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

Refer to NMFS No. WCRO-2019-00111
https://doi.org//10.25923/470r-jh52

July 19, 2019

Daniel Mathis
Division Administrator
U.S. Department of Transportation
Federal Highway Administration
Suite 501 Evergreen Plaza
711 South Capitol Way
Olympia, Washington
98501-1248

Re: Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation for the Replacement of the West Cashmere Bridge over the Wenatchee River in Chelan County, Washington (170200110707 Olalla Canyon–Wenatchee River).

Dear Mr. Mathis:

Thank you for your letter dated January 8, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (U.S.C. 1531 et seq.) for the replacement of the West Cashmere Bridge over the Wenatchee River at the City of Cashmere in Chelan County, Washington. In this biological opinion (opinion), NMFS concluded that the proposed action is not likely to jeopardize the continued existence of ESA-listed Upper Columbia River (UCR) spring-run Chinook salmon (*Oncorhynchus tshawytscha*) or UCR steelhead (*O. mykiss*), or result in the destruction or adverse modification of their critical habitat.

As required by section 7 of the ESA, NMFS provided an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize incidental take associated with these actions. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the federal agency and any person who performs the action must comply with to carry out the RPMs. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

We also evaluated potential impacts of the action on essential fish habitat (EFH) 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 regulation at 50 CFR 600. We concluded that the proposed action would adversely affect Pacific Coast salmon EFH; therefore, the enclosed document also includes our conservation recommendations to address those adverse effects.

Please contact Diane Driscoll of the Columbia Basin Branch at (509) 962-8911 x809 or electronic mail at diane.driscoll@noaa.gov with any questions or comments concerning this section 7 consultation.

Sincerely,

Michael P. Tehan
Assistant Regional Administrator
Interior Columbia Basin Area Office
NOAA Fisheries, West Coast Region

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act (MSA) Essential Fish Habitat (EFH) Consultation

Replacement of the West Cashmere Bridge over the Wenatchee River at Cashmere, Washington

NMFS Consultation Number: WCRO-2019-00111

Action Agency: U.S. Department of Transportation

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or critical habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify critical habitat?
Upper Columbia River spring-run Chinook salmon	Endangered	Yes	No	No
Upper Columbia River steelhead	Threatened	Yes	No	No

Fishery Management Plan That Describes 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:

Michael P. Tehan
Assistant Regional Administrator

Date: _____

TABLE OF CONTENTS

LIST OF TABLES ii
ACRONYM GLOSSARY iii
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Consultation History 1
1.3 Proposed Action 2
2.0 ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT 5
2.1 Analytical Approach 6
2.2 Range-wide Status of the Species and Critical Habitat 7
2.2.1 Status of the Species 7
2.2.2 Status of Critical Habitat 13
2.2.3 Climate Change 15
2.3 Action Area 16
2.4 Environmental Baseline 16
2.5 Effects of the Action 20
2.5.1 Effects on Species 20
2.5.2 Effects on Critical Habitat 26
2.6 Cumulative Effects 28
2.7 Integration and Synthesis 29
2.8 Conclusion 32
2.9 Incidental Take Statement 32
2.9.1 Amount or Extent of Take 32
2.9.2 Effect of the Take 35
2.9.3 Reasonable and Prudent Measures 35
2.9.4 Terms and Conditions 35
2.10 Conservation Recommendations 38
2.11 Reinitiation of Consultation 38
3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE 38
3.1 Essential Fish Habitat Affected by the Project 39
3.2 Adverse Effects on Essential Fish Habitat 39
3.3 Essential Fish Habitat Conservation Recommendations 39
3.4 Statutory Response Requirement 40
3.5 Supplemental Consultation 40
4.0 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW 40
4.1 Utility 40
4.2 Integrity 41
4.3 Objectivity 41
5.0 REFERENCES 42

LIST OF TABLES

Table 1. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for ESA-listed species considered in this consultation. Listing status: 'T' means listed as threatened; 'E' means listed as endangered..... 8

Table 2. Summary of the Upper Columbia River spring-run Chinook salmon population status and Interior Columbia Basin Technical Recovery Team viability criteria..... 9

Table 3. Estimate of hatchery origin spawning escapement for Upper Columbia River spring-run Chinook salmon populations..... 10

Table 4. Matrix used to assess the status of Upper Columbia River spring-run Chinook salmon populations across Viable Salmonid Population parameters or attributes. 10

Table 5. Summary of the Upper Columbia River steelhead population status and Interior Columbia Basin Technical Recovery Team viability criteria. 11

Table 6. Estimate of hatchery origin spawning escapement for UCR steelhead populations. ... 12

Table 7. Matrix used to assess the status of Upper Columbia River steelhead populations across Viable Salmonid Population parameters or attributes. 12

Table 8. Physical and biological features of critical habitats designated for ESA-listed salmon and steelhead species considered in this opinion. 14

Table 9. Monthly mean temperatures at USGS gage 12462500 at Monitor, Washington, River Mile 5.5 (2019). 17

ACRONYM GLOSSARY

BA	Biological Assessment
BMP	Best Management Practice
BNSF	Burlington Northern Santa Fe
CFR	Code of Federal Regulations
County	Chelan County Public Works Department
cSEL	Cumulative Sound Exposure Level
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FHWA	Federal Highway Administration
FHWG	Fisheries Hydroacoustic Working Group
FR	Federal Register
HUC	Hydrologic Unit Code
ICTRT	Interior Columbia Basin Technical Recovery Team
ISAB	Independent Scientific Advisory Board
ITS	Incidental Take Statement
LWD	Large Woody Debris
MSA	Magnuson–Stevens Fishery Conservation and Management Act
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
OHWM	Ordinary High Water Mark
opinion	Biological Opinion
PBF	Physical and Biological Feature
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
Project	West Cashmere Bridge Replacement Project
RM	River Mile
RMS	Root Mean Square
RPM	Reasonable and Prudent Measure
SEL	Sound Exposure Level
SPCC	Spill Prevention, Control and Countermeasures
TESC	Temporary Erosion and Sediment Control
U.S.C.	United States Code
UCR	Upper Columbia River
UCSRB	Upper Columbia Salmon Recovery Board
USFWS	U.S. Fish and Wildlife Service
VSP	Viable Salmonid Population
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington State Department of Ecology
WSDOT	Washington State Department of Transportation

1.0 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) (16 U.S.C. 1531 et seq.), and its implementing regulations at 50 CFR 402.

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Columbia Basin Branch field office in Ellensburg, Washington.

1.2 Consultation History

The following chronology documents key points of the consultation process that culminated in this opinion for NMFS listed species:

- June 22, 2017. The Chelan County Public Works Department (County), Washington State Department of Transportation (WSDOT) and the Federal Highway Administration (FHWA) met with NMFS, U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW) and the Washington State Department of Ecology (WDOE) to discuss the proposed replacement of the Cashmere West Bridge over the Wenatchee River in Cashmere, Chelan County, Washington. NMFS advised the County and WSDOT of the presence of ESA-listed species, their timing and habitat use in the area and likely requirements for the construction process.
- May 17, 2018. NMFS received an electronic biological assessment (BA) and request for formal consultation from FHWA for the replacement of the Cashmere West Bridge over the Wenatchee River at the City of Cashmere, Chelan County, Washington.
- June 18, 2018. After reviewing the BA, NMFS provided the County and FHWA with additional questions and concerns regarding the construction procedures.
- July 20, 2018. NMFS, USFWS and WDFW requested additional information from the County and WSDOT.
- October 11, 2018. The County and FHWA withdrew the request for consultation until the information requested by the NMFS, USFWS, and WDFW was available.
- January 8, 2019. The County and FHWA submitted a revised BA and a request for formal consultation.

- February 8, 2019. After review of the BA, NMFS initiated formal consultation with FHWA.
- June 5, 2019. NMFS and the County and FHWA agreed to extend the consultation timeline to July 22, 2019.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 CFR 402.02). "Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02). No interrelated actions or interdependent actions were identified for the proposed action.

The FHWA proposes to provide funding to the County to replace the West Cashmere Bridge over the Wenatchee River (Evans and Associates 2018). The County will replace the existing 89-year-old, fracture-critical bridge with a steel plate girder bridge with a cast-in-place concrete deck. The existing bridge has six piers. The new bridge will have four piers, with one pier mid-channel that will support three spans. The County will demolish the old bridge except for the existing bridge, Pier 4, between the Burlington Northern Santa Fe (BNSF) railroad tracks and the south side of the river. At this location, the base of the existing pier will be left intact, because it is serving as a retaining wall for the railroad fill prism. Removing it could destabilize the railroad tracks. The County may use up to 100 cubic yards (yd^3) of riprap to stabilize the bank between the pier and the river.

The proposed action is within the Wenatchee River, a major tributary to the Columbia River and is used in the action area for rearing and migration by Upper Columbia River (UCR) spring-run Chinook salmon and by UCR steelhead for spawning, rearing and migration.

The County estimates in-water work at the proposed bridge location will occur over a period of two construction seasons. Approximately 40 yd^3 of existing concrete and other material will be removed from the old pile cap for installation of the new pier. The County intends to leave the remaining portion of the pile cap below grade in place unless it restricts or prevents installation of the new and smaller pier, then it will be fully removed within the cofferdam. Activities to occur below the ordinary high water mark (OHWM) will include:

- Installing a cofferdam around the center bridge pier,
- Dewatering within the cofferdam,
- Pile driving up to 90 12- to 14-inch-diameter H-piles,
- Pre-drilling at pile locations and for the proposed sheet pile cofferdam,
- Installing and removing the work trestle,
- Demolishing the existing center pier and installing a new support column in the same location,
- Potentially installing up to 100 yd^3 of riprap to protect the pier adjacent to the BNSF tracks, and
- Removing bridge demolition debris.

In-water work will occur during the WDFW-approved fish work window of July 15 to September 30. Demolition of the near-shore or on-shore piers of the existing bridge will be isolated from the water by a cofferdam. Fish will be removed from the interior of the cofferdam according to standard WSDOT fish salvaging protocols (2012). The proposed cofferdam will be reinforced sheet piling or similar design approximately 40 feet long and 20 feet wide to surround the existing pier pile cap and sufficient to withstand peak flows in the Wenatchee River in between construction seasons.

The construction of the West Cashmere Bridge Replacement Project (Project) will require approximately 65 yd^3 of excavation below the OHWM to allow room for the new shaft in the center pier. Approximately 10 yd^3 of fill will be placed in the area surrounding the shaft below the OHWM. If the pile cap of the existing pier below the grade prevents installation of the new pier (worst-case scenario), the County will need to excavate an estimated 250 yd^3 of material below the OHWM, and an estimated 200 yd^3 of fill would then be placed around the new pier below the OHWM.

The Project will permanently remove up to 20 trees, most are saplings, along the existing riverbanks or on adjacent properties, which are in close proximity to the existing bridge and will be in the way of construction. This impact assumes a temporary riparian disturbance area extending up to 40 feet upstream and downstream from the bridge and 20 feet landward of the wetted edge of the river or 1,066 square yards (yd^2) around the bridge on the north and south banks.

Staging areas will be located in previously disturbed areas, including the open parcel northwest of the intersection of U.S. Highway 2 and Hay Canyon Road, as well as the north approach to the existing bridge (after the road is closed). These areas currently do not support any native vegetation. Any exposed soils in close proximity to the Wenatchee River will be stabilized during construction and with hydroseeding and/or native grasses, shrubs and trees after construction.

Stormwater runoff from the Project will be treated in compliance with the design standards set forth in the WSDOT Highway Runoff Manual (2016) and/or the WDOE Stormwater Management Manual for Eastern Washington (2004). Stormwater treatment will include a combination of bioswales, drywells and/or stormwater ponds. There will be no direct surface water discharge to any local waterbodies. Temporary Erosion and Sediment Control (TESC) measures will be installed prior to and during construction to minimize pollutants from entering into the Wenatchee River. Approximately 2.29 acres of existing impervious surface exists in the Project area, of which approximately 96 percent is pollution generating. Currently, the existing impervious surface area is infiltrated or dispersed. The Project would result in a net gain of approximately 29,500 square feet (0.67 acre) of impervious surface. This is the result primarily of the increased road length to accommodate the U.S. Highway 2 to Hay Canyon Road modification. All of this 0.67 acre will be treated by infiltration and dispersion.

Pile driving will be required to install the temporary work trestle. Up to 90 12-to 14-inch-diameter, steel H-piles will be used to support the temporary work trestle. Because of the potential difficulties with driving piles in a rocky substrate, the County is including the potential need for pre-drilling of pile locations and for the proposed sheet pile cofferdam to loosen the substrate and break up material. The County will accomplish pre-drilling using a 4- to 6-inch-diameter rotary drill auger, similar to what is used in geotechnical drilling applications. Pre-drilling will make subsequent impact and vibratory pile driving more effective. Finally, it is assumed (under a worst-case scenario) that vibratory pile driving will be ineffective and all piles will need to be driven using an impact pile driver. Nonetheless, the contractor will be required to attempt vibratory driving prior to using an impact hammer, per the impact minimization measures described below. Any piles driven using a vibratory hammer will need to be tested with an impact hammer.

Best Management Practices and Minimization Measures

The FHWA will ensure that the County complies will the following Best Management Practices (BMPs) and minimization measures:

- Vibratory pile driving will be used whenever feasible for temporary structures.
- Where necessary, dewatering and approved fish handling methods will be conducted.
- Sound attenuation measures will be used for impact pile driving, including, but not limited to, confined bubble curtains, cushion blocks, etc., in order to reduce peak noise levels.
- Conduct noise monitoring to ensure that impact pile driving does not exceed authorized take limits.
- In-water work resulting in turbidity levels above WDOE water quality standards will be required to implement BMPs to reduce levels of sediment until compliance is achieved.
- A TESC and a Source Control Plan will be developed and implemented for all activities requiring clearing, vegetation removal, grading, ditching, filling, embankment compaction, or excavation. The BMPs in the plans will be used to control sediments from all vegetation removal or ground-disturbing activities.
- Only vegetation impacted by construction will be close cut or trimmed as appropriate. Delineate clearing limits with orange barrier fencing wherever clearing is proposed in, or adjacent, to a stream/wetland or its buffer.
- The contractor shall use appropriate erosion control measures (e.g., blankets, wattles) on steep slopes that are susceptible to erosion and where ground-disturbing activities have occurred. This will reduce erosion and assist with establishment of native vegetation.
- The contractor will designate at least one employee as the TESC lead. The TESC lead will be responsible for the installation and monitoring of erosion control measures and maintaining spill containment and control equipment. The TESC lead will also be responsible for ensuring compliance with all local, state, and federal erosion and sediment control requirements.
- Inspect all temporary and permanent erosion and sedimentation control measures on a regular basis; maintain and repair to assure continued performance of their intended function. Inspect silt fences immediately after each rainfall, and at least daily during prolonged rainfall. Remove sediment as it collects behind the silt fences and prior to their final removal.

- Where practicable for soil stability, the contractor will use a native vegetation and/or a native seed mixture to revegetate areas disturbed by construction activities. Exposed soils will be seeded and covered with appropriate mulch after construction is complete.
- The contractor will install a containment system under the existing bridge to keep any foreign material from entering waters of the state during demolition of the existing bridge and associated piers.
- Equipment use within the wetted perimeter will comply with the following provisions:
    - Equipment shall be thoroughly cleaned of mud, petroleum products, or other deleterious material.
    - Turning and spinning within the wetted area is not allowed.
    - The stream bank and streambed or wetted area shall be returned to pre-Project condition prior to Project completion.
- The contractor shall prepare a Spill Prevention, Control, and Countermeasures (SPCC) Plan prior to beginning construction. The SPCC Plan shall identify the appropriate spill containment materials, which will be available at the Project site at all times.
- All equipment used for construction activities shall be cleaned and inspected prior to arriving at the Project site to ensure no potentially hazardous materials are exposed, no leaks are present, and the equipment is functioning properly.
- The contractor will inspect construction equipment daily to ensure there are no leaks of hydraulic fluids, fuel, lubricants, or other petroleum products. Should a leak be detected on heavy equipment used for the Project, the equipment shall be immediately removed from the area and not used again until adequately repaired.
- Project staging and material storage areas shall be located a minimum of 150 feet from perennial surface waters, in currently developed or previously disturbed areas such as parking lots or managed fields.
- Material that may be temporarily stored for use in Project activities shall be covered following WSDOT Standard Specifications for Road, Bridge and Municipal Construction with plastic or other impervious material to prevent sediments from being washed from the storage area to surface waters.
- If necessary, every 6 months until Project construction is completed, a biologist shall re-evaluate the Project for changes in design, and for potential impacts associated with those changes, as well as the status and location of listed species.
- No paving, chip sealing, or stripe painting will occur during periods of significant rain or wet weather.
- A concrete truck chute cleanout area shall be established to properly contain wet concrete.

2.0 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, federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. 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 habitat. If incidental take is expected, 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.

2.1 Analytical Approach

This opinion includes both a jeopardy analysis and 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 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 for the conservation of a listed species. As described in the Federal Register (FR), such alterations may include, but are not limited to, those that alter the physical and biological features (PBFs) essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

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 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 opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

- Identify the range-wide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Range-wide 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.

2.2.1 Status of the Species

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). These "viable salmonid population" criteria therefore encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these 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. These attributes are influenced by survival, behavior, and experiences throughout a species' entire life cycle, and these 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).

The summary that follows describe the status of the ESA-listed species and their designated critical habitats that are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 1) and in the most recent 5-year status review (NMFS 2016) , as well as applicable recovery plans and 5-year status reports. These additional documents are incorporated by reference.

Table 1. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for ESA-listed species considered in this consultation. Listing status: 'T' means listed as threatened; 'E' means listed as endangered.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Upper Columbia River spring-run	E 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	ESA section 9 applies
Steelhead (*O. mykiss*)			
Upper Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	2/01/06; 71 FR 5178

Upper Columbia River Spring-run Chinook salmon

On March 24, 1999, NMFS listed UCR spring-run Chinook salmon as an endangered species (64 FR 14308) and their endangered status was reaffirmed on June 28, 2005 (70 FR 37160), August 15, 2011, after a 5-year status review (76 FR 50448), and again on May 26, 2016, after a 5-year status review (81 FR 33468). The evolutionarily significant unit (ESU) includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam, excluding the Okanogan River (64 FR 14208). Three populations of UCR spring-run Chinook salmon are included in this ESU: the Wenatchee, Entiat, and Methow. Six artificial propagation programs are included in this ESU: The Twisp River, Chewuch River, Methow Composite, Winthrop National Fish Hatchery (NFH), Chiwawa River, and White River spring-run Chinook salmon hatchery programs.

UCR spring-run Chinook salmon exhibit stream-type life history strategies. Adults begin returning from the ocean in the early spring, with the run into the Columbia River peaking in mid-May. They then enter UCR tributaries from April through July, where they hold until spawning occurs in the late summer, peaking in mid to late August. Juvenile spring-run Chinook salmon spend a year in freshwater before migrating to the ocean. Most UCR spring-run Chinook salmon return as adults after 2 or 3 years in the ocean.

Abundance and Productivity. Both abundance and productivity characteristics remain at "high" risk for each of the three populations in this ESU (Table 2). The most recent 10-year (2005 to 2014) geometric mean abundance of adult natural origin spawners has increased for each population relative to the levels for the 1999 to 2008 series, but the estimates remain well below the minimum abundance targets for recovery. Estimated productivity (returns-per-spawner) was on average about the same in the current period and the previous period. This indicates that UCR spring-run Chinook salmon populations are not replacing themselves. Increases in natural origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging; however, average productivity levels remain extremely low. Possible contributing factors include density dependent effects, differences in spawning distribution relative to habitat quality, and reduced fitness of hatchery-origin spawners. Overall, the combinations of current abundance and productivity for each population result in a "high" risk rating.

Table 2. Summary of the Upper Columbia River spring-run Chinook salmon population status and Interior Columbia Basin Technical Recovery Team viability criteria.

	Abundance and Productivity Metrics				Spatial Structure and Diversity Metrics			Rating
Population	Abundance Threshold	Natural Spawning Abundance 2005-2014	Productivity (returns-per-spawner) 2005-2014	Integrated Abundance/ Productivity Risk	Natural Process Risk	Diversity Risk	Integrated Spatial Structure/ Diversity Risk	Overall Viability Rating
Wenatchee	2000	545	0.60	High	Low	High	High	High Risk
Methow	2000	379	0.46	High	Low	High	High	High Risk
Entiat	500	166	0.94	High	Moderate	High	High	High Risk

Spatial Structure and Diversity. The integrated spatial structure and diversity risk ratings for all three populations in this ESU are at "high" risk. The spatial processes component is "low" for the Wenatchee River and Methow River populations and "moderate" for the Entiat River (loss of production in the lower section increases effective distance to other populations). All three of the populations in this ESU are at "high" risk for diversity, driven primarily by chronically high proportions of hatchery-origin spawners of 26 to 76 percent (Table 3) in natural spawning areas and lack of genetic diversity among the natural-origin spawners (Ford 2011; NMFS 2014; NWFSC 2015). This effect is particularly high in the Wenatchee and Methow populations with hatchery spawners composing 66 percent and 76 percent respectively (NMFS 2014). The high proportion of hatchery spawners reflects the large increase in releases from the directed supplementation programs in those two drainages. The hatchery supplementation program in the Entiat was discontinued in 2007 and hatchery fish on the spawning grounds in the Entiat have declined in recent years.

Table 3. Estimate of hatchery origin spawning escapement for Upper Columbia River spring-run Chinook salmon populations.

Population	% Hatchery Origin (5-year average)		
	2000 to 2004	2005 to 2009	2010 to 2014
Wenatchee	46	76	65
Entiat	44	53	26
Methow	84	73	76

The UCR spring-run Chinook salmon ESU is not currently meeting the viability criteria (adapted from the Interior Columbia Basin Technical Recovery Team (ICTRT)) in the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan) and remains at a high risk of extinction (Ford 2011; NMFS 2011b; NWFSC 2015), see Table 4.

Table 4. Matrix used to assess the status of Upper Columbia River spring-run Chinook salmon populations across Viable Salmonid Population parameters or attributes.

		Risk Rating for Spatial Diversity			
		Very Low	Low	Moderate	High
Risk Rating for Abundance/Productivity	Very Low (<1%)	High Viable	Highly Viable	Viable	Maintained
	Low (1–5%)	Viable	Viable	Viable	Maintained
	Moderate (6–25%)	Maintained	Maintained	Maintained	High Risk
	High (>25%)	High Risk	High Risk	High Risk	High Risk **Wenatchee Entiat Methow**

Upper Columbia River Steelhead

The UCR steelhead Distinct Population Segment (DPS) was listed as endangered on August 18, 1997 (62 FR 43937), and their status was upgraded to threatened on January 5, 2006 (71 FR 834). The threatened status was affirmed on August 15, 2011, after a 5-year status review (76 FR 50448), and again on May 26, 2016, after a 5-year status review (81 FR 33468). The UCR steelhead DPS includes all naturally-spawned populations of steelhead in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the United States–Canada border (62 FR 43937). There are four populations of UCR steelhead included in this DPS—the Wenatchee, Entiat, Methow, and Okanogan. Six artificial propagation programs are considered part of the DPS: the Wenatchee River, Wells Hatchery in the Methow and Okanogan rivers, Winthrop NFH, Omak Creek, and the Ringold steelhead hatchery programs.

The life-history pattern of steelhead in the Upper Columbia is complex (Shields and Gray 1992). Adults return to the Columbia River in the late summer and early fall. Unlike spring-run Chinook salmon, most steelhead do not move up quickly to tributary spawning streams. A portion of the returning run overwinters in the mainstem reservoirs, passing over the UCR dams in April and May of the following year. Spawning occurs in the late spring. Juvenile steelhead generally spend 1 to 3 years rearing in freshwater before migrating to the ocean, but have been documented spending up to 7 years in freshwater before migrating. Most adult steelhead return to the Upper Columbia River after 1 or 2 years at sea.

Abundance and Productivity. Both abundance and productivity characteristics remain at "high" risk for three of the four populations in this DPS (Table 5). Although, UCR steelhead populations have increased in natural origin abundance in recent years, productivity levels remain low, except for the Wenatchee population. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan river populations, 76 percent and 87 percent respectively (NMFS 2014; NWFSC 2015). The modest improvements in natural returns in recent years are primarily the result of several years of relatively good survival in the ocean and tributary habitats.

Table 5. Summary of the Upper Columbia River steelhead population status and Interior Columbia Basin Technical Recovery Team viability criteria.

	Abundance and Productivity Metrics				Spatial Structure and Diversity Metrics			Rating
Population	Minimum Abundance Target	Natural Spawning Abundance 2005–2014	Productivity (returns-per-spawner) 2005–2014	Integrated Abundance/ Productivity Risk	Natural Process Risk	Diversity Risk	Integrated Spatial Structure/ Diversity Risk	Overall Viability Rating
Wenatchee	1000	1,025	1.207	Low	Low	High	High	Maintained
Methow	1000	651	0.371	High	Low	High	High	High Risk
Entiat	500	146	0.434	High	Moderate	High	High	High Risk
Okanogan	500	189	0.154	High	High	High	High	High Risk

Spatial Structure and Diversity. The integrated spatial structure and diversity risk ratings for all four populations of UCR steelhead are at "high" risk. These ratings are largely driven by chronic high levels of hatchery spawners of 42 to 87 percent (Table 6) within natural spawning areas and lack of genetic diversity among the populations. The relative effectiveness of hatchery origin spawners and the long-term impact on productivity of high levels of hatchery contribution to natural spawning are key uncertainties for these populations (Ford 2011; NMFS 2014; NWFSC 2015).

Table 6. Estimate of hatchery origin spawning escapement for UCR steelhead populations.

Population	% Hatchery Origin (5-year average)		
	2000 to 2004	2005 to 2009	2010 to 2014
Wenatchee	66	62	42
Entiat	76	76	69
Methow	89	85	76
Okanogan	94	91	87

The UCR steelhead DPS is not currently meeting the viability criteria (adapted from the ICTRT) of the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan. Overall, the viability of the UCR steelhead DPS has likely improved somewhat since the last status review, but the DPS is still in a condition that, but for continued hatchery supplementation, places it at "high" risk of extinction (Ford 2011; NWFSC 2015) in the next 100 years (Table 7).

Table 7. Matrix used to assess the status of Upper Columbia River steelhead populations across Viable Salmonid Population parameters or attributes.

Risk Rating for Abundance/Productivity	Risk Rating for Spatial Diversity			
	Very Low	Low	Moderate	High
Very Low (<1%)	High Viable	Highly Viable	Viable	Maintained
Low (1–5%)	Viable	Viable	Viable	Maintained ***Wenatchee***
Moderate (6–25%)	Maintained	Maintained	Maintained	High Risk
High (>25%)	High Risk	High Risk	High Risk	High Risk ***Entiat Methow Okanogan***

Limiting factors for both UCR species. UCR spring-run Chinook salmon ESU and UCR steelhead DPS, continue to experience many problems that limit their productivity, and hence the ability to recover to a non-threatened level. The most significant factors limiting productivity of these species include: (1) mainstem Columbia River hydropower adverse effects (i.e., modified hydrograph, increase in lentic conditions/decrease in riverine conditions—passage barriers, stream temperature, dissolved oxygen problems, and invasive species); (2) riparian degradation and large wood recruitment; (3) altered floodplain connectivity and function; (4) altered channel structure and complexity; (5) reduced streamflow; (6) hatchery-related adverse effects; and (7) predation and competition (NMFS 2011b).

Recovery Plan. In 2007, NMFS adopted a recovery plan for UCR spring-run Chinook salmon and UCR steelhead that was developed by the Upper Columbia Salmon Recovery Board (UCSRB). The Upper Columbia Salmon Recovery Plan's overall goal is "to achieve recovery and delisting of spring Chinook salmon and steelhead by ensuring the long-term persistence and viable populations of naturally-produced fish distributed across their native range." The recovery

plan outlined specific recovery actions that were intended to reduce threats associated with land and water management activities in the Upper Columbia Basin. These actions were to address primary threats associated with population abundance, productivity, spatial structure, and diversity.

Summary. Although the abundance of both spring-run Chinook salmon and steelhead in the Upper Columbia has increased, the improvement has been minor, and only one of the populations (UCR steelhead, Wenatchee) meet any of the recovery criteria established in their respective recovery plans. In addition, all but one population for both species remain at high risk in their overall viability rating and risk of extinction (NMFS 2011b; NWFSC 2015).

2.2.2 Status of Critical Habitat

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

For salmon and steelhead, NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field Hydrologic Unit Code (HUC5) in terms of the conservation value they provide to the listed species they support. The conservation rankings are high, medium, or low. To determine the conservation value of each watershed to species viability, NMFS' critical habitat analytical review teams evaluated:

1) The quantity and quality of habitat features (e.g., spawning gravels, wood and water condition, side channels).
2) The relationship of the area compared to other areas within the species' range.
3) The significance of the population occupying that area to the species' viability criteria.

Thus, even a location that has poor quality habitat could be ranked as a high conservation value, if it were essential due to factors such as limited availability (e.g., one of a very few spawning areas), a unique contribution of the population it served (e.g., a population at the extreme end of geographic distribution), or the fact that it serves another important role (e.g., obligate area for migration to upstream spawning areas).

The following table (Table 8) describes the PBFs of the habitat types within the full range of habitat designated as critical for the listed salmonid species. Range-wide, all habitat types are impaired to some degree, even though many of the watersheds comprising the fully-designated area are ranked as providing high conservation value. The proposed action, however, affects only freshwater habitats.

Table 8. Physical and biological features of critical habitats designated for ESA-listed salmon and steelhead species considered in this opinion.

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

The PBFs of freshwater spawning, rearing and migration sites include water flow, quality and temperature conditions supporting juvenile and adult mobility, suitable substrate for spawning and incubation, floodplain connectivity, forage, cover and free passage for adults and juveniles (Table 8). These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval and juvenile fish to move, grow and eventually proceed downstream and reach the ocean.

Interior Columbia Recovery Domain

Habitat quality in tributary streams in the Interior Columbia Recovery Domain range from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (UCSRB 2007; Wissmar 1994). Critical habitat throughout much of the Interior Columbia Recovery Domain has been degraded by intense agriculture, alteration of stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas.

Many stream reaches designated as critical habitat in the Interior Columbia Recovery Domain are over-allocated. Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increase summer stream temperatures, block fish migration, strand fish, and alter sediment transport (Spence et al. 1996). Reduced tributary stream flow has been identified as a major limiting factor for both of the subject species (NMFS 2007; 2011a; 2011b).

Despite these degraded habitat conditions, the HUCs that have been identified as critical habitat for these species are largely ranked as having high conservation value. Conservation value reflects several factors, including (1) how important the area is for various life history stages, (2) how necessary the area is to access other vital areas of habitat, and (3) the relative importance of the populations the area supports relative to the overall viability of the ESU or DPS.

2.2.3 Climate Change

Climate change has negative implications for salmon, steelhead, and their designated critical habitat in the Pacific Northwest (ISAB 2007; NWFSC 2015; Scheuerell and Williams 2005; Zabel et al. 2006). Average annual Northwest air temperatures have increased by approximately 1ºC since 1900, or about 50 percent more than the global average over the same period (ISAB 2007). The latest climate models project a warming of 0.1ºC to 0.6ºC per decade over the next century.

Climate change affects salmonids and their habitat throughout the Interior Columbia Basin. Several studies have demonstrated that climate change has the potential to affect ecosystems in nearly all tributaries throughout the region (Battin et al. 2007; ISAB 2007). While the intensity of effects will vary by region (ISAB 2007), climate change is generally expected to alter aquatic habitat (water yield, peak flows, and stream temperature). As climate change alters the structure and distribution of rainfall, snowpack, and glaciations, each factor will in turn alter riverine hydrographs. Given the increasing certainty that climate change is occurring and is accelerating (Battin et al. 2007), NMFS anticipates salmonid habitats will be affected. Climate and hydrology models project significant reductions in both total snow pack and low-elevation snow pack in the Pacific Northwest over the next 50 years (Mote and Salathé 2009), changes that will shrink the extent of the snowmelt-dominated habitat available to salmon. Such changes may restrict our ability to conserve diverse salmon life histories.

The Independent Scientific Advisory Board (ISAB) identified a number of effects climate change would have on Columbia Basin salmon. A few of these include: (1) water temperature increases, and depletion of cold water habitat that could reduce the amount of suitable salmonid habitat by about 22 percent by the year 2090 in Washington State; (2) variations in precipitation that may alter the seasonal hydrograph and modify shallow mainstem rearing habitat; and (3) earlier snowmelt and higher spring flows with warmer temperatures that may cause spring Chinook salmon and steelhead yearlings to smolt and emigrate to the ocean earlier in the spring (Crozier et al. 2010; ISAB 2007; O'Neal 2002). In addition, climate impacts in one life state generally affect body size of timing in the next life state and can be negative across multiple life stages (Healey 2011; Wade et al. 2013; Wainwright and Weitkamp 2013).

In summary, climate change is expected to make recovery targets for these salmon populations more difficult to achieve. However, habitat restoration action can address the adverse impacts of climate change on salmon. Examples include restoring connections to historical floodplains, and freshwater and estuarine habitats to provide fish refugia and areas to store excess floodwaters; protecting and restoring riparian vegetation to ameliorate stream temperature increases; and purchasing or applying easements to lands that provide important cold water or refuge habitat (Battin et al. 2007; ISAB 2007).

2.3 Action Area

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

For purposes of this consultation, the action area includes the Wenatchee River below the OHWM at the West Cashmere Bridge location extending up to 600 yards upstream and 600 yards downstream of the project disturbance. The action area extends laterally from the Wenatchee River for 40 feet from the OHWM. The extent of the action area is based on the estimated extent of noise disturbance from pile driving, and the extent of ground disturbance in riparian areas.

The riverine portion of the action area is used by UCR spring-run Chinook salmon, UCR steelhead, and is designated as critical habitat (September 2, 2005; 70 FR 52630) for both species. This area supports rearing and migration for both species and may support spawning for UCR steelhead. The Wenatchee River within the action area is also designated as EFH for Chinook salmon and coho salmon (PFMC 2014).

2.4 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

The Wenatchee River is the aquatic habitat potentially affected by the Project. The Project is located on the Lower Wenatchee River, approximately 10.9 miles upstream of the river's confluence with the Columbia River at the Rock Island Pool reservoir above the Rock Island Dam. The Lower Wenatchee River flows through a 0.5- to 2 mile-wide valley filled with alluvial, lacustrine, and glacial outwash terraces perched up to an elevation of about 1,000 feet. The mainstem Wenatchee River watershed covers approximately 204,000 acres. Snowmelt in the Cascades is the primary source of water for the river. Elevations range from 653 feet at sea level at the mouth of the river to 7,993 feet at sea level on Snowgrass Mountain. Precipitation ranges from 8.5 to almost 50 inches a year across the watershed.

The modern Wenatchee River floodplain typically ranges in width from about 500 to 1,000 feet, but local constrictions are as narrow as 250 feet and in some areas, as wide as 1,800 feet. The

channel width ranges from about 200 feet to as wide as 650 feet, with wider areas occurring in hydraulically-forced sedimentation zones where the channel can be locally braided. The river channel itself has an irregular meandering planform that includes some free-form meanders but is largely controlled by local bedrock exposures and other erosion-resistant valley margin features such as coarse alluvial fans.

Total juvenile salmonid densities in the Wenatchee River are primarily limited by the availability of high flow refuge habitat for post-emergent fry (Hillman et al. 1989). Fry densities that exceed the river's late summer rearing capacity may then be limited by available habitat quality and quantities during late summer (Hillman et al. 1989). The mainstem Wenatchee River also provides overwintering habitat for juvenile spring-run Chinook salmon and juvenile steelhead. Juvenile steelhead emigrate from smaller tributaries into the mainstem Wenatchee River with the onset of colder stream temperatures, this emphasizes the importance of maintaining adequate winter rearing habitat in the mainstem Wenatchee River to accommodate an additional influx of rearing salmonids. Protecting and restoring habitat that provides both high and low flow refugia is critical to improving salmon and steelhead production in the Wenatchee subbasin. The most significant habitat impacts in this watershed include a loss of floodplain habitat and habitat forming processes that develop and maintain habitat complexity. Water diversions and withdrawals that contribute to reduced flows during the late summer and early fall further exacerbate the problem of decreased habitat quantity and quality in the mainstem Wenatchee River during this period.

The Wenatchee River in the action area is WDOE 303(d) listed as polluted waters (Category 4A) for temperature and pH (2019b). This listing was based on temperature monitoring in 2002 that observed that the 7-day mean of daily maximum values exceeded the criterion for this waterbody (17.5 °C on 40 of 94 days, with a maximum-recorded temperature of 21.3°C). More recent U.S. Geological Survey (USGS 2019) temperature data from a maintained gauge station near the City of Monitor (approximately 5.5 miles downstream of the bridge) of the mean of daily mean values during the in-water work window are shown in Table 9.

Table 9. Monthly mean temperatures at USGS gage 12462500 at Monitor, Washington, River Mile 5.5 (2019).

	July 15 -31	**August**	**September**
Monthly mean °C	19.3	19.7	15.7
Range	15.4 – 23.7	20.8 – 24.3	11.4 – 21.5

Substrate in this reach of the river is dominated by a combination of large rock and boulders with some exposed bedrock. The Project site is located just upstream of a large sandstone ridge that cuts into the Wenatchee River valley from the north and forms a bedrock sill under the river.

Over the last 15 years, some of the highest concentrations of PCBs in fish tissue within Washington State have been found in the resident fish of the Wenatchee River (mainly mountain whitefish) (WDOE 2014). Fish advisories have been in place for much of this time. The Wenatchee River is also listed as impaired under the U.S. Environmental Protection Agency 303(d) list for DDT and DDT metabolites. The main source of DDT to the river is suspected to be agricultural lands in the Mission Creek subbasin, a tributary in the Lower Wenatchee Valley

located approximately 0.8 miles downstream of the action area. The source of PCBs to the Wenatchee River is more ambiguous. Sargeant et al. (2013a; 2010; 2011; 2013b) summarize surface water monitoring for pesticides in the lower Wenatchee River. That study reported 13 detections of eight different types of pesticides, including Endosulfan. Endosulfan is a highly toxic organochlorine insecticide that was banned globally in 2012 with all uses to be phased out by 2016. WDOE continued to sample the lower Wenatchee River site. In 2012, only two pesticides were detected and neither was above regulatory thresholds (Sargeant et al. 2013c). Of note, in 2012, the highest number of detections by far was from Brender Creek, which is a left bank tributary of Mission Creek just upstream of its confluence with the Wenatchee River in Cashmere. A large number of these detections were above regulatory thresholds, particularly for legacy DDT and DDT degradants and Endosulfan (Sargeant et al. 2013c).

There are no known physical barriers in the Wenatchee River downstream of the action area to the Columbia River. Extensive development and agricultural activities combined with flood control measures have channelized the lower Wenatchee River, reducing off-channel habitat and connections to refugia. A channel migration zone study for the County concluded that the reach of the Wenatchee River containing the Project had lost approximately 33 percent of the adjacent valley flat areas important for development of off-channel habitat (Evans and Associates 2018). TetraTech (2016) conducted a reach assessment on the lower Wenatchee River and concluded that the reach containing the Project, 54 percent of the floodplain, is disconnected floodplain, and there is 0 percent off-channel habitat. TetraTech (2016) reported that there were four pools in the reach of the Project (Reach 5), with an average of only 1.7 pools per mile. The reduced riparian zone has eliminated or severely curtailed large woody debris (LWD) recruitment. Relatively few pieces of LWD are present in the Project reach. Given the lack of LWD and channelized nature of the lower Wenatchee River, pools and pool-creating features are lacking (Evans and Associates 2018).

Channelization of some tributaries to the lower Wenatchee River and floodplain development in the mainstem corridor have degraded floodplain functions. Flood control measures in reaches not naturally confined by glaciofluvial terraces have contributed to the loss of functioning floodplain habitat. The altered riparian and channel conditions have reduced in-stream LWD and recruitment, pool frequency, and side channel/wetland habitat and the opportunity for development of side channel/wetland habitat. Conditions have also increased bank erosion and possibly increased channel entrenchment in stream reaches not naturally confined by glaciofluvial terraces, as well as altered the sediment transport regime. Combined, these factors have likely had some of the largest impacts on the fishery resource on the mainstem Wenatchee River, limiting the use of alternate channels and access to the floodplain to disperse high flows (Evans and Associates 2018).

In the action area, streambanks have been severely modified by development, including the BNSF railroad on the right bank, U.S. Highway 2 adjacent to the left bank, agriculture (orchards) and development. There are a number of actively eroding areas along the lower river, although some of these are natural steep bluff areas. Bank armoring is common in order to protect infrastructure and crops (Evans and Associates 2018). There are no known concerns with modified width to depth ratio. Floodplain connectivity is reduced by development in the

floodplain for agriculture, placement of roads in the floodplain, and development associated with the cities of Cashmere, Peshastin, Monitor and Wenatchee. Road density in the action area is higher than other areas in the watershed due to significant development associated with the City of Cashmere. Calculated road density in the action area is approximately 6.35 miles per square mile. The action area has a long history of disturbance from agriculture.

The 2007 Recovery Plan and the 2016 status review for Upper Columbia River Salmon and Steelhead describe threats and limiting factors for the Wenatchee River steelhead and spring-run Chinook salmon populations (NMFS 2016; UCSRB 2007). Land ownership in the action area is primarily private. The environmental baseline in the action area has been altered by recreational, urban and agricultural development. Floodplain development is a major threat to UCR steelhead and UCR spring-run Chinook salmon recovery throughout the basin, including the action area. Floodplain development reduces the quality and quantity of salmonid habitat in main channels and reduces or eliminates off-channel habitats. Adverse effects include: (1) discharging pollution from developed areas; (2) reducing the amount and functional integrity of riparian vegetation that contributes food, shade, LWD, and overhead cover to fish; (3) altering water, LWD, and sediment exchange between the main channel and off-channel habitats; (4) limiting access of fish into and out of off-channel habitats; and (5) floodplain development physically occupies floodplain area and shorelines that would otherwise be accessible and provide highly productive salmonid rearing habitat.

Floodplain development in the action area has altered what was once a network of diverse habitats occupied by salmon and steelhead with an increasingly simplified waterway that may not be able to provide adequate depth, shade or temperature at all times. The structure and function of the riparian zone and the ability of the river to access the floodplain in the action area has been eliminated.

The lower Wenatchee River is considered a critical migratory corridor for the Wenatchee River populations of UCR spring-run Chinook salmon ESU and the UCR steelhead DPS. Upstream of the action area the watershed has very little private ownership and provides a substantial amount of high-quality habitat managed by the Okanogan–Wenatchee National Forest. The action area provides PBFs for spawning, migration, and rearing; though these PBFs persist in the Wenatchee River they are degraded in the action. The baseline condition of the Wenatchee River in the action area limits the amount of suitable adult spawning habitat and juvenile rearing habitat, and limits the amount of time that the available habitat is suitable for spawning, migration and rearing juvenile salmonids. These conditions limit the productivity of the Wenatchee River action area by capping carrying capacity and likely suppressing juvenile to adult survival.

The 5-year geometric mean of natural spawners for the Wenatchee River population of UCR steelhead and UCR spring-run Chinook salmon from 1990 through 2014 has been estimated at 1,025 and 545, respectively (NWFSC 2015; Table 34). The Wenatchee River watershed UCR steelhead and UCR spring-run Chinook salmon long-term objectives for conservation and recovery call for at least 1,000 spawners of each species to return to the watershed each year to reduce the risk of extinction to 5 percent or less. Reaching that objective is hindered primarily by actions and conditions that occur throughout the watershed.

2.5 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

2.5.1 Effects on Species

Both UCR spring-run Chinook salmon and UCR steelhead have been documented using the lower Wenatchee River for migration and rearing where in-water work would occur. It is also possible that UCR steelhead would spawn in the action area but steelhead spawning and emergence take place prior to the in-water work window. All in-water work will occur in the approved construction window, July 15 to September 30, which will minimize impacts to salmonids.

Hicks (2002) and Wade et al. (2013) conducted broad reviews of the literature on temperature requirements for salmonids and steelhead at various life stages and determined that optimal rearing temperatures for juvenile Chinook salmon are in the ranges of 12.2 to 14.8°C and, where Chinook salmon are holding over the summer, the preferred average water temperatures are below 14°C. Optimal juvenile steelhead rearing temperatures range from 7.3 to 14°C. Hicks (2002) recommended a maximum of 16 to 17°C to fully protect juvenile steelhead rearing. Thermal blockages to adult salmonid migration occur consistently in the temperature range of 19 to 21°C with prolonged exposure to 21 to 22°C considered lethal (Hicks 2002; Wade et al. 2013).

Salmonids exposed to high temperatures for extended periods have increased stress and decreased probability of persistence throughout their life cycle, particularly as the temperature approaches the species' thermal limits (Ebersole et al. 2001; McHugh et al. 2017; Richter and Kolmes 2005; Sullivan et al. 2000). Based on recent mean water temperatures in the lower Wenatchee River in July and August (Table 9 above), at the beginning of the in-water work window, water temperatures are likely to be at or above preferred juvenile rearing levels and will be increasing. In addition, daytime highs will begin to limit or cause adult movement through this area to occur at night when temperatures decline (Richter and Kolmes 2005). During the in-water work window when daytime temperatures reach 19°C or higher, the nighttime temperatures decline an average of 3.5°C and by as much as 4.6°C providing an opportunity for adult steelhead or spring-run Chinook salmon movement at night. Expected water temperatures will reduce the number of adult and juvenile UCR spring-run Chinook salmon and UCR steelhead in and migrating through the action area during the in-water work window.

In 2015, monitoring of adult steelhead migrating past the Tumwater Dam at River Mile (RM) 30.9 (20 miles upstream of the action area) revealed that peak adult migration for both wild and hatchery steelhead occurred in September and October (Hillman et al. 2016). Adult steelhead will use holding habitat in the mainstem Columbia River or a few miles upstream of the action area where the Wenatchee River provides abundant deep pools with cool water from upwelling

before moving farther upriver in September and October[1]. Based on this timing and the expected daytime water temperatures, very few, if any, adult steelhead are likely to be migrating through the Project during the daytime hours of the mid-July and August in-water work window. The absence of deep pool habitat or cover in this reach of the river also make it unlikely that any adult steelhead would be holding in the action area.

Spring-run Chinook salmon spawning in the upper Wenatchee basin (primarily the Chiwawa River) peaks in early to mid-September (Hillman et al. 2016). More than 90 percent of spawning spring-run Chinook salmon (including both wild and hatchery origin fish) have passed Tumwater Dam RM 30.9 by August 1 (Hillman et al. 2016). Like adult steelhead, elevated daytime water temperatures make it unlikely that any adult spring-run Chinook will be migrating through the action area during daylight hours. The absence of deep pool habitat or cover in this reach of the river make it unlikely that any adult spring-run Chinook salmon would be holding in the action area.

Juvenile spring-run Chinook salmon and steelhead use the action area for migration and rearing year-round. At the start of the in-water work window, daytime water temperatures are likely to be within acceptable limits for rearing but will increase over the following 2 to 4 weeks (Table 9), forcing juveniles either out of the area or into pockets of cool water, and restricting mobility. Along with increasing water temperatures, the lack of natural riparian cover, side channels, and other refugia that would make it preferable for juvenile rearing are extremely limited in the action area, reducing the available rearing habitat for juvenile salmonids and the corresponding numbers likely to be in the action area.

Worksite Isolation and Fish Removal

The primary area of in-water work, which is removal of a portion of the center bridge pier and installation of the new pier, will be isolated with a sheet pile cofferdam and dewatered. Prior to dewatering the area behind the sheet piles, fish will be captured and relocated. Capture methods may include seining, dip netting, and/or electrofishing. The fish capture/relocation is included in this Project in order to avoid or minimize injury or death to fish due to dewatering. However, the fish rescue itself may cause stress, injury, or death, even though it will be conducted by a qualified fish biologist and done according to WSDOT Fish Exclusion Protocols and Standards (2012). Adult fish will not likely occupy the areas slated for isolation.

Fish exclusion, work area isolation, and project implementation during the in-water work window are intended to avoid and minimize effects of the in-water construction to salmonids. Fish handling, capture, collection and seining may injure fish and can include stress-related phenomena. Stress approaching or exceeding the physiological tolerance limits of individual fish impairs reproductive success, growth, resistance (Wedemeyer et al. 1990). The in-water work area that will be temporarily isolated and from which fish will be salvaged and excluded during construction will be approximately 89 yd^2.

[1] Personal observation by D. Driscoll in 1994–1995 during snorkeling of the Wenatchee River from Leavenworth Washington, downstream several miles.

Fish density estimates in the Wenatchee River by Mullan et al. (1992), including in the action area, found 2.2 juvenile Chinook and 2.2 juvenile steelhead per 100 yd^2. The area to be isolated is approximately 90 yd^2 (13 yards wide, 7 yards long). Therefore, we anticipate that up to two juvenile spring-run Chinook salmon and two juvenile steelhead will be in the area that will be isolated and salvaged. The contractor will not need to conduct any salvage to remove the cofferdam. When disturbance begins within the wetted channel for the placement of the cofferdam, NMFS will assume the worst-case scenario because of the natural substrate that provides much interstitial area within which juvenile salmonids will likely hide and thus expire when the area is dewatered.

Using life stage equivalents from Quinn (2005), the injury or death of up to two juvenile Chinook salmon and two juvenile steelhead does not accrue to the loss of one adult spring-run Chinook salmon or one adult steelhead, even if all the fish were from the same brood year.

Water Quality

Construction activities related to the bridge construction will temporarily disturb soil and riverbed sediments, resulting in the potential for temporary increases in turbidity and suspended sediments in the action area. Turbidity plumes are expected to affect a portion of the channel width and extend up to 300 feet downstream of the site. Construction-related increases in sedimentation and siltation above the background level 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. The magnitude of potential effects on fish depends on the timing and extent of sediment loading and flow in the river before, during, and immediately following construction.

High concentrations of suspended sediment can have both direct and indirect effects on salmonids. The severity of these effects depends on the sediment concentration, duration of exposure, and sensitivity of the affected life stage. Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat. Any increase in turbidity associated with in stream work is likely to be brief and occur near the site, attenuating downstream as suspended sediment settles out of the water column. For those fish that cannot avoid turbid conditions, effects of suspended sediment, either as turbidity or suspended solids, are well documented (Bash et al. 2001; Berg and Northcote 1985; Lloyd et al. 1987; Servizi and Martens 1987; 1991; Sigler et al. 1984).

Temporary increases in suspended sediment concentrations have highly variable effects on fish, ranging from behavioral effects including alarm reactions and avoidance responses to sublethal effects including reduced feeding and physiological stress (Newcombe and Jensen 1996). Juvenile salmonids often avoid streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler et al. 1984). Several studies have documented active avoidance of turbid areas by juvenile and adult salmonids (Lloyd et al. 1987; Servizi and Martens 1992; Sigler et al. 1984). The severity of effect of suspended sediment increases as a function of the sediment concentration and exposure time, or dose (Bash et al. 2001; Newcombe

and Jensen 1996). Sigler et al. (1984) found that prolonged exposure to turbidities between 25 and 50 NTU resulted in reduced growth and increased emigration rates of juvenile coho salmon and steelhead compared to controls. These findings are generally attributed to reductions in the ability of salmon to see and 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 (30-60 NTU). In this study, behavior returned to normal quickly after turbidity was reduced to lower levels (0-20 NTU).

Although NMFS expects all fish in the area to be mobile enough to avoid the spatially limited turbidity, elevated turbidity levels could result in conditions that will affect the behavior of some salmonids. During periods of turbidity, fish in close proximity to the origination point are likely to display avoidance behaviors. If avoidance behavior displaces fish from preferred rearing habitat, it can result in greater expenditure of energy, greater exposure to predators, and greater competition for holding areas and suitable prey base. Individual fish that encounter increased turbidity or sediment concentrations will likely move away from affected areas into more suitable surrounding habitat. In-water work will only occur from July 15 to September 30 when water temperatures are highest, the smallest number of salmonids are likely to be in the area, and pile driving will only occur during a subset of days during the work window, which will limit the duration of the turbidity effects.

Based on the Project description, sedimentation events and elevation of turbidity associated with construction are expected to be minor and transient in nature. In addition, avoidance and minimization techniques will be implemented in this Project as well as BMPs pertaining to the minimization of sedimentation and turbidity. Thus, NMFS does not expect turbidity to result in any injury or mortality or appreciably alter survival or fitness of any of those fish within the action area.

Forage

The proposed action in the Wenatchee River will have a temporary negative effect on benthic macroinvertebrates by temporarily isolating approximately 90 yd^2 of streambed with a cofferdam and covering approximately 10 yd^2 with the temporary piles during construction. Once the work trestle is deconstructed, the temporary pilings and the cofferdam is removed from the channel, the area that was isolated and dewatered will, for at least a few days, provide fewer macroinvertebrate prey items than before the action. However, forage species will begin to re-colonize the area after Project completion via drift and migration (Fowler 2004; Herrmann et al. 2012). Given the size of the disturbed area, the amount of available local habitat, and the short-term nature of the action, NMFS expects short-term (from a few days up to a couple weeks) localized reduced productivity followed by a return to pre-Project conditions such that effects to fish from reduced forage are not expected to be more than minimal.

Hydroacoustics

Piles that are driven into riverbed substrate propagate sound through the water, which can cause sudden rapid changes in pressure, rupturing or hemorrhaging tissue in a fish's swim bladder (Gisiner 1998; Popper et al. 2006). The swim bladder is the primary physiological mechanism that controls a fish's buoyancy. A perforated or hemorrhaged swim bladder has the potential to compromise the ability of a fish to orient itself both horizontally and vertically in the water column. This can result in diminished ability to feed, migrate, and avoid predators. Sensory cells and other internal organ tissue may also be damaged by noise generated during pile driving activities as sound reverberates through a fish's viscera (Gaspin 1975). In addition, morphological changes to the form and structure of auditory organs (saccular and lagenar maculae) have been observed after intense noise exposure (Hastings 1995). It is important to note that acute injury resulting from acoustic impacts should be scaled based on the mass of a given fish. Juveniles and fry have less inertial resistance to a passing sound wave and are therefore more at risk for non-auditory tissue damage (Popper and Hastings 2009).

Multiple studies have shown responses in the form of behavioral changes in fish due to human produced noise (Popper and Hastings 2009; Slotte et al. 2004; Wardle et al. 2001). Instantaneous behavioral responses may range from slight variations, a mild awareness, to a startle response. Fish may also vacate their normally occupied positions in their habitat for short or long durations. Depending on the behavior that is being disrupted, the direct and indirect negative effects could vary. Behavioral effects could affect juvenile fish more than adults could, as there are essential behaviors to their maturation and survival, such as feeding, sheltering, and migration. An example of a significant, direct negative effect would be interruption or alteration of migratory behavior. Though pile driving may affect migratory behavior, it is not expected to prevent salmonids from passing upstream or downstream, because pile driving will not be continuous through the day (maximum 1,500 strikes per day), and will not occur at night when adults can continue upstream migration.

A coalition of West Coast federal and state resource and transportation agencies, the Fisheries Hydroacoustic Working Group (FHWG 2008) assessed the available data and proposed interim criteria for the onset of injury to fishes from impact pile driving exposure (2008). Most historical research has used peak pressure to evaluate the effects on fishes from underwater sound. Current research, however, suggests that sound exposure level (SEL), a measure of the total sound energy expressed as the time-integrated, sound pressure squared, is also a relevant metric for evaluating the effects of sound on fishes. An advantage of the SEL metric is that the acoustic energy can be accumulated across multiple events and expressed as the cumulative SEL (cSEL). Therefore, a dual metric criterion was established by the FHWG and includes a threshold for peak pressure [206 decibels (dB)] and cSEL (187 dB for fishes 2 grams or larger and 183 dB for fishes smaller than 2 grams). Injury would be expected if either threshold were exceeded. There is uncertainty as to the behavioral response of fish to underwater sound produced when driving piles in or near water. Until new information indicates otherwise, NMFS believes a 150 dB RMS threshold for behavioral responses for UCR spring-run Chinook salmon and UCR steelhead populations is appropriate.

For purposes of analysis, all fish encountered are expected to be greater than 2 grams. NMFS conservatively assumed the piles for the temporary trestle will be installed in water first using a vibratory hammer unless and until the pile is refused, at which time an impact hammer with wood cushion blocks and a bubble curtain for attenuation will be used. The proposed action includes installation of up to 90 piles for the temporary trestle. Piles will be either 12- or 14-inch-diameter H-piles. According to Caltrans (2012; 2014), the installation of 14-inch-diameter steel H-piles, with a wood cushion block, in lentic systems will result in single-strike sound levels of 182 to 197 dB Peak and 161 to 176 dB RMS with an estimated SEL of 150 to 165 dB. For our analysis of distance to onset of physical injury, we used the highest sound levels, wood cushion blocks and the use of a bubble curtain that is assumed to provide a minimum of 5 dB of sound reduction for all sound levels. Vibratory driving has been shown to be 10 to 20 dB lower than impact driving steel piles of similar diameter (WSDOT 2014).

Based on the acoustic effects analysis, peak sound pressures are not expected to reach or exceed the thresholds for onset of physical injury of listed fish outside 1.1 yards of the pile being driven. Cumulative sound exposure levels are likely to exceed the 187 dB threshold for physical injury of fish greater than 2 grams, the size expected in the action area, within 4.4 yards of the pile being driven. Non-injurious behavioral effects are likely to occur within 275 yards of the pile being driven. Vibratory pile driving will not reach the peak threshold for onset of physical injury, will not exceed the cumulative 187 dB threshold for physical injury of fish greater than 2 grams, and non-injurious behavioral effects will extend only 24 yards. NMFS anticipates that the use of a vibratory hammer to start each pile will cause enough disturbance, without physical injury, to cause all adult fish to move at least 4.4 yards away from the pile being driven, and thus avoid physical injury. The same disturbance from the use of the vibratory hammer that is expected to cause adults (although due to high temperatures, adults are not likely to be present) to move away, may cause juveniles in the area to evacuate the area or to "sound" or dive into the substrate, a common avoidance behavior of juvenile fish when the substrate is suitable. If juveniles move into the substrate within 4.4 yards of the pile being driven, they are likely to be injured or killed. Once pile driving begins each day and fish have been disturbed, NMFS does not expect fish will move back into the area until the disturbance from pile driving ceases for the day. Thus, each day there is some likelihood that adults that may be migrating through the action area will be disturbed and move away, while a few juveniles rearing in the area could hide in the substrate and be injured or killed.

As described above, fish density estimates in the Wenatchee River by Mullan et al. (1992), including in the action area, found 2.2 juvenile Chinook and 2.2 juvenile steelhead per 100 yd^2. The area of impact pile driving where fish could experience physical injury extends 4.4 yards from each pile, or an area of 61 yd^2. NMFS estimates that up to two juvenile spring-run Chinook salmon and two juvenile steelhead could be within the 61-yd^2 area around a piling. NMFS also assumes that at the end of each workday the in-water work area will be reoccupied when in-water disturbance ends. Therefore, it is likely that up to two juvenile spring-run Chinook salmon and two juvenile steelhead will be within the area of potential physical injury at the start of each day that pile driving occurs. The County estimates it can drive up to 10 piles per day so the placement of 90 piles will take a total of nine days, not necessarily consecutive, to complete all pile driving. Assuming a worst-case scenario where the two juvenile Chinook and the two

juvenile steelhead within the area of injury encountered during pile driving each day are injured to the point of mortality, NMFS estimates 18 juvenile spring-run Chinook salmon and 18 juvenile steelhead will be killed by pile driving over the nine days of pile driving.

Again using life stage equivalents from Quinn (2005), the injury or death of up to 18 juvenile spring-run Chinook and 18 juvenile steelhead does not accrue to the loss of one adult spring-run Chinook salmon or one adult steelhead, even if all the fish were from the same brood year. Therefore NMFS does not believe the action of pile driving, when conducted as described, will influence the abundance or productivity of the Wenatchee River spring-run Chinook salmon population.

Relevance of Effects on Individual Fish to Salmonid Population Viability

NMFS assesses the importance of habitat effects in the action area on individual fish and the population by examining the relevance of those effects to the characteristics of viable salmonid Populations (VSPs). The characteristics of VSPs are sufficient abundance, population growth rate (productivity), spatial structure, and diversity. While these characteristics are generally described as unique components of population dynamics, each characteristic exerts significant influence on the others. Declining abundance, for example, can reduce the spatial structure component of a population and, when habitats are less varied, then diversity among the population declines.

2.5.2 Effects on Critical Habitat

Critical habitat within the action area has an associated combination of PBFs essential for rearing and migrating for UCR spring-run Chinook salmon and rearing, migrating and spawning for UCR steelhead. The PBFs of freshwater rearing sites and migration corridors that occur within the action area for UCR spring-run Chinook salmon are: (1) migratory corridors for both upstream and downstream migration, (2) food resources, (3) riparian habitat for juvenile rearing, (4) adequate flow regime for all life stages and, (5) water quality. The PBFs within the action area for UCR steelhead include all the previous features plus adequate substrate quality for spawning. These features are essential to conservation because they allow adult fish to reach upstream spawning areas and they allow juvenile fish to rear in and near natal streams for at least 1 to 2 years before proceeding downstream and to the ocean.

Although there is a great deal of anthropomorphic disturbance in the watershed, the overall quantity and quality of critical habitat upstream of the action area is very good in many areas. The essential elements of PBFs temporarily affected by the proposed action in the Wenatchee River are migratory corridors, water quality, forage and riparian habitat, all of which support adult and juvenile survival, growth, and mobility. In the action area, the freshwater habitat elements of water quality and forage are both present and generally of poor to fair quality with flows in late July and August experiencing increasing temperatures. The ability of these habitat elements to function properly in the action area is heavily influenced by the reduced riparian area and floodplain access because of adjacent agricultural development and roads.

Migratory Corridor (Safe Passage)

UCR spring-run Chinook salmon and UCR steelhead may alter migration behaviors during the pile-driving phase of the construction. The pre-drilling, vibratory hammer and impact hammer pile driving is likely to disturb or alter the normal movement of adults and juveniles in the action area during the installation of the pilings for the work trestle. Pile driving will not occur at night, and is expected to take a cumulative 9-day period over the in-water work window. Hydraulic modeling for the presence of the additional pilings in the river for the 2-year construction period indicates that changes in flow velocity and water depth will not obstruct or restrict passage and will not be detectable more than 100 feet from the structure. When the Project is completed, there will be a small beneficial effect to the migratory corridor for both species by reducing the number of in-water piers from two to one, and that one will be smaller than the existing piers.

Water Quality

Water quality is an essential PBF of the freshwater spawning, rearing and migration site types. When the cofferdam is placed and removed during pre-drilling, pile driving and piling removal, there is likely to be increased turbidity within the work area and up to a maximum of 300 linear feet immediately downstream of the bridge site. Additionally, the water may become contaminated from petrochemicals from construction equipment. Contamination is not likely to persist after construction work is complete, so the water will likely not be permanently affected due to the proposed action. Avoidance and mitigation efforts for sedimentation and contamination are discussed in the Proposed Action.

Forage

The proposed action in the Wenatchee River will have a short-term negative effect on the availability of benthic macroinvertebrates by covering, dewatering or displacing them from approximately 99 yd^2 of streambed while the cofferdam and temporary pilings are in place. There will be a short-term loss (up to a few weeks) of benthic production on the isolated substrate of the river. Within a few days to a few weeks after removal of the cofferdam, NMFS expects the quantity and quality of forage available in the action area to return to baseline conditions with no long-term effects.

Riparian Vegetation

The proposed action will remove shrubs and approximately 20 trees, mostly saplings on the north bank of the river, and disturb approximately 355 yd^2 of riverbank extending 40 feet upstream and downstream either side of the bridge and 20 feet landward from the wetted edge of the river. The disturbed riverbank area will experience several months to a few years of decreased shade and allochthonous input from the removal of vegetation. The riparian area in the action area sports a thin, discontinuous line of shrubs and small trees, but the width and orientation of the river in the action area mean that only trees on the south (right) bank can provide any shade and even then only along the margin of the river. As stated above in the Environmental Baseline, late season temperatures in the lower river can become stressful to fish.

The County will replant disturbed areas with native grasses, shrubs and trees, however, the removal of vegetation that currently provides shade, albeit only along the margins of the river because of its width, will cause additional degradation of an already poor condition.

Relevance of Effects on Physical or Biological Features to Conservation Value

As described above, the proposed action in the Wenatchee River will have a short-term negative effect on normal migratory behavior, water quality, and forage, but a potential longer-term negative effect on riparian vegetation from removal of trees on the riverbank. NMFS does not expect these effects from the proposed action to appreciably reduce the suitability of the action area as a migration corridor, as passage will be maintained throughout the Project and will continue with slight improvement, because of the reduction in the number of in-water bridge piers when construction is completed. Likewise, due to the short duration of turbidity, and the relatively small forage area affected, NMFS does not anticipate more than minimal effects to PBFs. The longer-term loss of trees that are providing shade for at least some portion of the river and decreased allocthonous input will maintain what is currently poor riparian conditions in the action area until replanted trees reach a size that can provide benefit to the river.

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). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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

Continued Development

Increases in urbanization and housing developments can affect habitat by altering watershed characteristics, and changing both water use and stormwater runoff patterns. Increased growth will place additional burdens on resource allocations, including natural gas, electricity, and water, as well as on infrastructure such as wastewater sanitation plants, roads and highways, and public utilities. Some of these actions, particularly those that are situated away from waterbodies, will not require federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

Levee and Streambank Stabilization

Cumulative effects include non-federal streambank stabilization riprap projects. Depending on the scope of the action, some non-federal riprap projects carried out by private entities (BNSF), state or local agencies do not require federal permits. These types of actions, including along BNSF railroad, which abuts the Wenatchee River and several tributaries for the better part of 22 miles and illegal placement of riprap by landowners, occurs throughout the Wenatchee River watershed. The effects of such actions result in continued degradation, simplification, and fragmentation of riparian and freshwater habitat.

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 because 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). NMFS takes into account the status of the species and critical habitat (Section 2.2), to formulate the agency's 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 for the conservation of the species.

Beyond the continuation of the human activities affecting the species, we also expect that ocean condition cycles and climatic shifts will continue to have both positive and negative effects on the species' ability to survive and recover. The Environmental Baseline section reviewed the status of the species and the factors that are affecting their survival and recovery in the action area. The Effects of the Action section reviewed the exposure of the species and critical habitat to the proposed action and cumulative effects. NMFS then evaluated the likely responses of individuals, populations, and critical habitat. This Integration and Synthesis section will consider all of these factors to determine the proposed action's influence on the likelihood of both the survival and recovery of the listed species, and on the conservation value of designated critical habitats.

Because actions in the action area are only temporarily negative, effects at the subwatershed and watershed scales, and designation scales will be even smaller. Therefore, the proposed action will only have minimal short-term impacts on the conservation value of designated critical habitat for UCR steelhead and UCR spring-run Chinook salmon.

Status of the Species and Environmental Baseline

The status of UCR spring-run Chinook salmon and UCR steelhead are driven by the high risk of extinction from low abundance, productivity, spatial structure, and diversity for all of their component populations. In 2005, the ICTRT noted a high viability risk for all UCR spring-run Chinook salmon and UCR steelhead populations. (UCSRB 2007). The UCR steelhead DPS is not currently meeting the viability criteria (adapted from the ICTRT) of the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan. Overall, the viability of the UCR steelhead DPS has likely improved somewhat since the last status review, but the DPS is still in a

condition that, but for continued hatchery supplementation, places it at “high” risk of extinction (Ford 2011; NWFSC 2015) in the next 100 years (Table 7 above).

The UCR spring-run Chinook salmon ESU is not currently meeting the viability criteria (adapted from the ICTRT in the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan) and remains at a high risk of extinction (Ford 2011; NMFS 2011b; NWFSC 2015), see Table 4 above.

The information presented in the environmental baseline section (Section 2.4) details that the habitat quality in tributary streams in the Interior Columbia Recovery Domain range from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (NMFS 2009; Wissmar et al. 1994). Although many of the PBFs of UCR spring-run Chinook salmon and UCR steelhead critical habitat are currently degraded and provide limited high quality habitat, the spawning habitat, migratory corridors, and rearing habitat that remain have high intrinsic value for the conservation of the species.

Cumulative Effects

Increased agriculture and urbanization, and continuing riprap revetment and levee projects can be reasonably assumed to occur in the future in the action area. The effects of these actions result in maintaining degraded, simplified, and fragmented riparian and freshwater habitat. Some of these actions, particularly those that are situated away from waterbodies, will not require federal permits, and thus will not undergo review through the ESA section 7 consultation process with NMFS.

As noted in section 2.2, climate change is likely to affect both species covered in this opinion. In 2007, the ISAB identified a number of effects climate change would have on Columbia Basin salmon and predictions have only gotten worse since then (Crozier et al. 2019; 2010; Mote and Salathé 2009). A few of these include: (1) water temperature increases, and depletion of cold water habitat that could reduce the amount of suitable salmon habitat by about 22 percent by the year 2090 in Washington State; (2) variations in precipitation that may alter the seasonal hydrograph and modify shallow mainstem rearing habitat; and (3) earlier snowmelt and higher spring flows with warmer temperatures that may cause spring Chinook salmon and steelhead yearlings to smolt and emigrate to the ocean earlier in the spring. Climate change is expected to make recovery targets for these salmon populations more difficult to achieve. However, habitat restoration actions can at least partially address the adverse impacts of climate change on salmon.

Summary of the Effects of the Proposed Action

The proposed action will have direct and indirect negative effects, and minor beneficial effects to both species covered in this opinion. As noted above, the placement of a cofferdam and salvage of fish within the cofferdam could kill up to two UCR spring-run Chinook salmon juveniles and two UCR steelhead juveniles. NMFS believes that ESA-listed fish will be affected by increased sediment and turbidity produced by disturbance of the riverbed during construction. As turbidity increases, the potential for and intensity of adverse impacts to ESA-listed species increases.

Placement of a cofferdam, pre-drilling, vibratory and impact pile driving will all create pulses of turbidity. The magnitude and duration of these pulses will vary according to substrate material and the length of time it takes for each action, but will only be conducted during daylight hours. A large and varied amount of pile driving can create enough sound pressure to damage a fish's internal organs or affect their migration and behavioral responses. Sound pressure attenuation measures, as well as BMPs, have been put in place to minimize the potential for negative effects to listed species such that a fish would need to be relatively undisturbed by a vibratory hammer (used before any impact hammer), be within 1 yard of an impact hammer, and remain with 4.4 yards of the continuous use of an impact hammer to experience physical injury. NMFS believes that adults of either ESA-listed species will move away at the onset of the use of a vibratory hammer prior to an impact hammer to avoid physical harm. However, to be conservative, we also estimate that each day of the estimated 9 days of pile driving, two juveniles of each species will be within the 61-yd^2 area of potential physical injury, will fail to evacuate the area at the onset of vibratory hammer use, and will be killed by sound pressure effects. A total of 20 juvenile UCR spring-run Chinook salmon and 20 juvenile UCR steelhead (cofferdam and pile driving) will be killed from the Wenatchee populations during the construction process.

We do not expect that the loss of these individual fish and the reduced fitness described above will influence the abundance or productivity of the Wenatchee population because too few fish will be affected over a relatively short time scale. Thus, we do not anticipate any changes to VSP parameters to the UCR Chinook ESU or the UCR steelhead DPS.

Critical Habitat Effects

The potential effects of the proposed action on critical habitat for UCR spring-run Chinook salmon and UCR steelhead in the action area is described in Section 2.5.2 (Effects on Critical Habitat). The specific attributes of designated critical habitat affected by the proposed action are water quality, forage, migratory corridors, and riparian vegetation. NMFS expects adverse effects to the above PBFs for both ESA-listed salmonids from placement and removal of a cofferdam and temporary piles that will disturb in-channel sediments and reduce local forage area. The Project will also result in the removal of streamside vegetation (with related effects of increasing stream temperatures, and interrupting the natural delivery of wood to stream channels), and potentially disturb normal migratory behavior during daylight hours. Some adverse effects such as turbidity and forage area will be short term (during daylight hours of several days to 2 years) as the construction actions are completed, while the loss of streambank trees are expected to last up to 20 years until vegetation is completely reestablished. The reduction in the number of piers within the channel will locally and permanently improve the migratory corridor for ESA-listed salmonids.

Based on our analysis, adverse effects from the proposed action will cause a localized, temporary decline in the quality and function of PBFs in the action area. The quality of the PBFs at the watershed scale is not likely to decline because of the proposed action, due to the minor to moderate intensity and localized nature of effects. The effects of the proposed action will not impede the ability of this critical habitat to play its intended conservation role, because the effects of the action are limited in scope and scale; and so, especially when considered at the

designation scale, the critical habitat will be capable of supporting migration, spawning, and rearing.

Summary

For all the reasons described in the preceding paragraphs of this section, the proposed action will not appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction or distribution nor will the proposed action reduce the value of designated critical habitat for the conservation of the species.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of UCR spring-run Chinook salmon or UCR steelhead, or destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

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

2.9.1 Amount or Extent of Take

Where possible, NMFS has estimated the number of fish that are likely to be in the action area that could be harmed by the proposed action. However, NMFS is not always able to precisely quantify and track the amount or number of individuals that are expected to be incidentally taken (injure, harm, kill, etc.) per species because of each mechanism of take. The difficulty is because of the variability and uncertainty associated with the response of listed species to the effects of the proposed action, the varying population size of each species, annual variations in the timing of spawning and migration, individual habitat use within the action area, and difficulty in observing injured or dead fish. However, it is possible to estimate the extent of incidental take by designating as ecological surrogates those elements of the Project that are expected to result in incidental take, that are more predictable and/or measurable, with the ability to monitor those surrogates to determine the extent of take that is occurring. Ecological surrogates are project

elements that are expected to result in take and are somewhat predictable and/or measurable. Ecological surrogates can be monitored to approximate the level of take that occurs. Ecological surrogates for construction effects are described below. In the opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

1) Direct Effects

   Incidental take is expected to occur from construction-related effects in the form of injury or death of listed species. Worksite isolation and salvage for the cofferdam may injure or kill fish when salvaged or when the area is dewatered. The area within the proposed cofferdam is approximately 90 yd^2. Fish density estimates indicate that up to two juvenile spring-run Chinook salmon and two juvenile steelhead may be affected by worksite isolation. If the County exceeds the two juvenile spring-run Chinook salmon or two juvenile steelhead when salvaging fish from the cofferdam, or exceeds the 90-yd^2 footprint, the Project will be considered to have exceeded anticipated take levels, thus requiring the County to cease operations and coordinate with FHWA and NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

2) Increased Sedimentation and Turbidity

   The analysis of the effects of the Project anticipates that the mixing zone for turbidity levels produced by installation and removal of piles will not exceed WDOE state water quality standards (2019a) and shall comply with the most restrictive combination of the following:

   a. Not extend in a downstream direction for a distance from the discharge point(s) greater than 300 feet plus the depth of water over the discharge point(s), or extend upstream for a distance of over 100 feet;
   b. Not affect greater than 25 percent of the flow; and
   c. Not occupy greater than 25 percent of the width of the water body.

   If turbidity exceeds these standards, and construction activities fail to halt and adjust work to return to acceptable levels, the Project will be considered to have exceeded anticipated take levels, thus requiring the County to cease operations and coordinate with FHWA and NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

3) Pile Driving and Acoustic Impacts

   The applicant anticipates installation of all of the steel H-piles for the temporary work trestle to be started with pre-drilling and using a vibratory hammer then driven by impact hammer with a wooden cushion block for attenuation. Pile driving will occur during daylight hours, but will not necessarily occur on consecutive days. Each pile will be started with the vibratory hammer to allow fish to evacuate the area. The Project will use the size and type of piles described in the proposed action. All piles will be driven during the in-water pile driving work window, between July 15 and September 30. Pile driving

with an impact hammer is expected to cause incidental take in the form of injury and mortality to salmonids through exposure to temporary high noise levels or sustained exposure to lower sound levels (less than 206 dB Peak or 183 or 187 dB SEL) within the water column during the installation of the piles. NMFS has assumed that the use of a vibratory hammer to start each piling will create enough non-injurious disturbance that adults will move at least 4.4 yards away before the impact hammer use begins, thus avoiding any physical injury. NMFS has also estimated that up to two juvenile spring-run Chinook salmon and two juvenile steelhead could be injured or killed at the start of pile driving each day by failing to move more than 4.4 yards away from the given pile over 9 days of pile driving for a total number of 18 juveniles of each species injured or killed.

In addition, because of the difficulty in observing and documenting harm from pile driving, NMFS will use the area of sound pressure wave impacts extending into the water column from each pile, and the time period for pile driving, as a surrogate for number of fish. Based on the acoustic effects analysis, peak sound pressures are estimated to be above the thresholds for injury and/or mortality of listed fish within 1 yard of the pile being driven, depending on the size of piles used (12-inch piles would have lower peak and cumulative sound pressure levels) and the use of sound attenuation techniques (addition of a bubble curtain can reduce sound pressure levels an additional 5 dB). Cumulative sound exposure levels are expected to meet or exceed the 187 dB threshold for physical injury to fish greater than 2 grams (the size expected in the action area) within 4.4 yards of the pile. Non-injurious behavioral effects are expected to occur within 275 yards of the pile. If the County's monitoring indicates that sound levels greater than 206 dB Peak, 187 dB or 183 dB cSEL, or 150 dB RMS, extend beyond the distances expected for the pile size and attenuation type, the amount of incidental take would be exceeded. If these ecological surrogates are not met and maintained, the Project will be considered to have exceeded anticipated take levels, thus requiring the County to cease operations and coordinate with FHWA and NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

4) Loss of Habitat

NMFS anticipates that ESA-listed anadromous fish may be harmed because of habitat modifications in the action area that reduce the quantity and quality of rearing habitat. The ecological surrogate for incidental take associated with the action is the disturbance of approximately 355 yd^2 of streambank riparian area and vegetation that influences the habitat where migrating and rearing juveniles of the species exist within the footprint of the proposed action.

Anticipated incidental take will be exceeded if the numbers of individual fish or the ecological surrogates described in the sections above are not met, the Project is not implemented as described in the BA, all minimization measures and BMPs are not implemented as described in the BA (including successful completion of monitoring and reporting criteria), or the Project is not implemented in compliance with the terms and conditions of this ITS. If the number of fish harmed is exceeded or these ecological

surrogates are not met and maintained, the proposed action will be considered to have exceeded anticipated take levels, thus requiring the County to cease and coordinate with FHWA and NMFS within 24 hours on ways to reduce the amount of take down to anticipated levels.

2.9.2 Effect of the Take

In the 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 measures described below are non-discretionary, and FHWA must ensure they are undertaken by the County so that they become binding conditions of any contracts or permits, as appropriate, for the exemption in section 7(o)(2) to apply. The FHWA has a continuing duty to regulate the activity covered by this ITS. If the FHWA (1) fails to assume and implement the terms and conditions or (2) fails to require its contractor(s) to adhere to the terms and conditions of the ITS through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FHWA must report the progress of the action and its impact on the species to NMFS as specified in the ITS [50 CFR§402.14(i)(3)].

1) Measures shall be taken to minimize the mobilization of in-channel sediments, the introduction of sediments to the river, and turbidity plumes.
2) Measures shall be taken to reduce the potential sound impacts.
3) Measures shall be taken to revegetate temporarily impacted areas below and above the OHWM with native plants, shrubs and trees.
4) FHWA shall monitor and report on the amount or extent of incidental take.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and FHWA or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The FHWA or any applicant (County) 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: Measures shall be taken to minimize the mobilization of in-channel sediments, the introduction of sediments to the river and turbidity plumes.

a. Minimization measures described in the BA and BMPs shall be implemented to prevent sediment incursion into the active channel and reduce the mobilization of sediments in the channel.
b. Water discharged into the Wenatchee River during construction will be filtered with a filter bag, diverted to a settling tank, upland, or infiltration area, and/or treated in a manner to ensure that discharges conform to the water quality requirements of the state water quality standards or waste discharge permit.
c. Monitoring to ensure turbidity does not exceed the most restrictive combination of the following:
    i. Not extend in a downstream direction for a distance from the discharge point(s) greater than 300 feet plus the depth of water over the discharge point(s), or extend upstream for a distance of over 100 feet;
    ii. Not utilize greater than 25 percent of the flow; and
    iii. Not occupy greater than 25 percent of the width of the water body.

    If turbidity exceeds these standards, construction activities will need to halt and adjust work to return to acceptable levels.

    iv. Use an appropriate and regularly calibrated turbidity meter.
    v. Collect background turbidity levels at an undisturbed location approximately 100 feet upstream of point of disturbance prior to expected turbidity pulse.
    vi. Turbidity samples will be taken every morning and mid-day approximately 200 or 300 feet (dependent on flow) downstream of disturbance point during expected periods of turbidity (during placement or removal). If the average exceeds state standards and is documented to exceed standards for more than 2 hours, work will cease until numbers decline to state standards. If necessary additional BMPs may be implemented to reduce turbidity levels as quickly as possible.

2) The following terms and conditions implement RPM 2: Measures shall be taken to reduce the potential sound impacts.

    a. Noise attenuation methods, such as a wooden cushion blocks, and bubble curtains shall be used.
    b. Pile driving shall not be conducted at night when migration is likely to occur.

3) The following terms and conditions implement RPM 3: Measures shall be taken to revegetate impacted areas below and above the OHWM with native plants, shrubs and trees.

    a. Plants placed on-site shall be irrigated and maintained for 3 years.
    b. Where possible, revegetation will include trees to provide shade and inputs to the river in the future.
    c. The removal of existing riparian and native vegetation shall be minimized to the maximum extent practicable.

4) The following terms and conditions implement RPM 4: FHWA shall monitor and report on the amount or extent of incidental take.
    a. FHWA shall provide a report of Project activities to NMFS by December 31 of each construction year.
    b. The report shall include Project schedules, Project completions, and details regarding Project implementation for each given year.
    c. This report shall include a summary description of in-water constraint activities, avoidance and minimization measures taken (including sound attenuation), and any observed take incidents.
    d. FHWA shall visually monitor the river in the action area during operations for any affected fish, including, but not limited to, UCR spring-run Chinook salmon, UCR steelhead. Observation of affected fish shall be reported to NMFS by telephone at (509) 962-8911, by FAX at (509) 962-8544, via email to the contact person identified in the transmittal letter for this opinion or at the address given below, within 24 hours of the incident. Operations shall be halted immediately until FHWA coordinates with NMFS to determine the cause of the incident and whether any additional protective measures are necessary to protect listed salmonids. Any protective measures that are determined necessary to protect listed salmonids shall be implemented as soon as practicable within hours of the incident.

        Affected fish are defined as:
        i. Dead or moribund fish at the water surface;
        ii. Showing signs of erratic swimming behavior or other obvious signs of distress;
        iii. Gasping at the water surface; or
        iv. Showing signs of other unusual behavior.

A follow-up written notification shall also be submitted to NMFS Law Enforcement at (206) 526-6133 or (800) 853-1964, through the contact person identified in the transmittal letter for this opinion, or through the NMFS Columbia Basin Branch Office. Information provided should include the date, time, and location that the carcass or injured specimen was found, a color photograph, the cause of injury or death, if known, and the name and affiliation of the person who found the specimen. Any dead specimen(s) shall be placed in a cooler with ice and held for pick up by NMFS personnel or an individual designated by NMFS to do so.

Updates and reports required by these terms and conditions shall be submitted to NMFS Interior Columbia Basin Area Office, Columbia Basin Branch at:

Attention: Diane Driscoll (WCRO-2019-00111)
National Marine Fisheries Service
Columbia Basin Branch
304 South Water Street, Suite 201
Ellensburg, WA 98926

2.10 Conservation Recommendations

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

(1) FHWA and the County should work cooperatively with other state and federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid habitat restoration projects within the Wenatchee River Watershed.

2.11 Reinitiation of Consultation

This concludes formal consultation for West Cashmere Bridge Replacement Project. 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 (50 CFR 402.16).

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 in the BA and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plan developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action and action area are described in the BA and this opinion. The Project area includes habitat which has been designated as EFH for various life stages of Chinook salmon (*O. tshawytscha*), and coho salmon (*O. kisutch*).

3.2 Adverse Effects on Essential Fish Habitat

See Section 2.4 of the opinion for a description of the adverse effects on anadromous species habitat for Pacific salmon. The effects of the action on Pacific Coast salmon are similar to those described above in the ESA portion of the document.

NMFS concludes that the proposed action will have adverse effects on EFH designated for Pacific Coast salmon in freshwater habitats where the proposed action occurs. Based on information provided by the action agency and the analysis of effects presented in the ESA portion of this document (Section 2.4), we conclude that the proposed action will have the following adverse effects on EFH for Pacific Coast salmon.

Pile Driving:

- temporary loss of habitat

Sedimentation and Turbidity:

- degraded water quality
- reduction in aquatic macroinvertebrate production

Contaminants and Pollution-related Effects:

- degraded water quality
- reduction in aquatic macroinvertebrate production

Vegetation removal:

- long-term loss of natural shade cover

3.3 Essential Fish Habitat Conservation Recommendations

The following are EFH conservation recommendations for the Project:

1) The FHWA should work cooperatively with other state and federal agencies, private landowners, governments, and local watershed groups to identify opportunities for cooperative analysis and funding to support salmonid restoration projects within the Wenatchee River Basin. EFH would benefit from implementation of restoration projects that include (1) complex channels and floodplain habitats, (2) thermal refugia, and (3) functional riparian vegetation.

2) The FHWA should post interpretive signs within the action area describing the presence of listed fish and/or critical habitat as well as highlighting their ecological and cultural value.

Fully implementing the EFH conservation recommendations above would protect EFH for Pacific coast salmon by avoiding or minimizing the adverse effects described in section 3.2.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, FHWA must provide a detailed response in writing to NMFS within 30 days after receiving an EFH conservation recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH conservation recommendations, unless NMFS and the federal agency have agreed to use alternative timeframes for the federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the conservation recommendations, the federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects [50 CFR 600.920(k)(1)]. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

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

4.0 DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the FHWA and Chelan County. Other interested users could include landowners in Cashmere, Washington, as well as people interested in the conservation of UCR spring-run Chinook salmon, and UCR steelhead. Individual copies of this opinion were provided to the FHWA and the County. 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, if applicable] contain more background on information sources and quality.

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

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

5.0 REFERENCES

Bash, J., C. Berman, and S. Bolton. 2001. Effects of turbidity and suspended solids on salmonids. University of Washington.

Battin, J., and coauthors. 2007. Projected impacts of climate change on salmon habitat restoration. Proceedings of the National Academy of Sciences of the United States of America 104(16):6720-6725.

Berg, L., and T. G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Caltrans (California Department of Transportation). 2012. Compendium of Pile Driving Sound Data.

Caltrans (California Department of Transportation). 2014. Caltrans compendium of underwater sound data from pile driving – 2014 update.

Crozier, L. G., and coauthors. 2019. Climate Vulnerability assessment for Pacific salmon and steelhead in the California Current Large Marine Ecosystem.

Crozier, L. G., R. W. Zabel, E. E. Hockersmith, and S. Achord. 2010. Interacting effects of density and temperature on body size in multiple populations of Chinook salmon. Journal of Animal Ecology 79(2):342-349.

Ebersole, J. L., W. J. Liss, and C. A. Frissell. 2001. Relationship between stream temperature, thermal refugia and rainbow trout *Oncorhynchus mykiss* abundance in arid-land streams in the northwestern United States. Ecology of Freshwater Fish 10:1-10.

Evans, D., and Associates. 2018. Biological Assessment for the West Cashmere Bridge Replacement Project.

FHWG (Fisheries Hydroacoustic Working Group). 2008. Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities.

Ford, M. J., editor. 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-113.

Fowler, R. T. 2004. The recovery of benthic invertebrate communiites following dewatering in two braided rivers. Hydrobiologia 523(1):17-28.

Gaspin, J. B. 1975. Experimental Investigations of the Effects of Underwater Explosions on Swimbladder Fish. I. Chesapeake Bay Tests. DTIC Document.

Gisiner, R. C. 1998. Workshop on the effects of anthropogenic noise in the marine environment. Marine Mammal Science Program, Office of Naval Research.

Hastings, M. C. 1995. Physical Effects of Noise on Fishes. INTER-NOISE and NOISE-CON Congress and Conference Proceedings. 2:979-984.

Healey, M. 2011. The cumulative impacts of climate change on Fraser River sockeye salmon (Oncorhynchus nerka) and implications for management (vol 68, pg 718, 2011). Canadian Journal of Fisheries and Aquatic Sciences 68(5):953-953.

Herrmann, P. B., C. R. Townsend, and C. D. Matthaei. 2012. Individual and combined effects of fish predation and bed disturbance on stream benthic communities: a streamside channel experiment. Freshwater Biology 57(12):2487-2503.

Hicks, M. 2002. Evaluating Standards for Protecting Aquatic Life in Washington's Surface Water Quality Standards - Temperature Criteria. Washington State Department of Ecology, 00-10-070.

Hillman, T., D. Chapman, and J. S. Griffith. 1989. Seasonal habitat use and behavioral interaction of juvenile chinook salmon and steelhead. I: Daytime habitat selection. Pages 42-82 *in* Summer and winter ecology of juvenile chinook salmon and steelhead trout in the Wenatchee River, Washington. Final report to Chelan County PUD. Wenatchee, Washington. Don Chapman Consultants, Inc.

Hillman, T., and coauthors. 2016. Monitoring and evaluation of the Chelan and Grant County PUDs hatchery programs: 2015 annual report. Report to the HCP and PRCC Hatchery Committees, Wenatchee and Ephrata, Washington.

ICTRT (Interior Columbia Technical Recovery Team). 2005. Viability criteria for application to Interior Columbia Basin salmonid ESUs. Northwest Fisheries Science Center.

ISAB (Independent Scientific Advisory Board). 2007. Climate change impacts on Columbia River Basin fish and wildlife, Portland, Oregon.

Lloyd, D. S., J. P. Koenings, and J. D. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries Management 7:18-33.

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units NOAA Technical Memorandum NMFS-NWFSC-42, NOAA Technical Memorandum NMFS-NWFSC-42.

McHugh, P. A., and coauthors. 2017. Linking models across scales to assess the viability and restoration potential of a threatened population of steelhead (Oncorhynchus mykiss) in the Middle Fork John Day River, Oregon, USA. Ecological Modelling 355:24-38.

Mote, P. W., and E. P. Salathé. 2009. Future climate in the Pacific Northwest. Climate Impacts Group, University of Washington, Seattle, Washington.

Mullan, J. W., K. R. Williams, G. Rhodus, T. Hillman, and J. D. McIntyre. 1992. Production and habitat of samonids in mid-Columbia River tributary streams., Monograph 1.

Newcombe, C. P., and J. O. T. Jensen. 1996. Channel suspended sediment and fisheries: a synthesis for quantitative assessment of risk and impact. North American Journal of Fisheries Management 16:693-727.

NMFS (National Marine Fisheries Service). 2007. 2007 Report to Congress, Pacific Coastal Salmon Recovery Fund FY 2000–2006. National Marine Fisheries Service, Seattle, Washington.

NMFS (National Marine Fisheries Service). 2009. Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan.

NMFS (National Marine Fisheries Service). 2011a. 5-Year Review: Summary & Evaluation of Upper Columbia River Steelhead Upper Columbia River Spring-run Chinook, Portland, Oregon.

NMFS (National Marine Fisheries Service). 2011b. 2011 Report to Congress, Pacific Coastal Salmon Recovery Fund 2000-2010. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, Washington.

NMFS (National Marine Fisheries Service). 2014. Consultation on Remand for Operation of the Federal Columbia River Power System.

NMFS (National Marine Fisheries Service). 2016. 2016 5-Year Review: Summary & Evaluation of Upper Columbia River Steelhead Upper Columbia River Spring-run Chinook Salmon. National Marine Fisheries Service West Coast Region, Portland, Oregon.

NWFSC (Northwest Fisheries Science Center). 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest.

O'Neal, K. 2002. Effects of Global Warming on Trout and Salmon in U.S. Streams. Defenders of Wildlife, Washington, D.C.

PFMC (Pacific Fishery Management Council). 2014. Pacific Coast Salmon Management Plan Appendix A: Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon, Portland, Oregon.

Popper, A. N., T. J. Carlson, A. D. Hawkins, B. L. Southfall, and R. L. Gentry. 2006. Interim criteria for injury of fish exposed to pile driving operations: a white paper.

Popper, A. N., and M. C. Hastings. 2009. The Effects of Human-Generated Sound on Fish. Integrative Zoology 4(1):43-52.

Quinn, T. P. 2005. The behavior and ecology of Pacific salmon and trout. American Fisheries Society, Bethesda, Maryland.

Richter, A., and S. A. Kolmes. 2005. Maximum temperature limits for Chinook, coho, and chum salmon, and steelhead trout in the Pacific Northwest. Reviews in Fisheries Science 13(23-49).

Sargeant, D., N. P. Anderson, and A. Cook. 2013a. Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams, 2009-2011 Triennial Report. Washington State Departments of Agriculture and Ecology, Olympia, Washington. Publication No. 13-03-002.

Sargeant, D., D. Dugger, E. Newell, P. Anderson, and J. Cowles. 2010. Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams, 2006-2008 Triennial Report. Washington State Departments of Agriculture and Ecology, Olympia, Washington. Publication No. 10-03-008.

Sargeant, D., D. Dugger, P. Anderson, and E. N. 2011. 2011. Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams, 2009 Data Summary. Washington State Departments of Agriculture and Ecology, Olympia, Washington. Publication No. 11-03-004.

Sargeant, D., E. Newell, P. Anderson, and A. Cook. 2013b. Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams, 2009-2011 Triennial Report. Washington State Departments of Agriculture and Ecology, Olympia, Washington. Publication No. 13-03-002.

Sargeant, D., E. Newell, P. Anderson, M. Friese, and M. Bischof. 2013c. Surface Water Monitoring Program for Pesticides in Salmonid-Bearing Streams, 2012 Data Summary. Environmental Assessment Program, Washington State Department of Ecology, Olympia, Washington. Publication No. 13-03-028.

Scheuerell, M. D., and J. G. Williams. 2005. Forecasting climate-induced changes in the survival of Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha*). Fisheries Oceanography 14(6):448-457.

Servizi, J. A., and D. W. Martens. 1987. Some effects of suspended Fraser River sediments on sockeye salmon (*Oncorhynchus nerka*) Canadian Special Publication of Fisheries and Aquatic Sciences 96:254-264.

Servizi, J. A., and D. W. Martens. 1991. Effect of Temperature, Season, and Fish Size on Acute Lethality of Suspended Sediments to Coho Salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Science 48(3):493-497.

Servizi, J. A., and D. W. Martens. 1992. Sublethal responses of coho salmon (Oncorhynchus kisutch) to suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 49:1389-1395.

Shields, F. D., and D. H. Gray. 1992. Effects of woody vegetation on sandy levee integrity. Water Resources Bulletin 28(5):917-931.

Sigler, J. W., T. C. Bjornn, and F. H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Slotte, A., K. Hansen, J. Dalen, and E. Ona. 2004. Acoustic Mapping of Pelagic Fish Distribution and Abundance in Relation to a Seismic Shooting Area Off the Norwegian West Coast. Fisheries Research 67(2):143-150 67(2):143-150.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. ManTech Environmental Research Services Corporation, Corvallis, Oregon.

Sullivan, K., D. J. Martin, R. D. Cardwell, J. E. Toll, and S. Duke. 2000. An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria. Sustainable Ecosystems Institute, Portland Oregon.

TetraTech. 2016. Lower Wenatchee River Reach Assessment. Prepared for Yakama Nation Fisheries. May 2016.

UCSRB (Upper Columbia Salmon Recovery Board). 2007. Upper Columbia spring Chinook salmon and steelhead recovery plan.

USGS (U.S. Geological Survey). 2019. National Water Information System: Web Interface: USGS 12462500 Wenatchee River at Monitor.

Wade, A. A., and coauthors. 2013. Steelhead vulnerability to climate change in the Pacific Northwest. Journal of Applied Ecology 50(5):1093-1104.

Wainwright, T. C., and L. A. Weitkamp. 2013. Effects of Climate Change on Oregon Coast Coho Salmon: Habitat and Life-Cycle Interactions, volume 87. BIOONE.

Wardle, C., and coauthors. 2001. Effects of Seismic Air Guns on Marine Fish. Continental Shelf Research 21(8):1005-1027.

Waters, T. F. 1995. Sediment in streams: Sources, biological effects, and control., Monograph 7 edition, volume Monograph 7. American Fisheries Society, Monograph 7, Bethesda, Maryland.

WDOE (Washington Department of Ecology). 2019a. WACs Title 173 Chapter 173-201A: Water quality standards for surface waters of the state of Washington Section 173-201A-400 Mixing Zones.

WDOE (Washington Department of Ecology). 2019b. Washington State Water Quality Assessment 303(d)/305(b) list. Washington State Department of Ecology.

WDOE (Washington State Department of Ecology). 2004. Stormwater Management Manual for Eastern Washington.

WDOE (Washington State Department of Ecology). 2014. Quality Assurance Project Plan Wenatchee River PCB and DDT Source Assessment

Wedemeyer, G. A., B. A. Barton, and D. J. McLeay. 1990. Stress and acclimation. Pages 451-477 *in* C. B. Schreck, and P. B. Moyle, editors. Methods for Fish Biology. American Fisheries Society, Bethesda, Maryland.

Wissmar, R., C., and coauthors. 1994. Ecological health of river basins in forested regions of Eastern Washington and Oregon. U.S. Department of Agriculture, Forest Service PNW-GTR-326.

WSDOT (Washington State Department of Transportation). 2012. Fish Exclusion Protocols and Standards.

WSDOT (Washington State Department of Transportation). 2014. Pile Driving Information.

WSDOT (Washington State Department of Transportation). 2016. Highway Runoff Manual, Olympia, Washington.

Zabel, R. W., M. D. Scheuerell, M. M. McClure, and J. G. Williams. 2006. The Interplay between Climate Variability and Density Dependence in the Population Viability of Chinook Salmon. Conservation Biology 20(1):11.