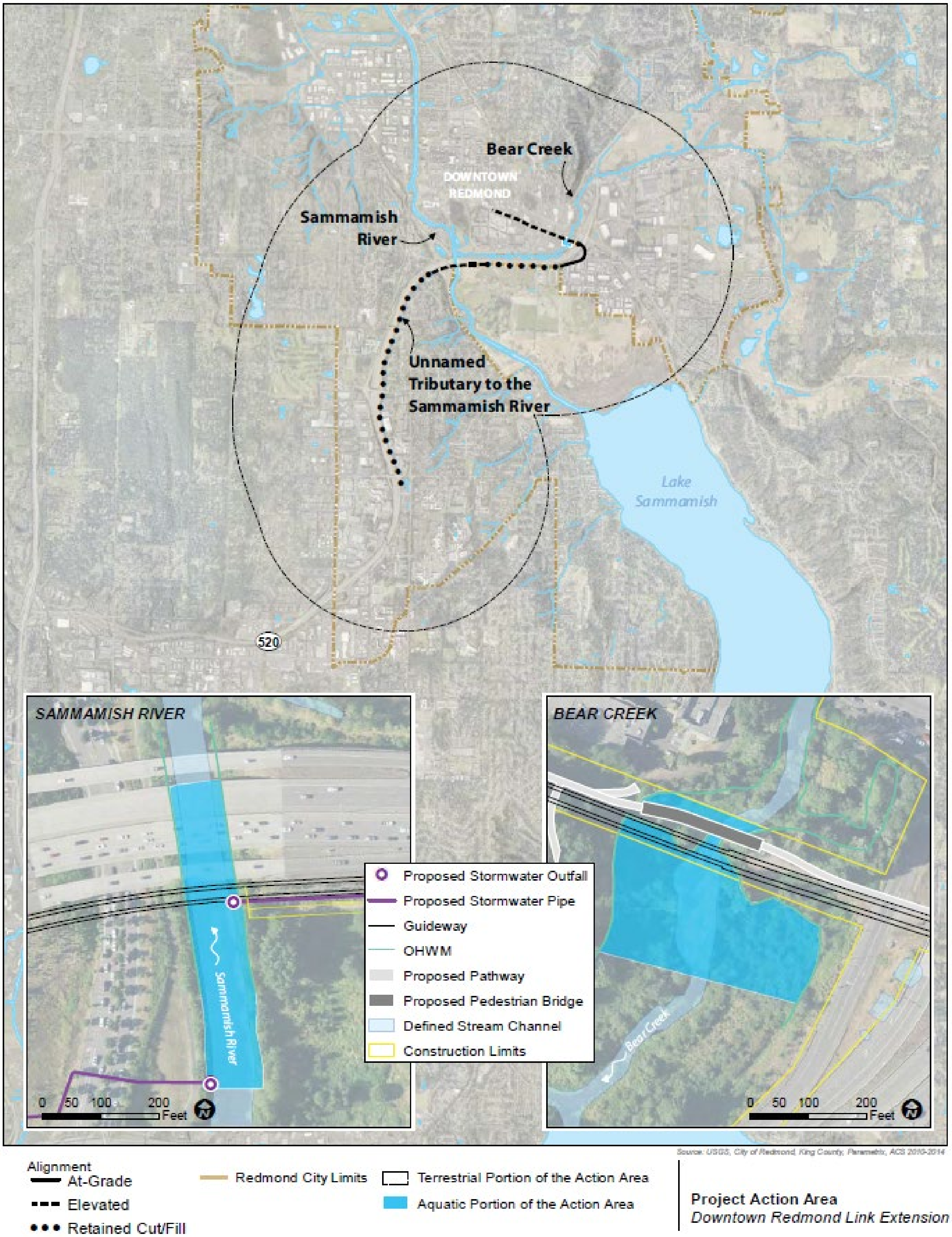

Figure 2. Project action area for downtown Redmond Link Extension Project.

The action area for direct effects associated with this project consists of aquatic areas along an approximately 400-foot-long section of Bear Creek and a 250-foot-long section of the Sammamish River, plus all terrestrial habitats within 1 mile of the project footprint. Indirect effects from this project will be contained within the action area that is defined for direct effects.

The Sammamish Chinook salmon population is one of the smallest populations of the Puget Sound ESU, with declining trends in wild estimates and escapements of less than 200 (NWFSC 2015). Average adult returns (including hatchery origin spawners) between 2006 and 2015 was 1,269 (WRIA 8 2017). Productivity of the Sammamish population was determined by using the egg-to-migrant survival.

2.4 Environmental Baseline

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

The action area includes two water bodies within Washington: the Sammamish River and Bear Creek, a tributary of the Sammamish River. Chinook salmon use the Sammamish River for migration but are found mainly in Bear Creek, which is used by all life stages. Adult Chinook salmon do not enter the Sammamish River or Bear Creek to spawn until September through early November (Berge *et al.* 2006), and juvenile Chinook salmon outmigrate from April to June (Kiyohara and Zimmerman 2009).

2.4.1 Sammamish River

Historically, the Sammamish River was 3.5 miles longer that it is today. In 1891, the COE reported that the river was 17 miles long, but development through the 20th century resulted in several dramatic changes that reduced the complexity of the floodplain. Such development changes included lowering the water level in Lake Washington, channelizing the Sammamish River, and constructing drainage ditches throughout the river valley. The Sammamish River is now about 13.5 miles long, extends from Lake Sammamish to Lake Washington, and accounts for approximately 30 percent of the surface water flow into Lake Washington (Pflug and Pauley 1981; Weitkamp *et al*. 2000). The entire Sammamish River drainage basin encompasses approximately 170 square miles, including main stem tributaries Bear Creek, Little Bear Creek, North Creek, and Swamp Creek (Ostergaard *et al.* 1995).

The Sammamish River is a highly modified water body with multiple water quality issues. Water quality is particularly poor during summer months. The combination of low summer flows, reduced riparian vegetation, and infestations of invasive aquatic vegetation, such as Brazilian elodea (*Egeria densa*) have contributed to the observed elevated water temperatures and low dissolved oxygen levels in the river (Ecology 2018). Monitoring work on the Sammamish River temperature and dissolved oxygen Total Maximum Daily Load (TMDL) began in 2014 and is still underway (Ecology 2018). Water temperature and dissolved oxygen are significant limiting factors for both juvenile and adult salmon (Kerwin and Nelson 2000).

The Lake Washington basin is the most populated basin in the Puget Sound, with 55 percent of its land area inside Urban Growth Areas (NIFC 2016). Land use in the Sammamish watershed contains a mix of urban, park, agricultural, and forested areas. The action area is within Redmond, a city that has experienced a population growth of 15 percent between 2010 and 2016 (U.S. Census Bureau 2018). By the year 2030, Redmond anticipates a population of 78,000 people and an employment base of 119,000 jobs (people commuting into the city) (Redmond 2012). Growing human populations generally trend towards more construction activity adding more impervious surfaces (NIFC 2016). The land surrounding the action area has between 12 and 40 percent imperious surface cover, degrading the Sammamish watershed (NIFC 2016).

In Lake Washington and Lake Sammamish, there are over 4,150 docks and piers along the shoreline (NIFC 2016). Although the Sammamish River only has a few docks and piers in the lower basin, near Lake Washington, there are numerous bridges (overwater structures) that span the river. Based on aerial images from 2017, the Sammamish River has more than 20 vehicle bridges and 10 footbridges (Google Earth 2017). Many of the bridges that span the Sammamish River are supported by piles and piers located above the OHWM, resulting in few in-water obstacles.

Numerous invasive plant removal and revegetation activities have been sporadically performed throughout the river corridor; however, riparian vegetation along the Sammamish River within the action area continues to be severely degraded. The river banks are heavily armored and contain a mix of native and nonnative shrubs (*e.g.,* twinberry [*Lonicera involucrata*], willows [*Salix* species], and Himalayan blackberry [*Rubus armeniacus*]) and young trees (*e.g.*, red alder [*Alnus rubra*], bigleaf maple [*Acer macrophyllum*], and black cottonwood [*Populus trichocarpa*]) (Sound Transit 2018). Many noxious weeds occur along the Sammamish River, including English ivy (*Hedera helix*), reed canarygrass, yellow-flag iris (*Iris pseudacorus*), Japanese and Bohemian knotweed *Fallopia japonica* and *Reynoutria x bohemica*), curly leaf pondweed (*Potamogeton crispus*), and Eurasian milfoil (*Myriophyllum spicatum*) (King County 2013). The functional riparian buffer west of the river is only 30 feet wide, consisting of a single row of deciduous trees and a mix of native and nonnative shrubs. To the east of the river, vegetation was cleared in 2009 for a different project but was replanted with a mix of conifers and native shrubs (Sound Transit 2018).

Within the Sammamish River channel, there is very little LWD. This condition is largely due to removal of trees during channel dredging and straightening, as well as a current lack of mature trees for recruitment along the main or tributary channels (U.S. Army Corps of Engineers and King County 2002; Sound Transit 2018). During a site visit for the Redmond Link Extension, Parametrix and Sound Transit did not observe LWD in the channel (Sound Transit 2018). Although some 2- to 4-inch-diameter, 3- to 4-foot-long logs were observed near the bank during site visits, all were mobile and not persistent.

2.4.2 Bear Creek

The Bear Creek subbasin covers approximately 32,100 acres and enters the Sammamish River approximately 1.5 miles downstream of Lake Sammamish near the intersection of the Sammamish River and SR 520. Bear Creek receives water from Cottage Lake and Evans Creeks. The Bear Creek subbasin is the most important salmonid system in the Sammamish River watershed (Kerwin 2001).

Development in the Bear Creek watershed began in the 1990s, and land use is predominantly residential (Coffin *et al*. 2011). Lower portions of the watershed in the city of Redmond have expanded to include commercial and industrial zones (Coffin *et al*. 2011). Impervious area in a watershed is a general predictor of biological and hydrological conditions (Schueler 1994). Bear Creek exhibits a wide range of impervious cover, with one subbasin beginning to show impact with 4 to 7 percent impervious surface, two subbasins showing impact with 7 to 12 percent impervious surface, and the remaining four subbasins at a degrading level of 12 to 40 percent impervious surface (NIFC 2016). The amount of impervious surface increased between 2006 and 2011 by 268 acres, adding to the previous estimate of 10,000 acres (NIFC 2016).

In 2004, Bear Creek and its tributaries, Evans and Cottage Lake Creeks, were observed to have elevated levels of fecal coliform bacteria and to have reaches that are too warm with minimal dissolved oxygen for salmonids (Coffin *et al*. 2011). The Washington State Department of Ecology (Ecology) produced a TMDL to address the fecal coliform bacteria in June 2008, and a TMDL for temperature and dissolved oxygen in September 2008 (Coffin *et al.* 2011). A high fecal coliform count generally means a greater presence of pathogens; areas that exhibit elevated fecal coliform counts include the project area and reaches immediately upstream and downstream of the project site (Coffin *et al*. 2011). Elevated temperatures affect the physiology and behavior of fish and other aquatic life, and the health of aquatic organisms also depends on maintaining an adequate supply of oxygen dissolved in the water. Elevated temperatures and minimal dissolved oxygen levels were documented in the project area, and upstream and downstream of the project site (Coffin *et al.* 2011). A recent study of stormwater impacts on the Bear Creek watershed confirmed that elevated levels of fecal coliform, elevated temperature, and low dissolved oxygen are still water quality concerns (King County 2017).

The vegetation in Bear Creek, like the rest of the Sammamish River basin, is typical of the lowland forest ecosystem and is dominated by evergreen conifers. The loss of riparian vegetation due to development (Coffin *et al.* 2011) has likely reduced the recruitment of LWD. In 2014, approximately 3,000 feet of channel and 14.6 acres of adjacent upland habitat were restored in the Bear Creek Rehabilitation project. The project involved constructing approximately 3,500 feet of new channel in open space, allowing for a more natural channel meander pattern, reconnection with the floodplain, and a more gradual profile. Habitat features such as LWD and streambed gravel were added to the stream, and over 10 acres of riparian buffer vegetation was planted.

2.5 Effects of the Action

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

Generally, as described in the previous opinion, effects that will occur because of the proposed action are either temporary or permanent. Temporary effects include: 1) diminished water quality from turbidity during in-channel work and treated timber pile removal; 2) loss of riparian vegetation; 3) dewatering the worksite, and 4) fish exclusion. Permanent effects include: 1) additional overwater structure; 2) the placement of structure and fill within the floodplain; and 3) episodic water quality impairment from road runoff and stormwater associated with stormwater outfalls. Loss of riparian vegetation can be considered both a temporary effect (within areas where vegetation was cleared for construction and replanted following the completion of activities) and a permanent effect (underneath and adjacent to the guideway where safety constraints and shading from the structure preclude the recovery and recruitment of native vegetation).

2.5.1 Effects on Critical Habitat

The action area does not contain Puget Sound Chinook salmon critical habitat.

2.5.2 Effects of the Action on Listed Species

2.5.2.1 Temporary Effects

Chinook salmon are unlikely to be present during the in-water work window. Adult Chinook salmon do not typically enter the Sammamish River or Bear Creek to spawn until September through early November (Berge *et al.* 2006), and juvenile Chinook salmon outmigrate from April to June (Kiyohara and Zimmerman 2009). Herrera conducted a snorkel survey in Bear Creek on May 25, 2017, and observed no juvenile or adult Chinook salmon or any other salmonids (Herrera 2017), indicating how few Chinook salmon are in the creek outside of peak migration periods. However, juvenile Chinook salmon can rear in Bear Creek year-round and could be present during construction. If they are present, they will be exposed to the following temporary effects:

Water Quality Impairment– Construction Activities

In-water construction activities will temporarily disturb soil and streambed sediments, increasing turbidity and suspended sediments in the action area. Construction-related increases in the sedimentation and turbidity above background levels could potentially affect fish species and their habitat by reducing juvenile survival, interfering with feeding activities, causing breakdown of social organization, and reducing primary and secondary productivity (Sigler *et al*. 1984; Berg and Northcote 1985; Waters 1995). Salmonids typically avoid areas of higher suspended sediment (Sigler *et al.* 1984), which means they displace themselves from their preferred habitat to seek areas with less suspended sediment. Fish unable to avoid suspended sediment can experience negative effects from exposure, the severity of which increase as a function of the sediment concentration and exposure time (Newcombe and Jensen 1996).

Research has shown that length of exposure to total suspended solids (TSS) plays a more dominant role than TSS concentration (Anderson *et al.* 1996). Prolonged exposures to turbidities between 25 and 50 NTU resulted reduced growth and increased emigration rates of juvenile coho salmon and steelhead compared to controls (Sigler *et al.* 1984). Those findings are generally attributed to reductions in the ability of salmon to capture prey in turbid water (Waters 1995). Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Waters 1995). Berg and Northcote (1985) observed changes in social and foraging behavior, and increased gill flaring (an indicator of stress) in juvenile coho salmon at moderate turbidity (30 to 60 NTU). In that study, behavior returned to normal quickly after turbidity was reduced to lower levels (0 to 20 NTU).

The project is not expected to generate turbidity levels or quantities of suspended sediments that would result in acute physical or behavioral effects to individual Chinook salmon. Individual fish that encounter increased turbidity or suspended sediment concentrations will likely move away from affected areas into more suitable surrounding habitat. In-water work will only occur for one season during the in-water work window, which will limit the duration of turbidity effects. Juvenile Chinook salmon may be present during increased construction activities and, thus, subject to effects from elevated turbidity. However, due to the short duration of turbidity-generating activities and the use of BMPs during construction, the effects of turbidity will be minor and are unlikely to result in increased predation, decreased feeding, injury, or death. NMFS does not expect the effects from the proposed action to reduce the suitability of the action area for supporting rearing or migrating salmonids. Fish passage along the Sammamish River will be maintained throughout the project and will continue unchanged when construction is completed, so that the migration corridor is not impaired. Although entire portions of Bear Creek may be dewatered during in-water work, cofferdams or other BMPs for in-water work area isolation will be configured to allow unimpeded upstream and downstream migration outside of the work zone. Turbid conditions are not expected to affect access to spawning or rearing habitats once stream flows are restored.

The proposed action involves construction activities and equipment staging over or near Bear Creek and the Sammamish River that will increase the potential for accidental releases of fuel, oil, and other contaminants. All work in or near water bodies in the action area will comply with the terms of federal, state, and local permits, minimizing the potential for sediment or pollutants to be carried from work sites to water bodies by stormwater. In addition, all work will be conducted in compliance with the TESC plan and SPCC plan for the project, and BMPs will be implemented to prevent construction-related sediment or pollutants from entering streams. For instance, the BMPs require that all equipment be free of leaks and that refueling, maintenance, and staging occur at least 100 feet from a stream. Additionally, the BMPs require all hazardous material spills be cleaned up immediately. Given the minimization measures and the BMPs proposed, NMFS expects the likelihood of an accidental spill of contaminants reaching a waterway to be unlikely and, therefore, discountable.

Water Quality Impairment – Treated Timber Pile Removal

The former BNSF railway bridge that spans Bear Creek is supported by 16, 16-inch-diameter, creosote-treated timber piles, which will be removed. Another 16, 12-inch-diameter, broken, creosote-treated timber piles in the channel will also be removed. Polycyclic aromatic hydrocarbons (PAHs) associated with creosote-treated wood can contaminate surrounding sediment up to 6.5 feet from the pile (Evans *et al.* 2009). Removal of the creosote-treated piles can mobilize PAHs into the surrounding water and sediments (Smith 2008; Parametrix 2011). The concentration of PAHs released into surface water rapidly dilutes. Smith (2008) reported concentrations of total PAHs of 101.8 micrograms per liter (µg/L) 30 seconds after creosote-pile removal and 22.7 µg/L 60 seconds after removal. PAH concentrations greater than 134 µg/L were observed 5 minutes following pile removal (Weston Solutions and Pascoe Environmental Consulting 2006). Contaminants in the water column generally settle out soon after pile removal; however, PAH levels in the sediment can remain high for 6 months or more (Smith 2008). Romberg (2005) found a major reduction in sediment PAH levels 3 years after pile removal contaminated an adjacent sediment cap.

There are two pathways for PAH exposure to listed fish species in the action area: direct uptake through the gills and dietary exposure (Lee and Dobbs 1972; Neff *et al.* 1976; Roubal *et al.* 1977; McCain *et al.* 1990; Varanasi *et al*. 1993; Karrow *et al.* 1999; Meador *et al*. 2006). Fish rapidly uptake PAHs through their gills and food, but also efficiently remove them from their body tissues (Lee and Dobbs 1972; Neff *et al*. 1976). Juvenile Chinook salmon prey include amphipods, copepods, and fish larvae. The prey species uptake PAHs from contaminated sediments; the PAHs bioaccumulate in their tissues and cause greater levels of contamination in predator fish species (Neff 1982; Landrum and Scavia 1983; Landrum *et al*. 1984).

The primary effects of PAHs on listed fish are immunosuppression and reduced growth. Karrow *et al*. (1999) characterized the immunotoxicity of creosote to rainbow trout (*O. mykiss*) and reported a lowest observable effect concentration for total PAHs of 17 µg/L after 28 days of exposure. Varanasi *et al*. (1993) found greater immune dysfunction, reduced growth, and increased mortality compared to control fish. Consumption of contaminated prey, rather than absorption from the water, probably represents the primary pathway of contamination in marine fishes, such as rockfish (West and O'Neill 1998). Physiological effects of PAH exposure on Puget Sound fish include liver cancer, reproductive impairment, reduced immune function, and suppressed growth (Johnson *et al*. 2008).

The project is not expected to generate high amounts of PAHs in the water column or sediment during and after treated timber pile removal. Piles will be removed during summer low flows when water depths range from 6 to 12 inches. The extreme low flows will minimize the quantity of contaminants that would be released into the water. The holes left when pulling piles will be filled with clean substrate shortly after removal. In addition, all pile removal activities will be performed within the approved in-water work window when Chinook salmon are unlikely to be present. Therefore, NMFS considers the quantity of contaminants to be released during treated timber pile removal to be unlikely to further reduce Chinook salmon fitness in the action area. Furthermore, by removing a source of creosote in the aquatic environment, Sound Transit will reduce a potential pathway of future contaminant exposure to Chinook salmon and other aquatic species.

Riparian Habitat Diminishment

Indirect effects associated with the removal of riparian vegetation can result in increased water temperatures (Mitchell 1999; Opperman and Merenlender 2004) and decreased water quality (Lowrance *et al.* 1985; Welsch 1991), attributable to a loss of shade and cover over the active channel. Approximately 2.65 acres of riparian vegetation will be temporarily cleared during construction of the Bear Creek crossing. Another 0.56 acre will be permanently removed by the crossing, as well as 0.18 acre adjacent to the Bear Creek pedestrian bridge, and 0.01 acre associated with the installation of the Sammamish River outfall pipes.

The cleared riparian vegetation may affect aquatic habitat and species. However, most of vegetation loss due to the proposed action is expected to be temporary because most disturbed areas will be replanted with native vegetation. Vegetation will be permanently removed from small area directly below and adjacent to the guideway across Bear Creek. That area must be maintained for safety, and all large trees will be permanently removed.

Functional riparian vegetation will be absent from approximately 650 feet along the shoreline for approximately 6 years (1 year for project construction and 5 years for the vegetation to mature). The riparian vegetation upstream and downstream of the immediate project vicinity is composed of a mix of lowland forest vegetation and nonnative, invasive shrubs and herbs. NMFS believes that the absence of mature vegetation for a small portion of the reach is unlikely to significantly impact rearing and migrating salmonids.

Dewatering of Aquatic Habitat

The project will dewater an area of approximately 11,250 square feet for the Bear Creek restoration activities and 1,650 square feet for the Sammamish River outfall pipe installation. Dewatering is commonly used to reduce the number of fish exposed to construction activities that will occur within or very close to the water, and which have been described above. NMFS anticipates temporary changes to instream flow upstream, within, and downstream of the project during each phase of in-water work.

Stream flow diversion and dewatering could harm individual rearing salmonids by concentrating or stranding them in residual wetted areas, or by entrapping them within the interstices of channel substrate where they may not be seen by fish relocation personnel. Juvenile salmonids that avoid capture in the project work area will likely die due to desiccation, thermal stress, or crushing. However, fish relocation efforts are expected to be effective at removing fish from the area. Therefore, NMFS expects that very few juvenile Chinook salmon may be missed and potentially left within the dewatered area.

Dewatering operations may also briefly affect aquatic food sources that Chinook salmon use for forage. Benthic aquatic macroinvertebrates, an important food source for salmonids, may be killed or their abundance reduced when the river is dewatered (Cushman 1985). However, effects on aquatic macroinvertebrates resulting from river flow diversions and dewatering will be temporary because construction activities will be short-term (less than 1 month). Rapid recolonization (2 weeks to 2 months) of disturbed areas by macroinvertebrates is expected following the removal of all work area isolation BMPs (Merz and Chan 2005). In addition, the effect of macroinvertebrate loss on juvenile salmonids is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered areas because river flow will be bypassed around the project work site. Therefore, Chinook salmon are unlikely to be exposed to a reduction in food sources from the temporary reduction in aquatic macroinvertebrates as a result of dewatering activities.

The in-water work zone will be isolated using sheet piles or similar BMPs. Sheet piles will be installed using vibratory methods. There are no established injury criteria for vibratory pile driving, and resource agencies in general are not concerned that vibratory pile driving results in adverse effects on fish (Caltrans 2015), though the disturbance associated with pile installation will likely cause any Chinook salmon in the immediate vicinity to avoid the area.

Fish Handling and Exclusion

Fish handling to remove fish from the dewatered worksite is intended to reduce fish exposure to harmful habitat conditions associated with the work, but fish removal and handling can injure a small percentage of the handled fish. As described above, Sound Transit will isolate approximately 11,250 square feet of Bear Creek and 1,650 square feet of the Sammamish River during in-water work. Along Bear Creek, entire portions of the channel within the project area may be dewatered during the approved in-water work window, although cofferdams will be configured to allow unimpeded upstream and downstream migration outside of the work zone.

Chinook salmon are unlikely to be present during the in-water work window, though juvenile Chinook salmon may rear in Bear Creek year-round and could be present during dewatering and fish exclusion. Per the WSDOT protocols, fish will first be herded out of the in-water work zone using seines and dip nets. Electrofishing may be used to remove any remaining fish.

Fish handling and transport is reasonably certain to harm some juvenile salmonids, disrupt their normal behavior, and cause short-term stress, fatigue, and some injury and mortality. Studies indicate stress is revealed by increased plasma levels of cortisol and glucose (Hemre and Krogdahl 1996; Sharpe *et al.* 1998). Even short-term, low intensity handling may cause reduced predatory avoidance for up to 24 hours (Wedemeyer 1972; Olla *et al.* 1995). While injury and death due to handling stress from nets and seines is expected to be lower than that for electrofishing, poor, improper, or careless handling after capture can result in as much mortality, stress, and injury as electrofishing (Barrett and Grossman 1988).

Electrofishing involves passing an electrical current through water containing fish to stun them, making them easier to locate and remove from the worksite. The process can cause a suite of effects on fish, ranging from disturbance or fright behavior and temporary immobility, to physical injury or death resulting from accidental contact with the electrodes. The amount of unintentional mortality attributable to electrofishing can vary widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. The long-term effects of electrofishing on both juvenile and adult salmonids is not well understood, but a few studies have examined the long-term effects of electrofishing on salmonid survival and growth (Dalbey *et al.* 1996; Thompson *et al.* 1997; Ainslie *et al.* 1998). Those studies indicate that, although some fish suffer spinal injury, few die as a result. Injured fish may suffer short-term, long-term, or lifetime handicaps that affect their behavior, health, growth, or reproduction, which could impact community structure and population size (Snyder 2003). Electrofishing stresses are cumulative when added to existing environmental stresses, increasing mortality due to stress and fatigue directly or indirectly through greater susceptibility to predators, disease, and parasites (Snyder 2003).

By restricting work isolation activities to the approved in-water work window, both exclusion activities and habitat disturbance will occur when there will be the fewest number of Puget Sound Chinook salmon present.

2.5.2.2 Permanent Effects

Because the project includes adding new infrastructure, modifying stream and floodplain habitat, and riparian vegetation removal, and these modifications are expected to persist for the design life of the project (roughly 50 years), it is certain that all subsequent cohorts of PS Chinook salmon from the Sammamish River population will be exposed to and respond to the following changes:

Additional Overwater Cover

The proposed 31-foot- wide guideway will create approximately 2,000 square feet of overwater coverage, and the proposed 18-foot-wide pedestrian footbridge will create approximately 1,400 square feet of overwater coverage. The footbridge will replace the existing 14-foot-wide BNSF railway, which creates 420 square feet of overwater structure. Overwater structures created as part of the project will increase overwater cover by approximately 2,980 square feet.

A study on the effects of overwater shading on migrating juvenile salmon showed that bridges delay some migrating smolts (Bloch *et al.* 2009). The delays were typically short in duration as the smolts would migrate towards the shoreline prior to continuing their downstream migration. However, many predatory species prefer habitat under bridges, and the delay in salmonid migration may increase risk of predators (Bloch *et al.* 2009). The presence of overwater structures may also reduce the production of benthic and epibenthic macroinvertebrates due to reduced light transmission and decreased primary production through shading.

The guideway has a minimum clearance of 4.2 feet above the channel, and the footbridge will be at least 5 feet above the channel. A WSDOT (2009) study on light transmission under the SR 520 bridge found that low, wide, bridge decks create deep shade in an area underneath the bridge decks and have little to no vegetation growing beneath them. While the SR 520 bridge is much wider and its decks allow much less light penetration than the proposed guideway and footbridge, the low elevation of the guideway and footbridge over Bear Creek will create a similar light/dark interface that could disorient migrating fish, increase the risk of predation, and prevent or delay the growth and recruitment of riparian vegetation and forage material to support migrating juvenile Chinook salmon and their prey.

In-Water Structures and Fill

Abutments for the Bear Creek crossing and the fill used to protect the stormwater outfall pipes will occupy portions of the floodplain above the active channel, resulting in an artificial setting in place of native bank materials. The bridge support structure and bank armoring will affect natural channel-evolution processes, effects that will last for the life of the structures. Individual fish could grow slower due to less food supplied by an unnatural bank (Garland *et al*. 2002), such as a bridge abutment, as compared to a natural stream bank. This permanent loss will diminish the amount of refuge habitat within an area of 126 square feet in Bear Creek and 140 square feet in the Sammamish River. The loss will be offset by removing fill associated with the existing railroad bridge, which will increase stream channel area by approximately 1,000 square feet. Sound Transit will also enhance stream substrates in the action area and will install LWD below the OHWM to improve salmonid habitat.

The bridge support structures are limited in spatial extent and will occur only beneath the bridge. The fill associated with the stormwater outfall pipes will be contoured to the existing bank slope and will be placed to prevent the use of pipes as cover for predatory species. The changes to the extent of natural banks occurring in the action area and interruption to the channel evolution process are small relative to the remaining habitats in Bear Creek and the Sammamish River that will be unaffected by the proposed project, and the bridge support structures and fill will be exposed to water only during high flow conditions. Therefore, NMFS does not expect any habitat-related fitness consequences to Chinook salmon individuals due to the presence of in-water structure and fill.

Stormwater Discharge

Roadways collect a variety of pollutants from traffic and are disproportionate contributors to overall pollutant loads in water bodies (Wheeler *et al.* 2005). Pollutants are mobilized by runoff water and are transported to nearby water bodies. Traffic residue contains several metals including iron, zinc, lead, cadmium, nickel, copper, and chromium (Wheeler *et al.* 2005). The metals come off disintegrating tires, brake pads, and other vehicle parts, and accumulate in roadside dust and soil (Wheeler *et al.* 2005). Increased copper and zinc loading presents two pathways for possible adverse effects: 1) direct exposure to water column pollutant concentrations in excess of biological effects thresholds, and 2) indirect adverse effects resulting from the accumulation of pollutants in the environment over time, altered food web productivity, and possible dietary exposure. Dissolved copper and dissolved zinc are the constituents of greatest concern because they are prevalent in stormwater, are biologically active at low concentrations, and have adverse effects on salmonids (Sprague 1968; Sandahl *et al.* 2007).

Sub-lethal concentrations of dissolved copper have been shown to impair olfactory function in salmon in freshwater (Tierney *et al*. 2010). Baldwin *et al*. (2003) found that 30- to 60-minute exposures to a dissolved copper concentration of 2.3 µg/L over background levels caused olfactory inhibition in coho salmon juveniles. Sandahl *et al*. (2007) found that a 3-hour exposure to a dissolved copper concentration of 2.0 µg/L caused olfactory inhibition in coho salmon juveniles. That copper-induced loss of smell leads to a reduction in predator avoidance (McIntyre *et al*. 2008). Further, fish have shown avoidance of sub-lethal levels of dissolved copper in fresh water (Giattina *et al*. 1982).

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

Seven TDAs in the action area discharge to Bear Creek and the Sammamish River (see Table 1 and Figure 1). Table 2 details changes in pollutant loading under existing and proposed conditions. Overall, PGIS in the action area will decrease by 0.53 acre, reducing pollutant loading in the action area.

Changes in PGIS and associated pollutant loading differs between TDAs (Table 2). PGIS will decrease in all TDAs except TDA 2, which is expected to exhibit an increase in TSS. Runoff from TDA 2 will discharge to a vegetated dispersion area approximately 300 feet from the water's edge before discharging to Lake Sammamish. The vegetated dispersion area is expected to provide additional stormwater treatment, and any pollutants that reach the Sammamish River will be diluted to negligible levels almost immediately.

In TDA 4, all runoff from PGIS is currently infiltrated and will continue to be infiltrated, so no loading analysis was performed for that TDA. In TDA 7, the 0.39 acre of existing PGIS will be removed and no new PGIS will be constructed.

Table 2. Pre- and post-project median pollutant loads for each threshold discharge area (TDA) in the action area.

TDA	Scenario	TSS Load (lb/yr)	DCu Load (lb/yr)	DZn Load (lb/yr)
1	Existing	332	0.029	0.193
	Proposed	331	0.028	0.19
	Difference	-1	-0.001	-0.03
	Percent Change	-0.3%	-3.4%	-15.5%
2	Existing	7.54	0.004	0.021
	Proposed	7.6	0.004	0.021
	Difference	+0.06	0.0	0.0
	Percent Change	+0.8%	0.0%	0.0%
3	Existing	155	0.043	0.236
	Proposed	70	0.038	0.2
	Difference	-85	-0.005	-0.036
	Percent Change	-54.8%	-11.6%	-15.3%
5	Existing	4.56	0	0.002
	Proposed	0.004	0	0
	Difference	-4.556	0	-0.002
	Percent Change	-99.9%	0.0%	100%
6	Existing	6.66	0.004	0.018
	Proposed	5.9	0.003	0.017
	Difference	-0.76	-0.001	-0.001
	Percent Change	-11.4%	-25%	-5.6%

lb/year = pounds per year
TSS = total suspended solids
DCu = dissolved copper
DZn = dissolved zinc

Although the changes in pollutant loading vary between TDAs, overall pollutant loading in the entire action area (*i.e.*, all seven TDAs combined) will decrease compared to existing conditions. These results are consistent with expectations based on the combined effects of treating all new PGIS and removing some areas of existing PGIS in the action area. In individual TDAs where pollutant loading will increase, the increases will be negligible following the installation of stormwater treatment facilities or dilution once discharged to Lake Sammamish. Overall pollutant loading will improve over existing conditions, based on a decrease in the total amount of impervious surface and increased stormwater treatment facilities.

Permanent Removal of Riparian Vegetation.

Like the temporary removal of vegetation, indirect effects associated with the permanent removal of 24,600 square feet (0.74 acre) of riparian vegetation can result in increased water temperatures (Mitchell 1999; Opperman and Merenlender 2004) and decreased water quality (Lowrance *et al*. 1985; Welsch 1991), attributable to a loss of shade and cover over the active channel. Vegetation will be permanently removed for the new guideway and pedestrian bridge and may affect aquatic habitat and species.

The loss of riparian vegetation is unlikely to result in an increase in water temperature due to decreased riparian shading because the overwater structures will reduce the amount of sunlight that penetrates to the water's surface. The overwater structures consist of a footbridge and a guideway, neither of which include pollution-generating surfaces and are unlikely to decrease water quality. The adjacent areas that are similarly affected by construction will be re-vegetated.

Modified Floodplain Features

A portion of the fill prism will be removed to modify and enhance floodplain features. Habitat restoration would cause short-term, construction-related adverse effects and long-term beneficial effects to salmonid habitat. The short-term effects described above in *Water Quality Impacts – Construction Activities* are unlikely to occur because the fill prism removal will take place in the dry. Construction BMPs will be in place to minimize water quality impacts such as sedimentation and an increase in turbidity. The permanent alterations to salmonid habitat would have long-term beneficial effects by increasing the quality and quantity of spawning and rearing habitat. Existing floodplain topography would be enhanced to activate the floodplain more frequently and at depths and velocities more appropriate for rearing salmonids.

2.5.2.3 Project Effects as Modified by Proposed Revisions and Infeasibility of One RPM

Based on project revisions and the inability to meet one reasonable and prudent measure from the prior biological opinion, we anticipate that the amount of water quality diminishment associated with construction will double, occurring in two years rather than one, and persist slightly longer with the increase in the amount of landscape affected. The disturbed area will be larger than described above, but the nature and mechanisms of these effects of the land disturbance on Puget Sound Chinook salmon will remain unchanged. We assume that isolation work will occur once, and stay in place for the duration of the habitat restoration, thus fish handling will not increase, but the period of exclusion from the area of in-water habitat will persist across two rearing periods.

With regard to permanent effects, the amount of shaded habitat as a permanent effect will not increase from the originally described project, however the amount of take cannot be reduced or minimized by the prior reasonable and prudent measure, due to engineering constraints.

Finally, over time, the restored area, being somewhat larger than originally described, should also increase the amount of habitat benefit for rearing juvenile Chinook salmon as a permanent effect, and may afford a minor increase in individual fitness and/or survival among the specific population affected.

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

The only reasonably foreseeable future actions that have no federal nexus and that could adversely affect ESA-listed species consist of urban development projects on private lands. If such projects result in the conversion of relatively undisturbed areas to housing, landscaping, and impervious surfaces, they could contribute to increased flows and pollutant loading in waters that support ESA-listed fish. No projects with that potential have been identified in the action area. Most lands in the action area are already heavily developed; those that are not developed (*e.g.*, Marymoor Park) are zoned for uses that preclude such development. Any future projects, therefore, would consist of redevelopment of existing developed parcels rather than conversion of relatively undisturbed areas. In addition, by improving habitat conditions in Bear Creek and by reducing the amount of PGIS within the action area, the project is expected to generate long-term benefits for ESA-listed species in the action area.

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 versus cumulative effects. Therefore, while relevant future climate-related environmental conditions in the action area are described briefly in the environmental baseline (Section 2.4), it bears noting that over the anticipated lifespan of the project (approximately 50 years), that air temperatures, water temperatures, stream volumes and velocities, and flood hydrographs are all likely to have increasing extremes, which can impair fish survival and frustrate recovery efforts.

2.7 Integration and Synthesis

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

Puget Sound Chinook salmon are threatened with extinction due to reduced abundance, productivity, spatial structure, and diversity, driven in part by system degradation or loss of habitat. The environmental baseline of the specific population of this species—Sammamish River Chinook—is such that individual Chinook salmon in the action area are exposed to reduced water quality, lack of suitable riparian and aquatic habitat, and restricted movement due to developed urban areas and land use practices. These stressors, as well as those from climate change, already exist and are in addition to any adverse effects produced by the proposed action. Major factors limiting recovery of Puget Sound Chinook salmon include degraded nearshore habitat, riparian areas and large wood recruitment, stream substrate, streamflow, fish passage, water quality, harvest and hatchery impacts, predation and competition, and disease.

When we consider the effects of the proposed action on the factors limiting recovery for Puget Sound Chinook salmon we include the temporary and/or minimal effects from the reduction in water quality due to construction activities and treated timber pile removal, the episodic water quality impairment from road runoff and stormwater, the loss of riparian vegetation, and the exclusion from rearing and migration habitat, and adverse effects from injury or mortality due to dewatering and fish exclusion activities and significant behavior changes due to increased overwater structures. The reduction in water quality will be short-term during the removal of treated timber piles and in-water construction activities. The permanent effects of new infrastructure will include behavioral changes among 100 percent of all cohorts of this population while the guideway and pedestrian bridge remain over the channel.

Even though the project will result in adverse effects on Chinook salmon that may affect Chinook salmon survival and recovery, the beneficial effects of the floodway redesign could improve carrying capacity and have an overall positive effect on the population. The total abundance of individuals within the population is extremely small, so even though the likelihood of an individual being in the action area during in-water work is low, any affect to an individual in this population is significant. Likewise, the long-term shading impacts caused by the presence of 3,400 square feet of overwater structures may result in population-level effects. However, the improvements to the habitat, such as removing existing creosote piles, enhancing floodplain habitat, and replacing non-functioning invasive vegetation with functional riparian species will have long-term benefits to the population and improve the habitat for spawning, rearing, and migrating salmonids. The cumulative effects described above are expected to have a positive effect on Chinook salmon populations.

Although the proposed actions may affect the long-term abundance or productivity of the affected population, the beneficial floodway design could improve the carrying capacity of the reach and have an overall positive effect on the population. The proposed action will have no effect on population diversity or spatial structure. Therefore, the proposed action will not reduce the productivity or survival of the affected population of Puget Sound Chinook salmon, even when combined with the degraded environmental baseline and additional pressure from cumulative effects and climate change.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the modified proposed action, the effects of other activities caused by the proposed action, and cumulative effects, and the project without the minimizing character of the term and condition related to overwater shading, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of Puget Sound Chinook salmon. No critical habitat has been designated or proposed for this species; therefore, none was analyzed.

2.9 Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). “Incidental take” is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and Section 7(o)(2) of the ESA 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 this biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows: Puget Sound Chinook salmon may be present in the action area and may be: 1) injured or killed during worksite isolation and fish exclusion and removal, and 2) their behavior may change significantly with habitat loss from shading due to large overwater structures. Although available information indicates that juvenile Chinook may be present and exposed to project construction activities, the density of the species in the action area is unknown. Additionally, there is no way to observe or count the number of fish affected without potentially increasing the number of injured or killed fish. For actions causing “harm,” the amount of take is extremely difficult and frequently impossible to quantify in terms of the number of affected fish. This impossibility occurs because the change in habitat conditions and fish response is not linear and the range of fish responses to habitat modification is highly variable. In the ESA, “harm” in the definition of “take” includes significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). Therefore, when NFMS cannot quantify take in numbers of fish, NMFS quantifies take in terms of the extent of habitat modified, because exposure to changes in habitat, and responses to those changes, are the mechanisms that harm individuals of the species, and the extent of modified habitat can be easily monitored and measured.

Because NMFS cannot quantify the number of fish that will be exposed to in-water work related to the proposed action, or exposed to the additional in- and over-water structures, NMFS quantifies the extent of take for the proposed action based on the physical area of: 1) the worksite areas to be isolated and 2) habitat underneath overwater cover.

NMFS cannot estimate the number of individuals that will experience adverse effects from fish capture and handling or the presence of overwater structure over Bear Creek. To conduct the work in the dry and prevent harm to fish from in-water construction, approximately 12,900 square feet (0.30 acre) will be dewatered and all remaining fish will be captured and released by qualified personnel. Most fish are expected to leave the area during the dewatering phase.

The project will increase the overall amount of bridge structure (pedestrian footbridge and guideway) that is over the Bear Creek channel. NMFS cannot estimate the proportion of fish each year that will be affected by the presence of overwater structures. Therefore, NMFS will use the overall area of the overwater structures as a surrogate for the number of Puget Sound Chinook salmon affected. Take from the continued presence of the overwater structure is reasonably certain to occur within the 3,400 square feet (0.08 acre) of channel impacted from overwater structure.

For this opinion, we summarize the extent of take in Table 3.

Table 3. Take summary.

Species	Life Stage	Type of Take	Description of Take Mechanism	Maximum Numbers Affected or Area Affected
Puget Sound ESU Chinook salmon	Juvenile	Harm	Fish capture and handling	Fish will be excluded from a dewatered area of 11,250 square feet in Bear Creek and 1,650 square feet in the Sammamish River (total 0.30 acre). Any fish that do not leave during the dewatering phase will be captured and released by qualified personnel.
Puget Sound ESU Chinook salmon	Juvenile and adult	Harm	Long-term habitat modification that reduces fitness and survival	3,400 square feet (0.08 acre) of habitat will be degraded by overwater structures for the expected life of the structure.

2.9.2 Effect of the Take

In this 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 nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). The RPMs must be carried out for the exemption in Section 7(o)(2) to apply.

The FTA shall minimize take of Puget Sound Chinook salmon. The following reasonable and prudent measures are necessary and appropriate to minimize take of this species. FTA shall:

1. Minimize incidental take from worksite isolation and fish handling during construction activities;

2. Minimize incidental take from modified floodplain and riparian habitat

3. Ensure the completion of a monitoring and reporting program to confirm that this biological opinion is meeting its objective of limiting the extent of take and minimizing take from permitting activities per 50 CFR 402.14(i)(1)(iv) and 50 CFR 402.14(i)(3).

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the FTA or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The FTA 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 RPM 1 (worksite isolation):
    a. Intakes for all pumps used for the project have fish screens installed, operated, and maintained according to NMFS' fish screen criteria (NMFS 2011) or equivalent.
    b. Any fish trapped in the in-water work area before dewatering will be herded out or removed and released to suitable habitat as near to the capture site as possible in compliance with the WSDOT Fish Exclusion Protocols and Standards (2016) or equivalent).
    c. ESA-listed fish will be handled with extreme care; fish will be kept in water to the maximum extent possible during dewatering, capture, and transfer.
    d. If electrofishing equipment is used to capture fish, it shall comply with the WSDOT Fish Exclusion Protocols and Standards (2016) or equivalent.
        i. Electrofishing will not be used if water temperatures exceed 64°F (18°C) or are expected to rise above 64°F (18°C), unless no other method of capture is available.
        ii. Water quality conditions are adequate in buckets or tanks used to transport fish by providing circulation of clean, cold water, using aerators to provide dissolved oxygen, and minimizing holding times.
        iii. NMFS, or its designated representative, is allowed to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities.
2. The following terms and conditions implement RPM 2 (floodplain and riparian habitat):
    a. Ensure 80 percent planting survival over the first 5 years post revegetation.
3. The following terms and conditions implement RPM 3 (monitoring):
    a. FTA shall ensure that all monitoring items will include, at a minimum, the following:
        i. Project identification:
            1) Project name: Downtown Redmond Link Extension Project

2) NMFS Tracking Number: WCR-2018-8825
3) A description of any elements of the project that were constructed differently than proposed
4) Water quality monitoring reports
5) Description and photos of the as-built restoration area

Submit monitoring report to NOAA Fisheries, Attention: Jennifer Quan, 7600 Sand Point Way NE, Seattle, WA 98115.

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 designated critical habitat or regarding the development of information (50 CFR 402.02).

NMFS recommends an evaluation of the habitat values from the floodplain recontouring after a period of 5 years, to determine if Sammamish fish abundance or productivity have improved.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Sound Transit Downtown Redmond Link Extension Project.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if: 1) the amount or extent of incidental taking specified in the ITS is exceeded, 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, 3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects on 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.

Based on this analysis, NMFS concurs with the COE that the proposed action is not likely to adversely affect Puget Sound steelhead. The action area does not contain Puget Sound steelhead critical habitat.

Puget Sound DPS Steelhead

The Puget Sound steelhead DPS comprises 32 populations. The DPS is currently at a very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the Puget Sound steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review (NWFSC 2015). Furthermore, the Puget Sound Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent major population groups and many of its 32 populations. In the near term, the outlook for environmental conditions affecting Puget Sound steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue.

The number of naturally spawned steelhead within the North Lake Washington and Lake Sammamish population is very low. The most recent 5-year estimate of spawning abundance was 12 fish (Ford 2011). Spawning abundance for this population could not be estimated for the subsequent status review update (NWFSC 2015). Based on the low counts from the Ballard locks and low documented natural spawning among the North Lake Washington and Lake Sammamish population (U.S. Army Corps of Engineers and King County 2002; NWFSC 2015; WDFW 2018), steelhead are unlikely to be present in the Sammamish River.

WDFW operates a smolt trap in Bear Creek to estimate the production of Chinook salmon, coho salmon, and steelhead, located along the downstream portion of the action area. Between 2007 and 2008, WDFW captured one steelhead smolt; none were captured in 2009 (Kiyohara and Volkhardt 2008; Kiyohara and Zimmerman 2009, 2011). Further analysis conducted for the Lower Bear Creek Restoration Project found that steelhead no longer occupy Bear Creek, and habitat suitable to sustain a steelhead population in Bear Creek does not exist (Shannon 2009). Given the very low abundance and infrequent presence of steelhead in Bear Creek and the Sammamish River, combined with the lack of suitable spawning or rearing habitat, NMFS concludes that steelhead are extremely unlikely to occur in the action area and the project effects on the Puget Sound steelhead DPS will be discountable.

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

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

This analysis is based, in part, on the EFH assessment provided by the COE and descriptions of EFH for Pacific Coast salmon (PFMC 2016) 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 proposed action and action area for this consultation are described in the introduction (Section 1) of this document. The action area includes areas designated as EFH for Pacific Coast salmon but does not occur within a Habitat Area of Particular Concern.

3.2 Adverse Effects on Essential Fish Habitat

NMFS determined that the proposed action will have adverse effects on EFH designated for Pacific Coast salmon, based on information provided in the 2018 biological assessment (Sound Transit 2018) and the analysis of effects presented in the ESA portion of this document. NMFS determined that the proposed action will adversely affect EFH by temporarily diminishing water quality, and by permanently degrading habitat through the continued presence of overwater structure, but will have an overall positive affect by improving the floodway and increasing the salmonid carrying capacity.

The EFH of forage, rearing, and migrating habitat (3,400 square feet [0.08 acre]) will be affected by overwater structure (pedestrian footbridge and guideway).

3.3 Essential Fish Habitat Conservation Recommendations

NMFS expects that full implementation of the following EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, approximately 47.7 acres of designated EFH for Pacific Coast salmon. This calculation is based on the amount of habitat presumed to be disturbed by elevated turbidity and altered hydrology. The conservation recommendations include a subset of the ESA terms and conditions. The NMFS recommends that FTA:

- Ensure at least 80 percent survival of replanted native vegetation within floodplain and riparian habitat.

Fully implementing this EFH conservation recommendation would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 3,400 square feet (0.08 acre) of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

The COE 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 those DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the FTA, NMFS, and COE. Other interested users could include WSDOT, the residents in the city of Redmond, King County, the State of Washington, and the general public. Individual copies of this opinion were provided to the above listed entities. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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