Project Title:

SR 241 Mabton Bridges Project, Yakima County, Washington

☑Biological Opinion
☐Concurrence Letter

Consultation Conducted By:

Interior Columbia Basin Area Office, West Coast Region, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce

Series Name and Number:

National Marine Fisheries Service Biological Opinion NMFS-BO-[WCRO-2019-00076]
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232-1274

Refer to NMFS No.:
WCRO-2019-00076

September 20, 2019

Michelle Walker
Chief, Regulatory Branch
Seattle District, U.S. Army Corps of Engineers
P.O. Box 3755
Seattle, WA 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat response for the SR 241 Mabton Bridges Project, Yakima County, Washington. (HUC 170300031003 Horseshoe Lake–Yakima River)

Dear Ms. Walker:

Thank you for your letter of February 27, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the SR 241 Mabton Bridges Project. The enclosed document contains a biological opinion (opinion) prepared by NMFS pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on the effects of the U.S. Army Corps of Engineers (USACE) proposed permitting of the Mabton Bridges Project under section 404 of the Clean Water Act and under section 10 of the Rivers and Harbors Act. In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Middle Columbia River (MCR) steelhead (*Oncorhynchus mykiss*) and is not likely to destroy or adversely modify MCR steelhead critical habitat.

As required by section 7 of the ESA, NMFS is providing an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that USACE and the permit recipient must comply with to carry out the RPMs. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

The NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1855(b)). The NMFS has included the results of that review in section 3 of this document. This section includes four conservation recommendations to avoid, minimize, or otherwise offset potential adverse impacts on the EFH of Pacific Coast salmon. The conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b)(4)(B) of the MSA requires federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the USACE must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Please contact DeeAn Jones of the Oregon Washington Coastal office in Lacey, Washington at (360) 905-2185 or by email at deean.jones@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

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

cc: Sandi Manning, USACE
Mark Norman, WSDOT
Geoff Gray, WSDOT
George Ritchotte, Herrera

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

SR 241 Mabton Bridges Project
Yakima County, Washington

NMFS Consultation Number: WCRO-2019-00076

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Middle Columbia River steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No

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

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

Michael P. Tehan
Assistant Regional Administrator
Interior Columbia Basin Office

Date: September 20, 2019

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GLOSSARY OF ACRONYMS

BA	Biological Assessment
BMP	Best Management Practices
CFR	Code of Federal Regulations
CHART	Critical Habitat Analytical Team
DPS	Distinct Population Segment
DQA	Data Quality Act
Ecology	Washington State Department of Ecology
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FR	Federal Register
ICTRT	Interior Columbia Basin Technical Recovery Team
ITS	Incidental Take Statement
MCR	Middle Columbia River
MPG	Major Population Group
MSA	Magnuson–Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NWFSC	Northwest Fisheries Science Center
OHWM	Ordinary High Water Mark
opinion	Biological Opinion
PBF	Physical and Biological Feature
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
RCW	Revised Code of Washington
RPM	Reasonable and Prudent Measure
SMA	Shoreline Management Act
SPCC	Spill Prevention, Control and Countermeasures
TESC	Temporary Erosion and Sediment Control
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

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1. INTRODUCTION

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

1.1 Background

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

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

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

The Washington State Department of Transportation (WSDOT) will carry out the project. The U.S. Army Corps of Engineers (USACE) will issue a permit under section 404 of the Clean Water Act and under section 10 of the Rivers and Harbors Act, and is the lead federal agency.

1.2 Consultation History

WSDOT environmental and design staff met with ESA liaisons from NMFS for a pre-biological assessment (BA) meeting on September 20, 2018. NMFS received a draft copy of the BA on December 4, 2018, and sent a request for additional information on January 27, 2019. On February 11, 2019, the USACE/WSDOT provided the requested additional information.

On February 27, 2019, the USACE submitted a biological assessment to NMFS and requested consultations under both ESA and MSA. After further review of the BA, NMFS asked that WSDOT perform a hydraulic analysis to analyze potential changes in water velocity resulting from a temporary work trestle spanning the entire Yakima River. NMFS initiated formal consultation for the Mabton Bridges Project on April 4, 2019, pending receipt of the analysis. WSDOT provided the hydraulic analysis on June 27, 2019.

1.3 Proposed Federal Action

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

The USACE proposes to permit a WSDOT project to replace Bridge 241/2 and repair Bridge 241/5 on SR 241 where it crosses the Yakima River in Yakima County, Washington (Figure 1). The entire project limits, from SR 241 milepost 1.06 to 1.50, are within 200 feet of sensitive habitats, which include the Yakima River and a wetland slough contiguous with the river. Bridge 241/2 spans the wetland and will be replaced by a new bridge in the same location as the existing bridge. Bridge 241/5 spans the Yakima River and will undergo repairs to the bridge deck hinge.

Construction will take place between May 1, 2021, and August 15, 2022, with an estimated total of 200 working days. In-water work will be conducted between June 1 and September 15; no impact pile driving will occur after August 31. No construction will take place from November 2021 to March 2022.

Site Preparation and Staging Areas

Project construction activities will be confined to construction limits, which will be staked or flagged to mark the project edges, clearing limits, and right-of-way. During construction, SR 241 will be closed and traffic detoured around the construction area on existing roads (Figure 1). Construction equipment will be staged upon the paved surface of SR 241 for two construction seasons (2021–2022). Construction areas will be temporarily cleared of vegetation and obstructions to provide adequate work space. Approximately 8,790 square feet of land will be cleared, up to 2,350 square feet of which will be within the 200-foot riparian buffer zone of the Yakima River: 2,000 square feet at the river and 350 square feet at the wetland (Table 1).

Temporary fill will be placed within the existing roadway prism to allow transition of equipment from the existing paved surface to the temporary work structures. Fill placement will affect 3,031 square feet of terrestrial vegetation at the 241/5 bridge site on the river and 3,409 square feet of terrestrial vegetation at the 241/2 bridge site for a total of 6,440 square feet of terrestrial vegetation temporarily disturbed (Table 1). All fill will be placed above the ordinary high water mark (OHWM) of the river.

Vegetation clearing will include removing branches and tree trunks but will leave the soil intact. Vegetation that is rooted on the abutment fill slope may be trimmed, but not grubbed, during construction. The project will not result in any permanent impacts to riparian vegetation. All temporarily cleared areas will be restored with native vegetation.

Detour Route Improvements

Two intersections along the detour route (Hornby Road/Grandview Pavement Road, South Euclid Road/Chase Road) will be improved by adding 400 square feet of new pavement at each intersection to allow detoured large trucks to safely navigate a right turn. All stormwater runoff from the new impervious surface will be treated via infiltration in road shoulder areas.

Figure 1. Project Overview for the SR 241 Mabton Bridges Project MP 1.06–1.50 in Yakima County, Washington.

Table 1. Summary of project components with the potential to impact listed species.

		30" Steel Piles	Bubble curtain	Effects: Substrate	Noise (SEL injury)	Overwater cover	Turbidity	Streambank	Riparian vegetation	Fill (upland)
		no.	type	sq. ft.	ac.	sq. ft.	ac.	ft.	sq. ft.	sq. ft.
Temporary Work Structures	**Yakima River (Bridge 241/5)**	145	confined	712	9	14,300	2.81	4,630	2,000	3,031
	Wetland (Bridge 241/2)	80	unconfined	393	--	9,360	--	--	350	3,409
	Totals	225		1,105	9	23,660	2.81	4,630	2,350	6,440
	+ Cofferdam area (wetland only)			2,000						

		Existing	Post-project	Net gain	Replaced	Pre-treated	Post-treated	Post-untreated
		sq. ft.	sq. ft.	sq. ft.	sq. ft.	sq. ft.	sq. ft.	sq. ft.
Impervious Surface (no change to Bridge 241/5)	**Wetland (Bridge 241/2)**	10,080	12,301	2,221	10,080	0	12,301	0
	Detour intersection paving	0	800	800	0	0	800	0

		Piles	12-hour rest	Piles/day	Strikes/pile	Strikes/day	Days drivers	Hours drivers
Pile Driving	**Yakima River (Bridge 241/5)**	145	yes	12	60	720	24.2	290
	Wetland (Bridge 241/2)	80					13.3	160
	Totals	225					37.5	450

		Piles	Piles area	Cofferdam area	Total area	Net loss
			sq. ft.	sq. ft.	sq. ft.	sq. ft.
Substrate Impact	**Yakima River (Bridge 241/5)**	145	712	--	712	0
	Wetland (Bridge 241/2)	80	393	2,000	2,393	95
	Totals	225	1,105	2,000	3,105	95

		Non-riparian		Riparian		Totals
		perm	temp	perm	temp	
		sq. ft.	sq. ft.	sq. ft.	sq. ft.	sq. ft.
Vegetation Impact	**Yakima River (Bridge 241/5)**	0	3,031	0	2,000	5,031
	Wetland (Bridge 241/2)	0	3,409	0	350	3,759
	Totals	0	6,440	0	2,350	8,790

Work Platforms

At Bridge 241/2, 80 30-inch-diameter steel piles will be driven into the wetland to support a full-length work platform constructed east of the existing bridge (Table 1). The work platform will be used to remove and replace the existing bridge structure. Each pile will occupy an area of 4.91 square feet, and the placement of 80 piles will disturb a total of 393 square feet of wetland substrate.

At Bridge 241/5, 145 30-inch-diameter steel piles will be driven into the riverbed to support a work platform spanning the entire river east of the existing bridge. The platform will include an extension under the bridge deck to support the hinge during repair. The platform will be supported by three-pile structural support units, or bents, with 10- to 15-foot spacing between bents. The placement of 145 piles will disturb a total of 712 square feet of substrate.

The temporary work platforms will be constructed from the existing roadway fill prism toward the center of the river/wetland, precluding the need for a barge. The two work access platforms will remain in place for the 2-year duration of the project. Once construction is complete, the temporary work platforms will be removed, and upland areas restored to pre-project condition. Piles supporting the platforms will be removed by direct pulling.
The dimensions of the work platforms are as follows:

- Bridge 241/2 work platform dimensions: 26 feet by 360 feet, 80-count pile structure.
- Bridge 241/5 work platform dimensions: 26 feet by 550 feet, 145-count steel pile structure.

The initial construction of the two work platforms will be done from the abutments and existing roadway areas of each bridge, respectively, and once enough of each platform has been constructed from the abutments and roadway, the rest will be built out from the work platforms themselves.

Bridge 241/2 Replacement

A new bridge will be constructed in the same location as the existing bridge, which spans a wetland slough contiguous with the Yakima River. The location and size of the bridge abutments, as well as the length and height of the bridge, will remain the same. The width of the new bridge will increase by 6 feet 2 inches (from 28 feet wide to 34 feet 2 inches wide), to meet current design standards. The increase in bridge width will add 2,221 square feet of impervious surface and overwater cover.

In replacing the 241/2 bridge, the 35 existing round concrete piers supporting the bridge will be removed. The piers will be removed either by direct pulling or vibration, pending the bridge demolition plan to be submitted by the contractor. Cofferdams (sheet piles) may be required for removal of the existing piers, for which fish exclusion will be needed. Cofferdams will temporarily disturb an additional 2,000 square feet of wetland substrate. The new bridge piers will be drilled into place and will increase the wetland footprint (net loss) by 95 square feet.

The contractor will submit a complete bridge demolition plan prior to beginning pier removal work, which will follow the general steps outlined below:

1. The road will be closed to traffic.
2. The work access platform will be built out from the southern abutment, along the east side of the bridge.
3. The deck will be removed from the existing bridge.
4. The old bridge piles will be removed (either through pulling or vibration).
5. The new bridge shafts will be drilled into place.
6. The new bridge deck will be built on top of the new piles.
7. The work platform will be removed.

Bridge 241/5 Repair

The bridge deck hinge will be repaired, situated approximately mid-channel over the Yakima River. The contractor will submit a work plan prior to repair work beginning. It is anticipated the work will follow the general steps outlined below:

1. The road will be closed to traffic.
2. The work access platform will be built out from the northern abutment, along the east side of the bridge.
3. A work platform will be built beneath the hinge area in the bridge.
4. The bridge deck hinge will be repaired or replaced.
5. The deck of the existing bridge will be repaired.
6. The work platforms will be removed.

Cofferdams will not be used at the river work site.

Pile Driving and Removal

Eighty 30-inch-diameter steel piles will be driven with an impact hammer into the wetland slough to support the work platform for Bridge 241/2, and 145 30-inch-diameter steel piles will be driven with an impact hammer into the Yakima River bed to support the work platform for Bridge 241/5. Steel piles may be driven from both banks concurrently in order to reduce pile driving time. A confined bubble curtain will be employed in the Yakima River, where practicable, in water at least 3 feet deep. An unconfined bubble curtain will be used in the wetland slough, in water at least 3 feet deep. The work platforms will be constructed from the existing roadway fill prism toward the centers of the river and wetland, respectively, and a barge will not be used. No mechanized equipment will operate below the OHWM.

An estimated six piles will be driven per day, assuming use of a single pile driver. If a second pile driver is used, 12 piles may be driven per day. Each pile will require an estimated 60 strikes, resulting in as many as 720 strikes per day. No pile driving will occur at night. The project will use a 12-hour rest period between pile driving periods. Assuming the use of a single pile driver, the total number of days on which pile driving will occur is estimated to be 37.5 (450 hours) during the in-water work window including pile driving time for the work platforms at both bridges (225 piles). If the contractor uses dual pile drivers, the duration of in-water work will be reduced. The 225 piles supporting both work platforms will be removed by direct pulling.

Stormwater Management

The existing Bridge 241/2 includes 10,080 square feet of impervious surface, the runoff from which is not treated before it enters the wetland slough. The increased width of the new bridge will add 2,221 square feet of impervious surface. Currently, stormwater discharges through drains in the bridge decks. Stormwater runoff from the new bridge will be directed off the bridge and will be treated to WSDOT Highway Runoff Manual standards (WSDOT 2019a) prior to discharge to the wetland.

Equipment

Equipment anticipated for the project includes: pile driver, crane, dump truck, water truck, grader, concrete truck, cleaning truck, excavator, bulldozer, front loader, paver, roller, sweeper, concrete saw, generator, pneumatic hand tools, jackhammer, and traffic control vehicles. No mechanized equipment will operate below the OHWM.

Restoration and Site Cleanup

The final elements of work will be restoration of temporarily disturbed areas, site cleanup, and demobilization. All temporarily cleared areas will be revegetated with native plant species, replacing any non-native and invasive species currently present. Restoration of temporarily disturbed areas will generally follow the standards contained in the WSDOT's Standard Specifications (WSDOT 2016a) for roadside restoration and the Roadside Policy Manual (WSDOT 2015). These standards include placing topsoil, compost, and soil amendments; planting native species; and adhering to project-specific weed and pest control and plant establishment plans. Plant survival will be monitored for 3 years, including replacement of plants that do not meet survival performance standards.

No restorative plantings are planned in the wetland. Natural recruitment and regrowth are expected to be rapid in those work areas.

Schedule

The project is scheduled to start May 1, 2021, and end August 15, 2022. WDFW in-water work window is June 1 to September 15. WSDOT has committed to an in-water work window of June 1 to August 31, to avoid impacts to adult steelhead migrating upstream. In-water work for both bridges will occur for 98 days, including pile driving in the Yakima River and in the wetland slough, replacement of the 241/2 bridge piers, and removal of the 225 temporary steel piles. The project schedule includes a winter pause from November 2021 to March 2022, during which construction will not occur.

Minimization Measures

Stormwater Quality and Quantity Minimization Measures

MM-1. All projects (except exempt activities as listed in section 3-2.2 of the Highway Runoff Manual (WSDOT 2019a), are subject to minimum stormwater management requirements as outlined in section 3-3. Non-exempt projects must address erosion control if greater than or equal to 7,000 square feet of soil will be disturbed or if there is greater than or equal to 2,000 square feet of new and replaced impervious surface. Erosion control requirements include: (1) a Temporary Erosion and Sediment Control (TESC) Plan (see TESC Manual); and (2) a project specific Spill Prevention, Control and Countermeasures (SPCC) Plan, as required in Standard Specification 1.07-15(1).

MM-2. WSDOT will ensure that projects within 200 feet of surface water will install and maintain Best Management Practices (BMP) as stated in the Contract to ensure that no foreign material, such as pavement slurry from asphalt grinding equipment, is sidecast, and to control and prevent sediments from entering aquatic systems.

MM-3. The contractor shall comply with the Washington State Department of Ecology's (Ecology's) State Water Quality Standards (WAC 173-201) or permit modifications. Permit modifications are limited to an extended temporary area of mixing granted by Ecology in a section 401 Water Quality Certification.

MM-5. The project will not cause or contribute to stream bed or bank scour or erosion (channel instability), and will not measurably affect base, peak, or flow durations in any threshold discharge area or receiving waterbody.

MM-6. Stormwater will be infiltrated and/or dispersed when possible.

Aquatic Area Buffers Minimization Measures

MM-7. No contractor staging areas will be allowed within 200 feet of potentially suitable wetland, stream, estuarine, river or marine drainage as identified by the project biologist, unless site specific review completed by the project biologist indicates that no impacts to the sensitive resource areas will occur due to topography or other factors.

MM-8. Temporary material storage piles consisting of erodible materials will be placed outside the 100-year floodplain during the rainy season (October 1 through June 1) except for emergency projects, or unless site specific review completed by the project biologist indicates that topography or other factors preclude runoff from entering waterbodies containing listed fish species or their prey. Such temporary storage piles will be stabilized with plastic sheeting, straw bales, or other BMPs, to prevent sediment delivery to these waterbodies. Material to be used within 12 hours of deposition will not be considered a temporary material storage pile.

MM-9. All excavated materials will be removed to an upland location where they cannot enter the waterbody.

Vegetation Removal Minimization Measures

MM-11. WSDOT designers will minimize removal of riparian vegetation and contractors shall replant riparian vegetation. Replanting may not be possible in permanent impact areas, the roadway clear zone, or adjacent to or under bridges. However, potential replanting of riparian vegetation near the site should be evaluated. The Programmatic Biological Assessment Determination Form will provide the justification for the removal of riparian vegetation and will include the proposed planting plans, if applicable.

MM-12. Vegetation will only be grubbed from areas undergoing permanent alteration. No grubbing will occur in areas slated for temporary impacts. Exceptions to grubbing temporary impact areas can be made if the temporary area is currently covered by non-native or invasive species and will be replanted with native species.

MM-13. Disturbance to riparian vegetation from the operation of heavy equipment will be minimized as practicable by straddling it with heavy equipment or by pruning it without damaging the roots. Existing riparian vegetation outside of the work area will not be removed or disturbed.

In-water Work Minimization Measures

MM-14. Seasonal restrictions applied to work conducted within or below the OHWM or Mean Higher High Waters will follow requirements within the Hydraulic Project Approval issued by WDFW, and Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC). In-water work duration will be minimized as practicable.

MM-16. Construction equipment will not enter any waterbody without authorization from WDFW, U.S. Fish and Wildlife Service (USFWS), and NMFS. Equipment will be operated as far from the water's edge as possible.

MM-17. Anthropogenic debris from bridge demolition will be directed toward storage areas on land or barges. Bridge demolition will include sectioning the structure to the extent possible to provide for safer disposal and to minimize debris falling into surface waters.

Revegetation and Slope Stability Minimization Measures

MM-18. Erodible earth not being worked, whether at final grade or not, shall be covered within the time periods specified below, using an approved soil covering practice: Western Washington (west of the Cascade Mountain Crest) (1) from October 1 through April 30 erodible earth may be exposed without cover for 2 days maximum, (2) from May 1 to September 30 for 7 days maximum. Eastern Washington (east of the Cascade Mountain Crest) (1) from October 1 through June 30 erodible earth may be exposed without cover for 5 days maximum, (2) from July 1 to September 30 for 10 days maximum.

MM-19. Temporarily disturbed areas will be restored to pre-work conditions to the extent possible, including protecting existing root systems and allowing re-sprouting of herbaceous and woody plants. Native trees and shrubs will be used that are endemic to the project vicinity or region of the state where the activity is occurring.

MM-20. All exposed areas will be mulched and seeded with an approved native or noninvasive herbaceous seed mix following construction and/or planted with native woody vegetation and trees (if appropriate) during the first available planting season.

General Construction Minimization Measures

MM-21. Construction impacts will be confined to the minimum area necessary to complete the project.

MM-22. WSDOT Construction will clearly flag the boundaries of clearing limits to prevent disturbance outside of the limits. The contractor shall install high visibility fencing in accordance with WSDOT Standard Specifications.

Pollutant Protection Minimization Measures

MM-23. The contractor will use BMPs, as stated in their SPCC Plan, to ensure that no foreign material such as oil or fuel from construction equipment will enter any wetlands, flowing or standing water.

MM-24. All equipment will be fueled and maintained more than 200 feet from the nearest wetland, ditches, flowing or standing water, unless site specific review completed by the project biologist indicates that no impacts to the resource areas will result due to topography or other factors. Exceptions to this requirement are allowed for large cranes, pile drivers, and drill rigs if they cannot be easily moved.

MM-25. Equipment will be checked daily for leaks and will be well maintained to prevent lubricants and any other deleterious materials from entering waters of the state. Prior to entering the water or below the OHWM, all equipment will be free of any external petroleum products, hydraulic fluid, coolants, and other deleterious materials. Wash water will not be discharged to any waterbody without pre-treatment.

MM-26. All equipment entering waters that may be used by listed fish species and/or if the waters are critical habitat, will use vegetable oil or other biodegradable acceptable hydraulic fluid substitute, unless the project is an emergency action.

Concrete Work Minimization Measures

MM-27. For projects involving concrete, concrete truck chute cleanout areas will be established to properly contain wet concrete and wash water and prevent it from entering wetlands and other waterbodies.

MM-28. The contractor will protect all inlets and catchments from stormwater runoff from fresh concrete, tackifier, paving, or paint striping if inclement weather unexpectedly occurs.

MM-29. All concrete will be poured in the dry, or within confined waters not being dewatered to surface waters and will be allowed to cure a minimum of 7 days before contact with surface water.

Restrictions in Rainy Weather Minimization Measures

MM-32. No paving, chip sealing, or stripe painting will be initiated in rainy weather.

Bridge Work Minimization Measures

MM-17. Anthropogenic debris from bridge demolition will be directed toward storage areas on land or barges. Bridge demolition will include sectioning the structure to the extent possible to provide for safer disposal and to minimize debris falling into surface waters.

MM-33. Bridge construction will take place from the adjacent streambanks, existing bridges, barges, or temporary work bridges. Some work may be allowed within a dewatered channel or on a dry gravel bar with WDFW, NMFS, and USFWS approval, but no equipment or vehicle staging will be allowed in these areas.

Work Area Isolation and Fish Handling Minimization Measures

MM-53. Listed fish species, including their forage fish, will be removed from the work area prior to any in-water work activities, unless removal would affect the individuals more than leaving them on-site. Fish exclusion activities will follow the most recent WSDOT protocol that has been approved by NMFS and USFWS.

MM-54. Water pumped out of the isolated project area will be discharged to a temporary storage and treatment site or to upland areas and filtered through vegetation prior to reentering the stream channel.

MM-55. All intake pumps within fish bearing streams will have a fish screen installed, operated and maintained. Screening techniques must utilize the specifications in the Hydraulic Project Approval and be in compliance with RCW 77.55.010, RCW 77.57.040 and RCW 77.57.070 or the specifications in the NMFS Anadromous Salmonid Passage Facility Design Manual (2008) and NMFS Fish Screening Criteria for Anadromous Salmonids (1997), whichever is more restrictive.

MM-59. WSDOT biologists will follow the WSDOT Fish Exclusion Protocols and Standards to conduct work area isolation, fish capture and removal, and dewatering/rewatering. Implementing these factors depends to some degree on local conditions and the professional judgment of the biologist. If block nets are in use, they will be checked three times daily. Flows shall be gradually reintroduced to the isolated work area, to prevent channel bed or bank instability, excessive scour, or turbidity and sedimentation. The directing biologist shall inspect the work area downstream reach to ensure no fish are stranded or in distress during reintroduction of flows.

MM-60. Upon completion of all in-water work, all stream diversion devices, equipment, pipe, and conduits will be removed, and disturbed soil will be restored after diversions are removed. Streambank plantings may occur at a later date during the planting season.

Cutting and Filling Minimization Measures

MM-66. Fill material will only be placed in specified and permitted locations. Fill placement may be permanent or temporary and will be located in a way that minimizes impacts to sensitive areas.

MM-67. Temporary fills must be entirely removed and the site restored to pre-existing contours.

Pile Installation/Removal Minimization Measures

MM-68. Installation of steel piles with an impact hammer in-water requires the use of a bubble curtain or other approved sound attenuation method(s) to minimize impacts within waterbodies that may be used by listed species, including marine mammals.

MM-69. No creosote-treated wood will be used below the OHWM.

MM-70. Any removed piling or other materials, including their waste water, will be fully contained and disposed of at a location with regulatory approval.

MM-71. For pile removal, direct pulling, vibratory removal, or cutting the piles below ground level will be prioritized to minimize localized turbidity. If using a clamshell bucket or other removal method is necessary due to pile breakage and the action will generate turbidity, the contractor shall employ a turbidity control BMP that is appropriate for that site.

MM-73. All treated wood will be contained during and after removal to preclude sediments and any contaminated materials from re-entering the aquatic environment. All contaminated materials will be disposed of at an approved and permitted disposal facility. No reuse of treated wood will occur.

MM-74. Sound pressure will be monitored per the approved WSDOT Hydroacoustic Monitoring Protocol for in-water pile driving to determine ambient conditions and the sound pressure generated during in-water impact pile driving of steel piles, including H-piles, and sheet piles. Sound pressure monitoring will occur for in-water work where listed fish species may be present. Monitoring results will be provided to the Service within 90 days following completion of pile driving.

Lighting Minimization Measures

MM-76. Temporary lights for night work will be directed away from waters with listed fish species to the greatest extent possible, with the intent to prevent light from shining on surface waters.

MM-77. When permanent lighting is needed on a bridge or road segment adjacent to surface waters with listed fish species, individual "cobra head" or similar lamps will be used when possible, rather than area lights that illuminate larger areas. Lights will be directed away from waters with listed fish species to the extent possible.

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

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

The USACE determined the proposed action is likely to affect MCR distinct population segment (DPS) steelhead (*O. mykiss*) and MCR steelhead critical habitat. This species and habitat are addressed in section 2.2.

2.1 Analytical Approach

This opinion includes 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. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

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

1. Identify the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
2. Describe the environmental baseline in the action area.
3. Analyze the effects of the proposed action on both species and their habitat using an "exposure-response-risk" approach.
4. Describe any cumulative effects in the action area.
5. 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.
6. Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
7. If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each listed 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. These documents inform the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential PBFs that help to form that conservation value.

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

During the last century, average regional air temperatures in the Pacific Northwest increased by 1°F to 1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Kunkel et al. 2013; Abatzoglou et al. 2014). Warming is likely to continue during the next century as average temperatures are projected to increase another 3°F to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

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

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

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.8 °F to 6.7°F by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011; Reeder et al. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012; Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10 to 32 inches by 2081 to 2100 (IPCC 2014). These changes will likely result in increased erosion, more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011; Reeder et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances; therefore, these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This trend is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011; Reeder et al. 2013).

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

2.2.1 Status of the Species

Table 2 provides a summary of listing and recovery plan information, status summary, and limiting factors for MCR steelhead. More information can be found in recovery plans and status reviews. Those documents are available on the NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov).

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” parameters, 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. The parameters 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.

Table 2. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Middle Columbia River steelhead	Threatened 3/25/1999 (64 FR 14517); Reaffirmed 1/5/2006 (71 FR 834); Reaffirmed 8/15/2011 (76 FR 50448); Reaffirmed 4/14/2014 (79 FR 20802); Reaffirmed 5/26/2016 (81 FR 33468)	NMFS 2009	NWFSC 2015	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan.	Degraded freshwater habitat Mainstem Columbia River hydropower-related impacts Degraded estuarine and nearshore marine habitat Hatchery-related effects Harvest-related effects Effects of predation, competition, and disease.

DPS = Distinct Population Segment

“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).

Middle Columbia River Steelhead

The MCR steelhead DPS includes all naturally spawning populations of steelhead using tributaries upstream and exclusive of the Wind River, Washington, and the Hood River, Oregon, excluding the upper Columbia River tributaries (upstream of Priest Rapids Dam) and the Snake River. The MCR steelhead DPS was listed as threatened on March 25, 1999 (64 FR 14517). Its threatened status was reaffirmed on January 5, 2006 (71 FR 834), August 15, 2011 (76 FR 50448), April 14, 2014 (79 FR 20802), and May 26, 2016 (81 FR 33458). NMFS has defined DPSs of steelhead to include only the anadromous members of this species (70 FR 67130).

Our approach to assessing the current status of a steelhead DPS is based on evaluating information on the abundance, productivity, spatial structure, and diversity of the anadromous component of this species (Good et al. 2005; 70 FR 67130). Many steelhead populations along the U.S. West Coast co-occur with conspecific populations of resident rainbow trout. There may be situations where reproductive contributions from resident rainbow trout may mitigate short-term extinction risk for some steelhead DPSs (Good et al. 2005; 70 FR 67130). We assume that any benefits to an anadromous population resulting from the presence of a conspecific resident form will be reflected in direct measures of the current status of the anadromous form (Ford 2011).

The Interior Columbia Basin Technical Recovery Team (ICTRT) has identified 17 extant populations in the MCR steelhead DPS. The populations fall into four major population groups (MPGs): the Yakima River basin (four extant populations), the Umatilla/Walla Walla drainages (three extant populations and one extirpated population), the John Day River drainage (five extant populations), and the Eastern Cascades group (five extant and two extirpated populations).

Life History. Life history characteristics for MCR steelhead are similar to those of other inland steelhead DPSs. Most fish smolt at 2 years and spend 1 to 2 years in salt water before reentering freshwater, where they may remain up to a year before spawning (Howell et al. 1985). All steelhead upstream of The Dalles Dam are summer-run fish that enter the Columbia River from June to August. Adult steelhead ascend mainstem rivers and tributaries throughout the winter, spawning in the late winter and early spring. Fry emergence typically occurs between May and August (Reisenbichler et al. 1992).

Limiting Factors. The major factors limiting recovery of the MCR steelhead DPS include: (1) Mainstem Columbia River hydropower system mortality, (2) reduced streamflow in tributaries, (3) impaired passage in tributaries, (4) excessive sediment, (5) degraded water quality, and (6) altered channel morphology (NMFS 2005a).

Abundance and Productivity. According to the most recent 5-year status review (2010 to 2014 data), 7 of 15 populations studied are currently above the minimum abundance thresholds identified by the ICTRT (NWFSC 2015). There are insufficient data to identify 5-year abundances for the Klickitat River and Rock Creek. Total escapement and natural-origin escapements for all five John Day populations increased relative to Ford's (2011) prior 5-year review. Total spawning escapements have increased in the most recent brood cycle for all three populations in the Umatilla–Walla Walla MPG as well. In the Eastern Cascades MPG, total escapement and natural-origin escapements for two of three populations have increased since the previous 5-year review.

The proposed action will take place on the mainstem Yakima River within the Yakima River Basin MPG boundaries, and it will affect the four populations within this MPG: Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River. The MCR Steelhead Recovery Plan (NMFS 2009) characterized five MCR steelhead populations as being at high risk of extinction in terms of abundance based on 1995 to 2004 spawner numbers, including the Naches and Upper Yakima populations. The remaining populations in the Yakima MPG were rated at moderate risk of extinction in terms of abundance. A newer analysis by Ford (2011) used more recent spawner numbers from 2000 to 2009 and rated the Naches population as a moderate risk of extinction in terms of abundance, and the latest Northwest Fisheries Science Center (NWFSC) (2015) review rated the Upper Yakima population as a moderate risk. The Satus Creek and Toppenish Creek populations were rated low risk by the NWFSC (2015) for the integrated abundance and productivity risk of extinction. Recent spawner numbers are given in Table 3.

Table 3. Abundance and Abundance Thresholds for Yakima River major population group of Middle Columbia River Steelhead.

Population	ICTRT Minimum Abundance Threshold	Natural Spawner Abundance 2005–2014	Overall Viability Rating
Satus Creek	1,000	1,127	Viable
Toppenish Creek	500	516	Viable
Naches River	1,500	1,244	Moderate
Upper Yakima River	500	246	High risk

Spatial Structure and Diversity. The NWFSC (2015) reported no change in the integrated spatial structure and diversity risk for all 17 MCR steelhead populations relative to the previous status review by Ford (2011). Two populations are considered to be at low risk, 14 at moderate risk, and one with a high risk of extinction based on spatial structure and diversity criteria. Within the Yakima River MPG, the Satus, Toppenish, and Naches populations are at moderate risk of extinction, while the Upper Yakima population is characterized as high risk.

Biological Risk Summary. The NWFSC (2015) reported that there have been improvements in the viability ratings for some of the component populations, but the MCR steelhead DPS is not currently meeting the viability criteria described in the MCR Steelhead Recovery Plan (NMFS 2009). Natural origin returns to the majority of populations in two of the four MPGs (Yakima River and John Day River) increased modestly relative to the levels reported in the last 5-year review. Abundance estimates for two of three populations with sufficient data in the remaining two MPGs (Eastside Cascades and Umatilla/Walla Walla) were marginally lower. Updated information indicates that stray levels into the John Day River populations have decreased in recent years. Out-of-basin hatchery stray proportions, although reduced, remain high in spawning reaches within the Deschutes River Basin populations. In general, the majority of population level viability ratings remained unchanged from prior reviews for each MPG within the DPS (NWFSC 2015). For the Yakima River MPG, NWFSC (2015) gave overall viability ratings of Viable for the Satus Creek and Toppenish Creek populations, Moderate for the Naches River population, and High Risk for the Upper Yakima River population (Table 3).

2.2.2 Status of Critical Habitat

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

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

NMFS designated critical habitat for MCR steelhead in the Upper Yakima, Naches, Lower Yakima, Middle Columbia/Lake Wallula, Walla Walla, Umatilla, Middle Columbia/Hood, Klickitat, Upper John Day, North Fork John Day, Middle Fork John Day, Lower John Day, Lower Deschutes, Trout, and Upper Columbia/Priest Rapids subbasins, as well as the Columbia River migration corridor. There are 114 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 24 received a medium rating, and 81 received a high rating (NMFS 2005b).

Many factors, both human-caused and natural, have contributed to the decline of the functional condition of the essential features of PBFs of designated critical habitat. Steelhead habitat has been altered through activities such as urban development, logging, grazing, power generation, and agriculture. These habitat alterations have resulted in the loss of important spawning and rearing habitat and the loss or degradation of migration corridors. The following are the major factors which impair the essential features of the PBFs within designated critical habitat for MCR steelhead:

- Mainstem Columbia River hydropower system mortality (freshwater migration corridors without obstructions)
- Reduced tributary stream flow (freshwater spawning sites with water quantity conditions supporting spawning, incubation and larval development; freshwater rearing sites with water quantity to form and maintain physical habitat conditions that support juvenile growth and development)
- Impaired passage in tributaries (freshwater rearing sites with water quantity to form and maintain physical habitat conditions that support juvenile growth and development; freshwater migration corridors with water quantity conditions supporting juvenile and adult mobility and survival)
- Excessive sediment in tributaries (spawning sites with substrate to support egg incubation and larval growth and development; juvenile migration corridors and rearing sites with forage to support juvenile growth and development)
- Degraded tributary water quality (spawning sites with water quality to support egg incubation and larval growth and development; juvenile rearing sites and migration corridors with water quality supporting juvenile growth and development)
- Altered tributary channel morphology (freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; freshwater rearing sites with floodplain connectivity to form and maintain physical habitat conditions that support juvenile growth and development)
- Climate change, which is expected to alter critical habitat as described in section 2.2 by generally increasing temperature and peak flows and decreasing base flows. Although changes will not be spatially homogenous, effects of climate change will generally decrease the capacity of critical habitat to support successful spawning, rearing, and migration.

The two freshwater PBFs which are present in the action area are listed below in Table 4. The condition of these PBFs in the action area is discussed in greater detail in the Environmental Baseline section, which follows.

Table 4. Critical habitat physical and biological features (PBFs) relevant to this consultation.

PBF Site	PBF Characteristics	Species Life Stage
Freshwater rearing	Water quantity and floodplain connectivity	Juvenile growth and mobility
	Water quality and forage	Juvenile development
	Natural cover	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover	Juvenile and adult mobility and survival

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is defined as the geographical extent (in both aquatic and terrestrial environments) of the physical, chemical, and biological effects resulting from the proposed action, including direct and indirect effects, as well as effects of interrelated and interdependent activities.

The project occurs on SR 241 (milepost 1.06-1.50) where it crosses the Yakima River at RM 60, approximately 1.5 miles north of the City of Mabton in Yakima County, Washington. The action area is delimited by anticipated construction noise over baseline levels and includes the areas within 1 mile of pile driving (Figure 2). The aquatic portion of the action area is defined by the extent of underwater noise and water quality impacts (increased turbidity and suspended sediment) due to pile driving and removal (Figure 3). At the site of Bridge 241/2 in the wetland slough, the aquatic action area does not extend beyond the site of the bridge and temporary work structure, as dense emergent vegetation and shallow water are expected to dampen sound transmission and contain water quality impacts. The aquatic action area in the Yakima River encompasses 31 acres of the river channel upstream and downstream of Bridge 241/5 due to underwater noise. Pile driving at 185dB_{RMS} extends to bends in the river (RMS zone) and includes 9.27 acres of sound exposure level (SEL) injury zone for fish less than 2 grams up to 486 feet from the piles (Figure 3). Increased turbidity and suspended sediment will extend approximately 300 feet downstream of Bridge 241/5.

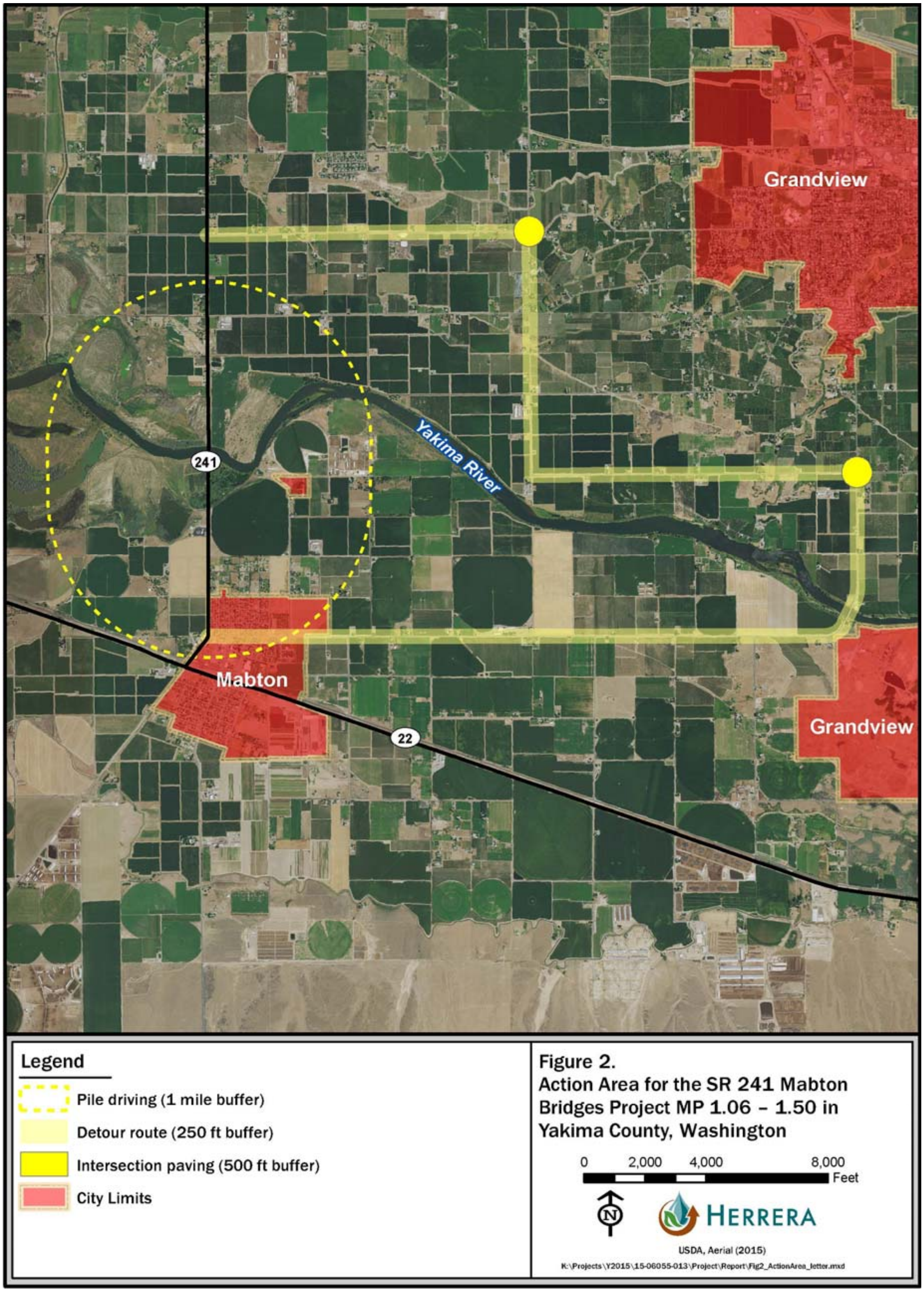

Figure 2. Action Area for the SR 241 Mabton Bridges Project MP 1.06–1.50 in Yakima County, Washington.

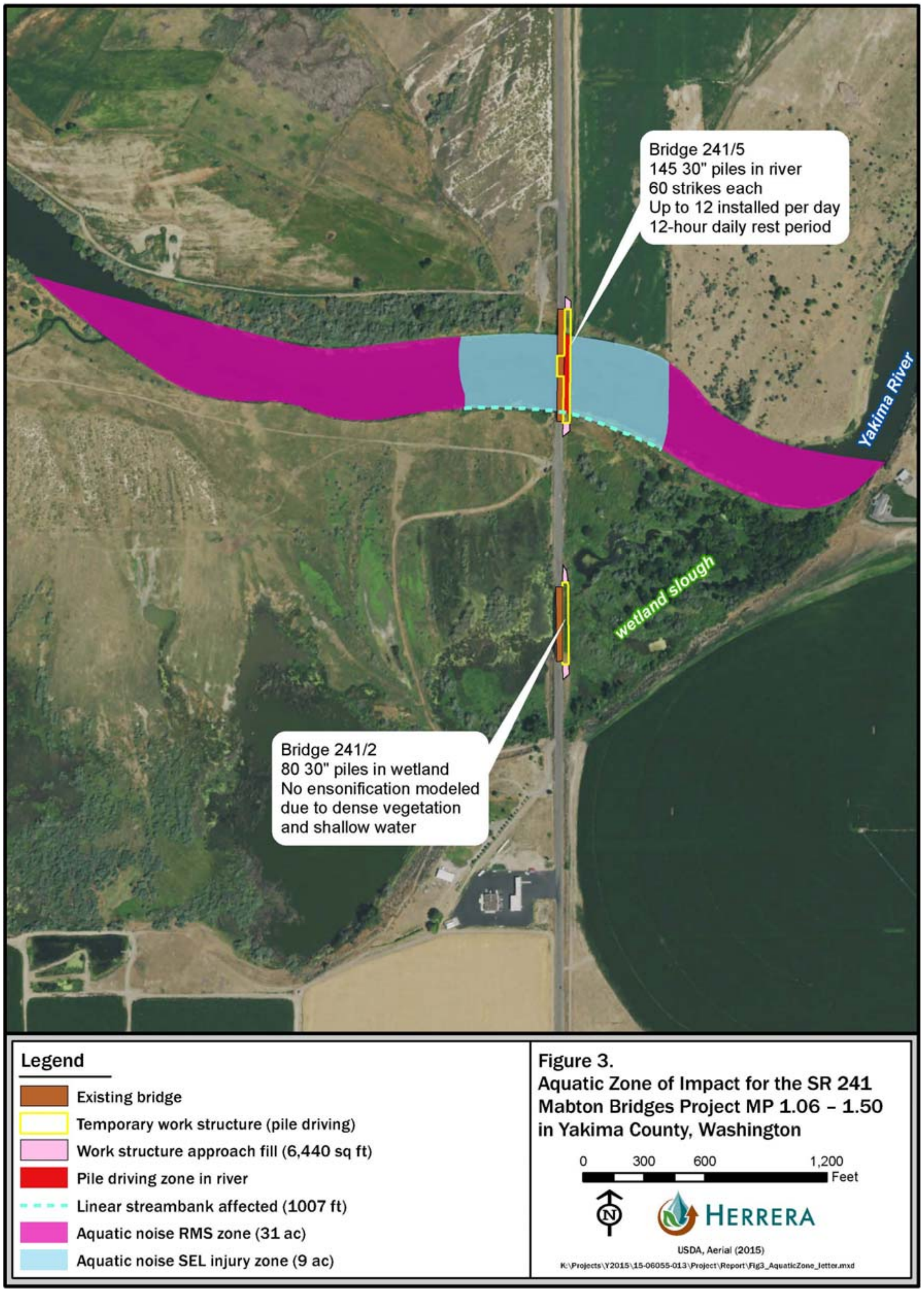

Figure 3. Aquatic Zone of Impact for the SR 241 Mabton Bridges Project MP 1.06–1.50 in Yakima County, Washington.

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 project action occurs in the sixth-field hydrologic unit code (HUC6) 170300031003 (Horseshoe Lake–Yakima River) and Water Resource Inventory Area 37 (Lower Yakima). The proposed project occurs along the lower mainstem Yakima River at approximate RM 60. The Yakima River in the action area is designated MCR steelhead critical habitat, serving as a migration corridor for adults to reach key upstream spawning habitat. The mainstem also provides a migration corridor and year-round rearing habitat for juveniles. The action area is used by steelhead from the Upper Yakima, Naches, Toppenish, and Satus populations.

The Yakima River flows 215 miles from the outlet of Keechelus Lake in the central Washington Cascades southeasterly to the Columbia River, draining an area of 6,155 square miles. The Yakima River Basin is bounded by the Cascade Mountains to the west, the Wenatchee Mountains to the north, Rattlesnake Mountain and the Rattlesnake Hills to the east, and the Horse Heaven Hills to the south (NMFS 2009; YBFWRB 2009). The basin includes parts of four counties (Kittitas, Yakima, Klickitat, and Benton) and has a population of about 300,000 people. The largest cities in the basin are Ellensburg, Yakima, Richland, and Kennewick, Washington.

The Bureau of Reclamation (Reclamation) began an intense effort to provide irrigation in the Yakima Basin beginning in the early 1900s. The effort, called the Yakima Project, includes storage dams and reservoirs in the Yakima River headwaters and tributaries including Bumping Lake, Clear Creek, Tieton River, Cle Elum Lake, Kachess Lake, and Keechelus Lake. The Yakima River and its tributaries have been heavily altered for irrigated agriculture, including numerous dams and irrigation canals. The irrigation system in the Yakima watershed causes periods of both severe river dewatering and elevated flows, relative to the historic streamflow regime (NMFS 2009; YBFWRB 2009). Climate, topography, precipitation, and vegetative cover are highly variable across the basin. Precipitation in the basin ranges from over 120 inches in the mountains to 7 inches in the lower Yakima Valley (NMFS 2009; YBFWRB 2009).

Factors for decline of summer steelhead within the Yakima Basin include the following: (1) alteration of stream flows due to irrigation and water level manipulations associated with water storage and delivery from upstream reservoirs; (2) creation of passage barriers associated with diversion dams, road crossings, and Reclamation storage dams; (3) reductions in floodplain function due to channelization, diking, and agricultural and urban development; (4) degraded riparian and upland hydrology conditions resulting from past, and, to a lesser extent, present grazing and forestry practices; and (5) changes in ecological dynamics and processes, including reduction of beaver populations, reduction in nutrient deposition in headwaters from returning salmon, introduction of exotic species, and increased predation by native species (YBFWRB 2009).

The Yakima River at Mabton, Washington, had an annual mean flow of 3,384 cfs for the period of 1971 to 2018 (USGS 2019a). Flows vary seasonally, with an average peak flow of 5,680 cfs in May and a low of 1,340 cfs in August. Water temperatures in the action area are high in the summer, with measurements of 23.9°C at Prosser, Washington, approximately 13 miles downstream of the action area, in June and August of 2019 (USGS 2019b). There are no fish passage barriers in the action area.

Riparian buffer condition in the action area is impaired, with agricultural disturbance directly adjacent to the river and wetland slough. Riverbank vegetation is a thin band of reed canary grass (*Phalaris arundinacea*) with intermittent shrubs and lacks large trees. The river is wide, slow-moving, and warm, with little woody vegetation to provide cover (Mark Norman, WSDOT, personal communication, February 11, 2019). The river within the action area is listed on the Department of Ecology Clean Water Act section 303(d) list (Category 5) of polluted waters for bacteria and 4,4’-DDD (WSDOE 2019).

NMFS classified the Yakima Basin steelhead as summer-run steelhead within the Middle Columbia River DPS in 1999 (64 FR 14517). Most steelhead that pass Prosser Dam in the fall overwinter in the Yakima River between Prosser and Sunnyside dams in reaches with deep pools and low velocity (Hockersmith et al. 1995). The final migration from holding areas to the spawning grounds begins between January and May, with fish that will spawn in lower elevation tributaries generally beginning to move earlier. Altered stream flows result in higher water temperatures that persist in the lower Yakima River throughout the irrigation season. The higher in-stream temperatures cause migrating adult steelhead to hold in the Columbia River near the mouth of the Yakima River until the river cools in the late summer or fall (YBFWRB 2009). Adults are observed migrating past Prosser Dam as early as early September (Columbia Basin Research 2019).

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. Neither the action agency nor NMFS identified any interrelated or interdependent actions during consultation.

2.5.1 Effects on ESA-Listed Species

Steelhead presence in the action area. During the June 1 through September 15 in-water work window, steelhead juveniles may be present in the action area and within the project footprint. Juvenile numbers are expected to be low, however, as this reach of the Yakima River mainstem is warm in summer (Mark Norman, WSDOT, personal communication, February 11, 2019). Low numbers of adults may also be present in the action area. Fish passage data from Prosser Dam, approximately 13 miles downstream of the project area, indicates a low number of steelhead migrating during the in-water work window (Columbia Basin Research 2019). According to 10-year daily averages (2008–2017) at Prosser, an average of 148 adult wild steelhead pass the dam from June 1 to September 15, 3.5 percent of the average annual total of 4,219. Most adults do not begin their upstream migration until early September (Columbia Basin Research 2019). Preferred summer water temperatures for anadromous salmon are 10 to 17°C, and temperatures above 21°C are associated with avoidance in juvenile steelhead and blocked migration in adults (EPA 2001a, EPA 2001b, EPA 2003). High water temperatures, such as those observed at Prosser, likely cause adult and juvenile steelhead to avoid this reach of the Yakima River in summer.

Pile driving noise. High levels of underwater sound can injure or kill fish and cause alterations in behavior (Turnpenny and Nedwell 1994; Turnpenny et al. 1994; Popper 2003; Hastings and Popper 2005). Death from barotrauma can be instantaneous or delayed up to several days after exposure. Noise from impact pile driving has been implicated in fish mortality and injury (Stotz and Colby 2001; Fordjour 2003; Abbott et al. 2005; Hastings and Popper 2005). Even in the absence of mortality, elevated noise levels can cause sublethal injuries. Fish suffering damage to hearing organs may suffer equilibrium problems and may have a reduced ability to detect predators and prey (Turnpenny et al. 1994; Hastings et al. 1996).

Adverse effects on survival and fitness can occur even in the absence of overt injury. Exposure to elevated noise levels can cause a temporary shift in hearing sensitivity (referred to as a temporary threshold shift), decreasing sensory capability for periods lasting from hours to days (Turnpenny et al. 1994; Hastings et al. 1996). Popper et al. (2005) found temporary threshold shifts in hearing sensitivity after exposure to cumulative SELs as low as 184 dB. Temporary threshold shifts reduce the survival, growth, and reproduction of the affected fish by increasing the risk of predation and reducing foraging or spawning success.

In the proposed action, a total of 225, 30-inch diameter steel piles will be driven to support the temporary work platforms, with 80 in the wetland slough and 145 below the OHWM in the Yakima River. Underwater noise was not modeled in the wetland slough, as shallow water and emergent vegetation are expected to limit sound propagation to the immediate vicinity of the piles. The expected noise produced by pile driving in the Yakima River was calculated assuming 12 piles driven per 12-hour day (two pile drivers), with 60 strikes per pile, for a total of 720 strikes per day. Piles installed in a water depth of over 3 feet are estimated to produce sound levels at 210 peak decibels (dB_{peak}) and 190 dB_{RMS} at a distance of 10 meters from the pile during impact pile driving (CalTrans 2015). The contractor will use a confined bubble curtain in the river and estimates that this will achieve an attenuation of 5 dB, reducing the SEL injury distance by 564 feet.

Fish less than 2 grams in the Yakima River would potentially be exposed to injury-level noise energy up to 486 feet (148 meters) from the piles (Table 5), equivalent to an area of 403,963 square feet (9.27 acres). Fish 2 grams or heavier would potentially be exposed to injury-level noise energy within 262 feet (80 meters) of the piles. Behavioral effects from non-injurious levels of noise extend farther than those that cause injury to fish, but the extent of these effects is limited by bends in the river which prevent the propagation of pile driving noise. An area of 1,341,212 square feet (approximately 31 acres) would be exposed to non-injurious levels of noise and associated behavioral effects. Figure 3 shows the extent of the river exposed to aquatic noise from pile driving.

Table 5. Steelhead injury thresholds for impact pile driving.

Pile Size/Estimated Number of Strikes	Distance (feet) to Threshold			
	Onset of Physical Injury			Behavior
		cSEL dB		
	dBPEAK	Fish ≥ 2 grams	Fish < 2 grams	dBRMS
30-inch-diameter/720[a]	30	262	486	7,067

[a] Analysis assumes 5 dB attenuation from bubble curtain

Both adult and juvenile steelhead are unlikely to occur within the injury zone. Most adults begin their upstream migration in early September, after impact pile driving will have ceased. Elevated water temperatures in the Yakima River during summer months likely precludes juvenile steelhead presence, although outmigrating smolts could still be present in early June. We expect most impact pile driving will occur later in June through August, after the majority of smolts have outmigrated and when summer water temperatures make it unlikely that juveniles will be rearing in the action area. The most likely effect to steelhead from impact pile driving would be avoidance of the ensonified zone, with associated delayed migration and reduced foraging. Underwater noise from pile driving has been demonstrated to affect salmonid behavior, with fish avoiding the area and decreased numbers of fish schooling observed during periods of pile driving (Popper and Hastings 2009; USACE 2009). Effects would be intermittent during the in-water work window, and will be short-term–impact pile driving in the Yakima River is expected to last only 25 days (Table 1).

Suspended sediments and turbidity. The effects of increased suspended solids on salmonids depend on the extent, duration, timing, and frequency of increased sediment levels at the place where it will occur (Bash et al. 2001). Depending on the level of these parameters, sedimentation can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids (Newcombe and Jensen 1996). Avoidance of turbid areas is the typical behavioral response, which can mean that fish are displaced from their preferred habitats in order to seek areas with less suspended sediment. Sublethal effects include reduction in feeding rates, reduced growth rates, stress, elevated blood sugars, gill flaring, and coughing (Berg and Northcote 1985; Servizi and Martens 1991; Spence et al. 1996).

Adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjornn and Reiser 1991), indicating these species are adapted to withstand seasonal sediment pulses. However, research indicates that chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Lloyd et al. 1987; Servizi and Martens 1991). We expect adults and subadults would leave areas with levels of suspended sediment high enough to impair respiration and feeding. Thus, they would be mostly affected by the effects of temporary displacement, rather than the direct effects of exposure to increased sediment. Juveniles are less likely to be in the action area due to elevated water temperatures and would therefore be less likely to be exposed to construction-related suspended sediment.

In-water work in the Yakima River is likely to temporarily increase suspended sediment concentrations and turbidity. Sediment production from pile driving in the Yakima River will be short-term and will return to baseline conditions following the cessation of construction activities. The USACE will comply with Ecology's State Water Quality Standards. Temporary elevated turbidity is expected to dissipate within 300 feet downstream of Bridge 241/5 in the Yakima River. In the wetland slough, we anticipate temporary elevated turbidity to be contained to the immediate bridge vicinity by dense emergent vegetation and stagnant water. Minimization measures and environmental conditions will keep suspended sediment and turbidity levels low and will limit the duration and extent of exposure. We do not anticipate that steelhead would experience harm from exposure to elevated levels of suspended sediment or turbidity.

Impeded migration from overwater cover. The presence of overwater structures can change shading and ambient light patterns, altering fish behavior and habitat function (Carrasquero 2001). Shading can also reduce the amount of light necessary for photosynthesis, limiting the distribution and abundance of vegetation underneath overwater structures and decreasing habitat quality (Nightingale and Simenstad 2001).

Shading may affect steelhead migrating behavior. Migrating salmonids tend to travel along the edges of overwater structures instead of underneath them, with associated energetic and predation costs (Nightingale and Simenstad 2001; Rondorf et al. 2010). The effects of those costs are not well known but are assumed to be detrimental (Simenstad et al. 1999).

The two work platforms will produce a total of 23,660 square feet of overwater cover (14,300 over the river and 9,360 over the wetland slough), and the increased width of the new wetland bridge will create an additional 2,221 square feet of cover over the wetland. The overwater cover from both work platforms will be temporary, as the platforms will be removed at the completion of construction. As such, impacts to steelhead from shading in the river will be short-term (less than 2 years). The presence of additional overwater cover may cause temporary delays in migration, but the magnitude and duration of the effect is not likely to cause harm to individual fish.

Impeded migration from temporary steel piles. To support the temporary work platforms, the project includes the installation of 145 30-inch-diameter steel piles across the Yakima River channel. As the piles will be installed three to a row, parallel to river flow, with 10- to 15-foot spacing between rows, approximately 121 linear feet of the river width will be impeded by piles. This spacing equates to approximately 30 percent of the river's wetted width (approximately 400 feet). A hydraulic analysis conducted for this project demonstrated that the presence of piles will not increase water velocities beyond baseline conditions immediately downstream of the action area (WSDOT 2019b).

The piles will be in place from the start of in-water work in June 2021 to the end of in-water work in September 2022, encompassing an entire spawning cycle. Any effects from the piles will be temporary and minor, and preconstruction conditions will return following the removal of piles.

Stormwater. The existing Bridge 241/2 includes 10,080 square feet of impervious surface, from which runoff is not treated and runs directly into the wetland slough. The design of the replacement bridge will treat all of the bridge surface stormwater runoff to Highway Runoff Manual standards, thereby improving water quality in the wetland slough by reducing the introduction of pollutants. Because the wetland is connected to the Yakima River, stormwater treatment will benefit river water quality as well by reducing the pollutant load entering the river.

Fish stranding and handling during dewatering. Cofferdams will be used in the wetland slough for the removal of the existing bridge piers, with a dewatered area of 2,000 square feet. Although juvenile steelhead could be present in the wetland slough, numbers are expected to be low due to warm water temperatures during the in-water work window. Cofferdams will not be used in the Yakima River.

A dewatering plan will be submitted as part of the overall bridge demolition plan prepared by the contractor and is required to meet all water quality standards. Dispersion and/or infiltration are not anticipated methods of pumped water disposal, due to the steep slopes of the bridge abutments and the surrounding land. Water will likely be collected and treated on site for return to the wetland slough, or removed to a permitted, off-site disposal location.

The project will follow the WSDOT Fish Exclusion Protocols and Standards that have been approved by USFWS and NMFS to minimize direct effects to steelhead from strandings, capture, and handling (WSDOT 2016b). The fish exclusion protocol directs that all fish capture operations will be conducted by or under the supervision of an experienced fishery biologist, and all staff involved in capture operations must have the necessary knowledge, skills, and abilities to ensure the safe handling of salmonids. Additionally, this protocol directs that fish must always be handled with extreme care and kept in water (maintained at appropriate temperatures) during transfer in order to prevent the added stress of an out-of-water transfer. The fish removed from the work area will be released as near as possible to the capture site into habitat that provides cover and flow refuge.

The potential direct effects to steelhead from work area isolation of the wetland slough include injury or mortality from stranding, impingement on fish screens, or entrainment into pumps. Other potential effects include disruption of rearing and temporary loss of foraging. Juvenile are harder to detect and remove during fish exclusion; if they remain undetected, these fish may be stranded. Adult and subadult salmonids are easier to detect and herd downstream. Juveniles are therefore considered at higher risk than subadult and adult steelhead for stranding, and for potential injury and mortality resulting from fish handling and capture.

The potential effects to steelhead from exclusion include harassment or harm from capture and relocation or from herding out of the project area. Capture and handling of fish causes a stress response, possible loss of the fish’s protective mucous coating, and potential injury or mortality from contact with nets or during electrofishing. Delayed responses may include increased susceptibility to parasites or disease from a stress-induced decrease in immune function and/or the loss of fish’s protective mucous covering. Additional delayed responses include missed feedings due to stress or injury, or delayed mortality from a handling injury. Because it is easier to exclude larger fish from a work area, injuries or mortalities to subadult or adult steelhead due to fish handling are expected to be low. Juveniles are the life stage most likely to be affected by fish exclusion activities.

The number of steelhead that could be present in the wetland slough during in-water work is difficult to estimate, but is expected to be low due to project timing and high summer water temperatures. The WSDOT rarely encounters listed fish species during fish exclusion on the Yakima River (Geoff Gray, WSDOT, personal communication on July 24, 2019). However, there is a possibility that steelhead could be present in the slough during fish exclusion activities, and could experience adverse effects.

Mullan et al (1992) estimated juvenile fish density according to habitat quality. During summer months, the slough constitutes "fair" habitat, with an associated juvenile steelhead density of 2.3 fish per 100 square meters. Cofferdams will occupy approximately 2,000 square feet, or 185 square meters. As many as five juvenile steelhead could therefore be present with that area and could be captured during fish exclusion. Most fish (95 percent) that are captured and handled survive with no long-term adverse effects, but up to 5 percent may be injured or killed (USFWS 2015). We estimate that one juvenile steelhead may be killed during fish exclusion.

Benthic habitat disturbance and riparian vegetation removal. The project will result in the disturbance of 1,105 square feet of benthic habitat to place 225 steel piles for the temporary work structures (each 30-inch pile occupies 4.91 square feet), with 712 square feet disturbed in the Yakima River (145 piles) and 393 square feet disturbed in the wetland slough (80 piles). Cofferdam placement will temporarily disturb an additional 2,000 square feet of substrate in the wetland slough, for a total disturbance in the wetland slough of 2,393 square feet. The total combined disturbance in the river and wetland slough will be 3,105 square feet. There will be a net loss of 95 square feet of substrate in the wetland slough as the footprint of the new bridge piles is larger than the existing footprint.

Impacts to benthic habitat will kill or displace benthic invertebrates, reducing available forage for juvenile steelhead. Aquatic invertebrates could start recolonizing within days to months after construction (Miller and Golladay 1996; Paltridge et al. 1997; Fowler 2004; Korsu 2004). Some aquatic insect life cycles can extend up to 3 years (Pennak 1953; Hilsenhoff 1981), but most aquatic insects in the north temperate zone have an annual life cycle (Merritt and Cummins 1996). Thus, we estimate that recolonization of the disturbed areas will mostly occur within a year.

The project will temporarily disturb an estimated 2,350 square feet of riparian vegetation, with 2,000 square feet at the Yakima River bridge and 350 square feet at the wetland slough bridge. Disturbance is expected to be limited to trimming of vegetation on the existing abutment fill slopes. Agricultural disturbance surrounds and encroaches up to the riverbank and wetland. Given the high level of disturbance along the river and lack of dense cover next to the waterline, the riparian buffer in the action area provides a low level of function.

Due to small areas that will be affected by benthic habitat disturbance and riparian vegetation removal, and the temporary nature of the impacts, we do not anticipate these project impacts will result in adverse effects to steelhead.

2.5.2 Effects to Critical Habitat

The PBF characteristics affected by the proposed action are water quality, forage, and a migratory corridor free of artificial obstructions.

Water quality. In-water construction activities will temporarily increase suspended sediments and turbidity within 300 feet of the project footprint. This will only affect water quality during and immediately following construction, causing no long-term effects to critical habitat. Stormwater treatment for Bridge 241/2 over the wetland slough will result in minor water quality improvements in the wetland and the Yakima River for the duration of the project.

Forage. The project will trim 2,350 square feet of riparian vegetation, and the 225 piles installed for temporary work structures will temporarily occupy 1,105 square feet of benthic habitat. Cofferdams will disturb an additional 2,000 square feet of substrate in the wetland slough. These impacts will temporarily reduce forage availability. The footprint of the new bridge piers in the wetland slough will be greater than existing, resulting in a permanent loss of 95 square feet of substrate in the wetland. This minor loss of riparian vegetation and wetland habitat is not likely to reduce the function of this PBF.

Migratory corridor free of artificial obstructions. The 145 30-inch-diameter temporary piles installed in the Yakima River will reduce the width of the river channel by 30 percent for an entire spawning season. Furthermore, the entire channel width (9.27 acres within the wetted width) will be ensonified above the injury threshold for up to 12 hours each day during the fish window. Elevated noise levels may act as a temporary barrier to fish migration. Pile driving in the Yakima River will last approximately 25 days (assuming 145 piles, with six piles driven per day) during daylight hours. Fish may experience intermittently delayed migration through the action area for one in-water work season. The extent and magnitude of the delay is not expected to reduce the overall function of this PBF.

Shade associated with the temporary work platform on the Yakima River could also affect migrating behavior. Migrating salmon tend to travel along the edges of overwater structures instead of underneath them, with associated energetic and predation costs (Nightingale and Simenstad 2001; Rondorf et al. 2010). As described above, impacts from shading associated with the proposed project would be small-scale and temporary. Therefore, we do not anticipate that shading from the proposed action will measurably affect this PBF characteristic.

In summary, the project will result in minor short-term impacts to water quality, but an overall improvement in water quality due to reduced pollutant loading: minor reductions in forage, and a temporary decrease in the function of the migratory corridor PBF.

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.

Potential impacts that may contribute to cumulative effects, especially within the neighboring major tributaries, include water flow fluctuations, degraded water quality, migration barriers, habitat degradation, resource competition, and introduction of non-native invasive species. Because the action area primarily encompasses an aquatic environment, water quality and availability are primary concerns when evaluating potential effects to steelhead. Elevated levels of contaminants in the waterways can adversely affect aquatic species through direct lethal or sublethal toxicity, through indirect effects on their food supply, or through interactions with other compounds present in the water. Agricultural practices associated with irrigation also have the potential to adversely affect aquatic environments. Water withdrawals and runoff of irrigation water containing residual constituents of pesticides and fertilizers can contribute excessive nutrients, elevated levels of chemicals, and substantial amounts of sediment to natural waterways, further degrading the water quality and quantity within the river systems throughout the broader region. Likewise, urban and rural land uses for residential, commercial, industrial, and recreational activities, such as boating and golf courses, often require water withdrawals and can further contribute pollutants and sediments to surface waters. Agriculture and development are likely to continue within the action area for the foreseeable future, with associated adverse effects.

There are a number of other state and private interest approaches that have generally helped to address potential impacts to steelhead from urban development within the broader region encompassing the action area. These approaches include initiatives under Critical Areas Ordinances and measures associated with the state's Shoreline Management Act (SMA). Many cities and counties in Washington are required to adopt Critical Areas Ordinances under the state's Growth Management Act. Among other concerns, the ordinances address important fish and wildlife habitats, including wetlands, rivers, streams, lakes, and marine shorelines. The SMA seeks to prevent harm to identified resources due to haphazard development of state shorelines. The responsibilities of local governments under the SMA, with support and oversight provided by Ecology include: (1) administering a shoreline permit system for proposed substantial development; (2) conducting and compiling a shoreline inventory; and (3) developing a Shoreline Master Program for regulating the state's shorelines.

Throughout the Yakima River basin, watershed councils, Native American tribes, local municipalities, conservation groups, and others will continue to carry out restoration projects in support of listed fish recovery. Many of these actions will be covered by other consultations, or by future individual consultations, in which cases their effects are not cumulative effects. Some of the private or state-funded actions will not undergo consultation. These effects will result in small improvements to abundance, productivity, and spatial structure of steelhead at the population scale.

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).

To the extent that recovery actions are implemented and on-going actions continued in the Yakima basin, adverse cumulative effects may be minimized, but will not be completely avoided. It is reasonably likely that those effects within the action area will have a small negative effect on the survival and recovery of the ESU over the long term.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (section 2.5) to the environmental baseline (section 2.4) and the cumulative effects (section 2.6), taking into account the status of the species and critical habitat (section 2.2), to formulate the agency's 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.

The MCR steelhead DPS is unviable because a majority of populations are at moderate risk of extinction. The DPS cannot achieve viability without significant improvements in abundance, productivity, and diversity for many populations. MCR steelhead in the Yakima River MPG, comprising the Upper Yakima, Naches, Toppenish, and Satus populations, are present in the action area. The Upper Yakima is among those populations most at risk in the DPS. Despite increased abundance in recent years, the Upper Yakima and Naches populations are short of recovery goals for both abundance and productivity. All four populations are not meeting goals for spatial structure and diversity criteria, with the Satus, Toppenish, and Naches populations at moderate risk of extinction and the Upper Yakima population characterized as high risk. Urban development, logging, grazing, power generation, and agriculture have all resulted in the loss of important spawning and rearing habitat, and the loss or degradation of migration corridors.

Within the action area, the primary impacts limiting recovery of MCR steelhead and their critical habitat are flow regulation and human development in the floodplain, including miles of federal levees. Cumulative effects are likely to improve habitat functions to some degree as local governments pursue floodplain restoration and focus additional floodplain development in areas that will have limited impact. Recovery actions may minimize impacts of cumulative effects, but are not likely to be sufficient to completely avoid them. Cumulative effects will therefore have a small negative effect on the likelihood of the survival and recovery of the ESU over the long term.

The proposed action will occur in the mainstem of the Yakima River in habitat that is likely used by steelhead for freshwater rearing and migration, and as such, steelhead will be affected by the construction of the proposed action. The NMFS expects adverse effects to steelhead due to effects from underwater noise as a result of pile driving and fish handling and exclusion associated with the use of cofferdams.

The effects of all project elements will likely result in sub-lethal and lethal adverse effects due to elevated underwater noise and fish exclusion. Based on project timing, it is likely that only juvenile steelhead will be affected; adults are not likely to be present in the wetland slough, and impact pile driving in the mainstem Yakima River will not extend into September when adults begin their upstream migration. Although the number of juvenile steelhead that will be adversely affected by the action is impossible to determine, the number is likely small in proportion to the total number of individuals in any of the affected populations of the Yakima River MPG. The number of steelhead adversely affected by the action will be small in proportion to the total number of individuals in any of the affected populations of the Yakima River MPG. Even in consideration of the impaired status of the populations, the environmental baseline, and expected cumulative effects in the action area, the number of steelhead that will be adversely affected will be too small to affect abundance, productivity, spatial structure, or diversity at the population level, much less at the MCR DPS level. The action is not expected to reduce appreciably the likelihood of both the survival and recovery of MCR steelhead by reducing their numbers, reproduction, or distribution.

Implementation of this project will cause short-term degradation of critical habitat due to suspended sediments, disturbance to substrate, and artificial obstructions to migration. These effects will be minor and temporary, and the PBFs of critical habitat will quickly recover from these disturbances. The anticipated direct and indirect effects of the action, combined with the status of critical habitat, the environmental baseline, and the cumulative effects associated with future state, tribal, local, and private actions, will not reduce the value of designated critical habitat for the conservation of MCR steelhead.

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, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of MCR steelhead or destroy or adversely modify its 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

In this opinion, NMFS determined that incidental take is reasonably certain to occur due to exposure to elevated underwater noise, and fish handling and exclusion.

The take in the form of harm and harassment from elevated underwater noise cannot be accurately quantified as a number of fish because NMFS cannot predict, using the best available science, the number of individuals of listed fish species that will be exposed to this stressor. Furthermore, even if NMFS could estimate that number, the manner in which each exposed individual responds to that exposure cannot be predicted.

In circumstances where NMFS cannot estimate the amount of individual fish that would be injured or killed by the effects of the proposed action, NMFS assesses the extent of take as an amount of modified habitat and exempts take based only on that extent (Table 6). This extent is readily observable and therefore suffices to trigger reinitiation of consultation, if exceeded and necessary [see H.R. Rep. No 97-567, 97th Cong., 2d Sess. 27 (1982)].

Table 6. Take summary for Middle Columbia River steelhead.

Life Stage	**Type of Take**	**Description of Take Mechanism**	**Maximum Area/Number of Fish Affected**
Juveniles	Harm	Exposure to cSEL above harm threshold	Fish <2 grams: within 486 feet of pile driving Fish ≥2 grams: within 262 feet of pile driving
		Fish exclusion and handling during dewatering of cofferdams	2,000 square feet within cofferdams 5 fish captured; 2 mortalities

The NMFS cannot estimate the number of individuals that will experience adverse effects from underwater sound. Impact pile driving will occur episodically throughout the in-water work season. NMFS cannot predict the number of individual fish that will be exposed, and not all exposed individuals will experience adverse effects. Therefore, NMFS will use the physical extent of injurious levels of underwater sound as a surrogate for the number of fish. Take in the form of harm and harassment of listed fish species from impact pile driving noise (cSEL greater than 183 dB/187 dB) is reasonably certain to occur for the area within 486 feet of pile driving for fish less than 2 grams and within 262 feet of pile driving for fish ≥ equal to or greater than 2 grams.

Based on the approximate density of juvenile steelhead in the wetland slough, we estimate that up to five juvenile steelhead could be captured during cofferdam dewatering, one of which could be injured or killed.

2.9.2 Effect of the Take

In this 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).

Full application of conservation measures included as part of the proposed action, together with use of the RPMs and terms and conditions described below, are necessary and appropriate to minimize the likelihood of incidental take of MCR steelhead due to completion of the proposed action.

The USACE shall minimize take of MCR steelhead. The following RPMs are necessary and appropriate to minimize the take. The USACE shall:

1. Minimize take from impact driving of steel piles.
2. Minimize take from fish handling and exclusion.
3. Ensure the completion of a monitoring and reporting program to confirm that this opinion is meeting its objective of limiting the extent of take and minimizing take from permitting activities per 50 CFR 402.14(i)(1)(iv) and 50 CFR 402.14(i)(3) and that the extent and/or amount of take is not exceeded.

2.9.4 Terms and Conditions

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

1. The following terms and conditions implement RPM 1:
    a. Use a bubble curtain system during installation of each pile and make sure it is functioning properly.
    b. Monitor underwater noise to confirm that the expected sound levels are not exceeded. The WSDOT/USACE will contact NMFS if measured sound levels exceed expected levels.
2. The following terms and conditions implement RPM 2:
    a. Intakes for all pumps used for the project have fish screens installed, operated, and maintained according to NMFS' fish screen criteria (NMFS 2011) or equivalent.
    b. Any fish trapped in the in-water work area before dewatering will be herded out or removed and released to suitable habitat as near to the capture site as possible in

compliance with the WSDOT Fish Exclusion Protocols and Standards (2016b) or equivalent.

   c. ESA-listed fish will be handled with extreme care; fish will be kept in water to the maximum extent possible during dewatering, capture, and transfer.
   d. If electrofishing equipment is used to capture fish, it shall comply with the WSDOT Fish Exclusion Protocols and Standards (2016b) or equivalent.
      i. Electrofishing will not be used if water temperatures exceed 64°F (18°C) or are expected to rise above 64°F (18°C), unless no other method of capture is available.
      ii. Water quality conditions are adequate in buckets or tanks used to transport fish by providing circulation of clean, cold water, using aerators to provide dissolved oxygen, and minimizing holding times.
   e. NMFS, or its designated representative, is allowed to accompany the capture team during the capture and release activity, and to inspect the team's capture and release records and facilities. Take is allowed for no more than 5 steelhead captured, one of which could be killed.

3. The following terms and conditions implement RPM 3 (monitoring):
   a. USACE shall ensure that all monitoring items will include, at a minimum, the following:
      i. Project identification:
         1) Project name: SR 241 Mabton Bridges Project
         2) NMFS Tracking Number: WCR-2019-00076
      iii. A description of any elements of the project that were constructed differently than proposed
      iv. Noise monitoring reports
      v. Water quality monitoring reports
      vi. Submit monitoring reports to NOAA Fisheries, Attention: DeeAn Jones, 510 Desmond Drive SE, Suite 103, Lacey WA, 98503.

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).

Conservation Recommendations:

1. Limit impact pile driving in the mainstem Yakima River to July and August to the extent possible, when listed fish are least likely to be present in the action area.
2. Use vibratory methods to drive piles to the extent possible, and only use impact pile driving to achieve the required load-bearing depth.

2.11 Reinitiation of Consultation

This concludes formal consultation for the SR 241 Mabton Bridges Project. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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

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

This analysis is based, in part, on the EFH assessment provided by the USACE and descriptions of EFH for Pacific Coast salmon contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce (PFMC 2014).

3.1 Essential Fish Habitat Affected by the Project

The proposed project action area includes EFH for Chinook salmon (*O. tshawytscha*) and coho salmon (*O. kisutch*) (PFMC 2014). Habitat areas of particular concern within the action area include complex channel and floodplain habitat (PFMC 2014).

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided in the BA, associated communications, and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will adversely affect EFH designated for Chinook salmon and coho salmon. Construction activity will adversely affect EFH by temporarily elevating suspended sediment and turbidity levels, producing underwater noise as a result of pile driving, and dewatering an area of 2,000 square feet for cofferdams.

Specifically, NMFS has determined that the action will adversely affect EFH as follows:

1. The EFH within 300 feet of in-water work will be affected by elevated suspended sediment and turbidity.
2. The EFH within 486 feet of each steel pile will be affected by impact pile driving with elevated sound pressure levels exceeding the injury level for fish less than 2 grams.
3. The EFH in 2,000 square feet of the wetland slough will be affected by dewatering for installation of cofferdams.

3.3 Essential Fish Habitat Conservation Recommendations

We provide the following conservation recommendations:

1. Limit impact pile driving in the mainstem Yakima River to July and August to the extent possible, when listed fish are least likely to be present in the action area.
2. Use vibratory methods to drive piles to the extent possible, and only use impact pile driving to achieve the required load-bearing depth.
3. Monitor the downstream extent of turbidity, and cease work if turbidity exceeds predicted levels until turbidity returns to predicted levels.
4. Minimize the number of piles used to construct the work trestles.
5. Use a bubble curtain system during installation of each pile and make sure the bubble curtain is functioning properly.
6. Monitor sound pressure levels during impact pile driving to confirm that the expected sound levels are not exceeded.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 31 acres of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the USACE. Other interested users could include Reclamation, WDFW, Yakama Nation, and Yakima County. Individual copies of this opinion were provided to the USACE. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

5. REFERENCES

Abatzoglou, J.T., D.E. Rupp, and P.W. Mote. 2014. Seasonal climate variability and change in the Pacific Northwest of the United States. Journal of Climate 27(5):2125–2142.

Abbott, R.R., J.A. Reyff, and G. Marty. 2005. Monitoring the effects of conventional pile driving on three species of fish. Final Report. Strategic Environmental Consulting, Inc. Manson Construction Company. Richmond, California.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of turbidity and suspended solids on salmonids. Center for Streamside Studies, University of Washington, Seattle.

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.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. In Influences of forest and rangeland management on salmonid fishes and their habitats. W.R. Meehan, (ed.) American Fisheries Society Special Publication 19. Bethesda, Maryland.

CalTrans. 2015. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. California Department of Transportation, Division of Environmental Analysis.

Carrasquero, J. 2001. Over-water structures: freshwater issues. White paper submitted to Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation. April 12, 2001. 127 pp.

Columbia Basin Research. 2019. Columbia River DART (Data Access in Real Time). University of Washington, School of Aquatic & Fishery Sciences. Accessed March 1, 2019. http://www.cbr.washington.edu/dart.

Crozier, L.G., A.P. Hendry, P.W. Lawson, T.P. Quinn, N.J. Mantua, J. Battin, R.G. Shaw, and R.B. Huey. 2008. Potential responses to climate change in organisms with complex life histories: Evolution and plasticity in Pacific salmon. Evolutionary Applications, 1(2):252–270.

Crozier, L.G., M.D. Scheuerell, and E.W. Zabel. 2011. Using Time Series Analysis to Characterize Evolutionary and Plastic Responses to Environmental Change: A Case Study of a Shift Toward Earlier Migration Date in Sockeye Salmon. The American Naturalist, 178(6):755-773.

Dominguez, F., E. Rivera, D.P. Lettenmaier, and C.L. Castro. 2012. Changes in Winter Precipitation Extremes for the Western United States under a Warmer Climate as Simulated by Regional Climate Models. Geophysical Research Letters 39(5).

Doney, S.C., M. Ruckelshaus, J.E. Duffy, J.P. Barry, F. Chan, C.A. English, H.M. Galindo, J.M. Grebmeier, A.B. Hollowed, N. Knowlton, J. Polovina, N.N. Rabalais, W.J. Sydeman, and L.D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. Annual Review of Marine Science, 4:11–37.

EPA (U.S. Environmental Protection Agency). 2001a. Issue Paper 1: Salmonid Behavior and Water Temperature. EPA-910-D-01-001. U.S. Environmental Protection Agency.

EPA (U.S. Environmental Protection Agency). 2001b. Technical Synthesis: Scientific Issues Relating to Temperature Criteria for Salmon, Trout, and Char Native to the Pacific Northwest. EPA-910-R-01-007. U.S. Environmental Protection Agency.

EPA (U.S. Environmental Protection Agency). 2003. EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. EPA-910-B-03-002. U.S. Environmental Protection Agency.

Feely, R.A., T. Klinger, J.A. Newton, and M. Chadsey, editors. 2012. Scientific summary of ocean acidification in Washington State marine waters. NOAA OAR Special Report.

Ford, M.J., (editor). 2011. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NWFSC-113. 281 p.

Fordjour, K. 2003. Bremerton Dolphin Replacement—Report of Fish Kill. Washington State Department of Transportation. Olympia, Washington. 2 pp.

Fowler, R.T. 2004. The recovery of benthic invertebrate communities following dewatering in two braided rivers. Hydrobiologia 523:17–28.

Glick, P., J. Clough, and B. Nunley. 2007. Sea-Level Rise and Coastal Habitats in the Pacific Northwest: An analysis for Puget Sound, southwestern Washington, and northwestern Oregon. National Wildlife Federation, Washington.

Good, T.P., Waples, R.S., and Adams, P. 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce. p. 597.

Goode, J.R., J.M. Buffington, D. Tonina, D.J. Isaak, R.F. Thurow, S. Wenger, D. Nagel, C. Luce, D. Tetzlaff, and C. Soulsby. 2013. Potential effects of climate change on streambed scour and risks to salmonid survival in snow-dominated mountain basins. Hydrological Processes, 27(5):750–765.

Hastings, M.C., and A.N. Popper. 2005. Effects of Sound on Fish. Prepared by Jones and Stokes for the California Department of Transportation, Sacramento, California (August 23, 2005). 82 pp.

Hastings, M.C., A.N. Popper, J.J. Finneran, and P. Lanford. 1996. Effects of low frequency underwater sound on hair cells of the inner ear and lateral line of the teleost fish *Astronotus ocellatus*. Journal of the Acoustical Society of America 99(3):1759–1766.

Hilsenhoff, W.L. 1981. Aquatic insects of Wisconsin. Keys to Wisconsin genera and notes on biology, distribution and species. Natural History Council, University of Wisconsin-Madison. Distributed by the Geological and Natural History Survey, Madison.

Hockersmith, E., J. Vella, L. Stuehrenberg, R.N. Iwamoto, and G. Swan. 1995. Yakima River Radio-Telemetry Study: Steelhead, 1989–93. Bonneville Power Administration, Division of Fish and Wildlife (Portland) and National Marine Fisheries Service, Northwest Fisheries Science Center (Seattle). Project 89-089. 95 pp.

Howell, P., K. Jones, D. Scarnecchia, L. LaVoy, W. Kendra, and D. Ortmann. 1985. Stock assessment of Columbia River anadromous salmonids. Report to Bonneville Power Admin., Project 83-335, Portland, Oregon.

IPCC (Intergovernmental Panel on Climate Change). 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland.

Isaak, D.J, S. Wollrab, D. Horan, and G. Chandler. 2012. Climate change effects on stream and river temperatures across the northwest U.S. from 1980–2009 and implication for salmonid fishes. Climate Change 113: 499-524.

ISAB (Independent Scientific Advisory Board). 2007. Climate change impacts on Columbia River basin fish and wildlife. Northwest Power and Conservation Council, Portland, Oregon.

Korsu, K. 2004. Response of benthic invertebrates to disturbance from stream restoration: the importance of bryophytes. Hydrobiologia 523:37–45.

Kunkel, K.E., L.E. Stevens, S.E. Stevens, L. Sun, E. Janssen, D. Wuebbles, K.T. Redmond, and J.G. Dobson. 2013. Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Part 6. Climate of the Northwest U.S. NOAA Technical Report NESDIS 1426. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, Washington, D.C.

Lawson, P.W., E.A. Logerwell, N.J. Mantua, R.C. Francis, and V.N. Agostini. 2004. Environmental factors influencing freshwater survival and smolt production in Pacific Northwest coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences, 61(3):360–373.

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(1):18–33.

Mantua, N., I. Tohver, and A.F. Hamlet. 2009. Impacts of climate change on key aspects of freshwater salmon habitat in Washington State. *In* Washington Climate Change Impacts Assessment: Evaluating Washington's future in a changing climate. Climate Impacts Group, University of Washington, Seattle.

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. U.S. Department of Commerce, National Marine Fisheries Service.

McMahon, T.E., and G.F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences, 46:1551–1557.

Merritt, R.W., and K.W. Cummins, editors. 1996. An introduction to the aquatic insects of North America. Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 p.

Miller, A.M., and S.W. Golladay. 1996. Effects of spates and drying on macroinvertebrate assemblages of an intermittent and a perennial prairie stream. Journal of the North American Benthological Society 15:670–689.

Mote, P.W., J.T. Abatzoglou, and K.E. Kunkel. 2013. Climate: Variability and Change in the Past and the Future. Chapter 2, pp. 25–40, *in* M.M. Dalton, P.W. Mote, and A.K. Snover, eds. Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities. Island Press, Washington, D.C.

Mote, P.W, A.K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R.R. Raymondi, and W.S. Reeder. 2014. Ch. 21: Northwest. *In* Climate Change Impacts in the United States: The Third National Climate Assessment, J.M. Melillo, T.C. Richmond, and G.W. Yohe, eds. U.S. Global Change Research Program, pp. 487–513.

Mote, P.W., D.E. Rupp, S. Li, D.J. Sharp, F. Otto, P.F. Uhe, M. Xiao, D.P. Lettenmaier, H. Cullen, and M.R. Allen. 2016. Perspectives on the cause of exceptionally low 2015 snowpack in the western United States, Geophysical Research Letters 43.

Mullan, J. W., K. R. Williams, G. Rhodus, T. W. Hillman, and J. D. McIntyre. 1992. Production and habitat of salmonids in mid-Columbia tributary streams. U.S. Fish and Wildlife Service 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.

Nightingale, B.J., and C.A. Simenstad. 2001. Overwater structures: marine issues. Prepared for the Washington State Transportation Commission.

NMFS (National Marine Fisheries Service). 2005a. 2005 report to congress, Pacific coastal salmon recovery fund 2000–2004. National Marine Fisheries Service, Seattle, Washington.

NMFS (National Marine Fisheries Service). 2005b. Final assessment of NOAA Fisheries' critical habitat analytical review teams for 12 evolutionarily significant units of West Coast Salmon and Steelhead. NOAA, Portland, Oregon.

NMFS (National Marine Fisheries Service). 2009. Middle Columbia River steelhead distinct population segment ESA recovery plan. National Marine Fisheries Service, Northwest Region.

NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest 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.

Paltridge, R.M., P.L. Dostine, C.L. Humphrey, and A.J. Boulton. 1997. Macroinvertebrate recolonization after re-wetting of a tropical seasonally-flowing stream (Magela Creek, Northern Territory, Australia). Marine and Freshwater Research 48:633–645.

Pennak, R.W. 1953. Fresh-water invertebrates of the United States. The Ronald Press Company, New York. 769 p.

PFMC (Pacific Fishery Management Council). 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18 to the Pacific Coast Salmon Plan: Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon. Pacific Fishery Management Council, Portland, Oregon. September 2014. 196 p. + appendices.

Popper, A.N. 2003. Effects of anthropogenic sounds on fishes. Fisheries 28(10):24–31.

Popper, A.N. and M. C. Hastings. 2009. The effects of anthropogenic sources of sound on fishes. Journal of Fish Biology 75: 455–489.

Popper, A.N., M.E. Smith, P.A. Cott, B.W. Hanna, A.O. MacGillivray, M.E. Austin, and D.A. Mann. 2005. Effects of exposure to seismic airgun use on hearing of three fish species. Journal of the Acoustical Society of America 117(6):3958–71.

Raymondi, R.R., J.E. Cuhaciyan, P. Glick, S.M. Capalbo, L.L. Houston, S.L. Shafer, and O. Grah. 2013. Water Resources: Implications of Changes in Temperature and Precipitation. *In* Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, pp. 41–58. Island Press, Washington, D.C.

Reeder, W.S., P.R. Ruggiero, S.L. Shafer, A.K. Snover, L.L. Houston, P. Glick, J.A. Newton, and S.M. Capalbo. 2013. Coasts: Complex Changes Affecting the Northwest's Diverse Shorelines. *In* Climate Change in the Northwest: Implications for Our Landscapes, Waters, and Communities, edited by M.M. Dalton, P.W. Mote, and A.K. Snover, pp. 41–58. Island Press, Washington, D.C.

Reisenbichler, R.R., J.D. McIntyre, M.F. Solazzi, and S.W. Landino. 1992. Genetic variation in steelhead of Oregon and northern California. Transactions of the American Fisheries Society. 121:158–169.

Rondorf, D.W., G.L. Rutz, and J.C. Charrier. 2010. Minimizing effects of over-water docks on federally listed fish stocks in McNary Reservoir: a literature review for criteria. Anadromous Fish Evaluation Program Report 2010-W68SBV91602084. U.S. Army Corps of Engineers, Walla Walla District.

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 14:448-457.

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 Sciences 48:493–497.

Simenstad, C.A., B.J. Nightingale, R.M. Thom, and D.K. Shreffler. 1999. Impacts of ferry terminals on juvenile salmon migrating along Puget Sound shorelines. Phase I: synthesis and state of knowledge. Prepared for the Washington State Transportation Commission.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Noviztki. 1996. An Ecosystem Approach to Salmonid Conservation. Prepared by ManTech Environmental Research Services, Inc., Corvallis, Oregon, for National Marine Fisheries Service, Publication TR- 4501-96-6057, Portland, Oregon (December 1996). 356 pp.

Stotz, T., and J. Colby. 2001. January 2001 dive report for Mukilteo wingwall replacement project. Washington State Ferries Memorandum. 5 pp. + appendices.

Sunda, W.G., and W.J. Cai. 2012. Eutrophication induced CO_2-acidification of subsurface coastal waters: Interactive effects of temperature, salinity, and atmospheric pCO_2, Environmental Science and Technology 46:10651–10659.

Tillmann, P., and D. Siemann. 2011. Climate Change Effects and Adaptation Approaches in Marine and Coastal Ecosystems of the North Pacific Landscape Conservation Cooperative Region. National Wildlife Federation.

Turnpenny, A., and J. Nedwell. 1994. The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sound Generated by Seismic Surveys. Fawley Aquatic Research Laboratories Limited, Marine and Freshwater Biology Unit, Southampton, Hampshire, UK. 48 pp.

Turnpenny, A.W.H., K.P. Thatcher, and J.R. Nedwell. 1994. The effects on fish and other marine animals of high-level underwater sound. Fawley Aquatic Research Laboratory, Ltd., Report FRR 127/94, United Kingdom (October 1994). 79 pp.

USACE (U.S. Army Corps of Engineers). 2009. Literature Review (for studies conducted prior to 2008): Fish Behavior in Response to Dredging and Dredged Material Placement Activities. W912P7-07-P-0079. U.S. Army Corps of Engineers.

USFWS. 2015. Biological Opinion: Statewide programmatic consultation for Washington State Department of Transportation. USFWS reference numbers 01EWFW00-2014-F-0286 and 01EWFW00-2014-FC-0287. U.S. Fish and Wildlife Service. July 2015.

USGS (U.S. Geological Survey). 2019a. National Water Information System. USGS 12508990 YAKIMA RIVER AT MABTON, WA. Accessed July 14, 2019. https://nwis.waterdata.usgs.gov/wa/nwis/uv/?site_no=12508990&agency_cd=USGS.

USGS (U.S. Geological Survey). 2019b. National Water Information System. USGS 12509489 YAKIMA RIVER AT PROSSER, WA. Accessed August 16, 2019. https://nwis.waterdata.usgs.gov/wa/nwis/uv/?site_no=12509489&agency_cd=USGS.

Wainwright, T.C., and L.A. Weitkamp. 2013. Effects of climate change on Oregon Coast coho salmon: habitat and life-cycle interactions. Northwest Science, 87(3):219–242.

Winder, M., and D.E. Schindler. 2004. Climate change uncouples trophic interactions in an aquatic ecosystem. Ecology 85: 2100–2106.

WSDOE (Washington State Department of Ecology). 2019. Washington State Water Quality Assessment. 303(d)/305(b) List. Accessed July 14, 2019. https://ecology.wa.gov.

WSDOT (Washington State Department of Transportation). 2015. Roadside Policy Manual. M 3110.03. Washington State Department of Transportation.

WSDOT (Washington State Department of Transportation). 2016a. Standard Specifications for Road, Bridge, and Municipal Construction. M 41-10. Washington State Department of Transportation.

WSDOT (Washington State Department of Transportation). 2016b. Fish Exclusion Protocols and Standards. Washington State Department of Transportation. Accessed July 14, 2019. https://www.wsdot.wa.gov/environment/technical/disciplines/fish-wildlife/policies-procedures.

WSDOT (Washington State Department of Transportation). 2019a. Highway Runoff Manual. M 31-16.05. Washington State Department of Transportation.

WSDOT (Washington State Department of Transportation). 2019b. SR 241 - MP 1.34 – Yakima River Bridge (Bridge 241/5) Temporary Access Work Bridge and Falsework Platform Hydraulic Analysis. Memorandum from Julie Heilman and Casey Kramer to Alex Sanguino. June 19, 2019.

YBFWRB (Yakima Basin Fish and Wildlife Recovery Board). 2009. 2009 Yakima Steelhead Recovery Plan. Extracted from the 2005 Yakima Subbasin Salmon Recovery Plan with Updates. Yakima Basin Fish and Wildlife Recovery Board. http://www.ybfwrb.org.

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):190-200.