UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
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Portland, Oregon 97232-1274

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Refer to NMFS No: WCRO-2020-01573

October 28, 2020

Candace A. McKinley
Environmental Program Manager
U.S. Bureau of Reclamation
Columbia–Cascades Area Office
1917 Marsh Road
Yakima, WA 98901-2058

Re: Endangered Species Act Section 7(a)(2) Biological Opinion for the Cle Elum Dam Fish Passage Facilities Project (Splitter Wall), Kittitas County, Washington

Dear Ms. McKinley:

Thank you for your letter of June 12, 2020, 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 Cle Elum Dam Fish Passage Facilities Project (Splitter Wall). Your request is for consultation on modifications to an action for which our agencies completed an informal consultation in 2010 (NMFS No. 2010-04694) and which has been partially constructed. In order to complete a comprehensive consultation, the attached biological opinion considers all elements of the proposed action included in your 2010 Biological Assessment, as modified by your 2020 consultation request and 2020 Biological Assessment. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

In this opinion, NMFS concluded that the proposed action is not likely to jeopardize the continued existence of ESA listed Middle Columbia River steelhead (*Oncorhynchus mykiss*), or result in the destruction or adverse modification of their critical habitat. As required by section 7 of the ESA, NMFS provided an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize incidental take associated with the proposed action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the federal agency and any person who performs the action must comply with to carry out the RPMs. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition. NMFS also provided one voluntary conservation recommendation.

Please note that the scope of this consultation does not include operation of the adult passage facilities. Detailed operational plans will be developed and Reclamation and/or the Yakama Nation will apply for all permits necessary to handle trapped adult fish before the facility commences operation in 2025 or later.

Please contact Sean Gross, Interior Columbia Basin Office, Ellensburg, (509) 962-8911 ext. 806, sean.gross@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Assistant Regional Administrator
Interior Columbia Basin Office
NOAA Fisheries, West Coast Region

Enclosure

cc: Scott Willey, Reclamation, wwilley@usbr.gov
Richard Visser, Reclamation, rvisser@usbr.gov

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion

Cle Elum Dam Fish Passage Facilities Project (Splitter Wall)

NMFS Consultation Number: WCRO-2020-01573

Action Agency: U.S. Bureau of Reclamation

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

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

Issued By: ____________
Michael Tehan
Assistant Regional Administrator
Interior Columbia Basin Office
NOAA Fisheries, West Coast Region

Date: October 28, 2020

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ACRONYM GLOSSARY

A&P	Abundance and Productivity
BA	Biological Assessment
BMP	Best Management Practice
cfs	cubic feet per second
DPS	Distinct Population Segment
DQA	Data Quality Act
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
FR	Federal Register
HUC	Hydrologic Unit Code
ICTRT	Interior Columbia Basin Technical Recovery Team
ISAB	Independent Scientific Advisory Board
ITS	Incidental Take Statement
LWD	Large Woody Debris
MCR	Middle Columbia River steelhead
mm	millimeter
MPG	Major Population Group
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Unit(s)
NWFSC	Northwest Fisheries Science Center
opinion	Biological Opinion
PAH	polycyclic aromatic hydrocarbons
PBF	Physical or Biological Feature
PCE	Primary Constituent Element
Reclamation	U.S. Bureau of Reclamation
RPM	Reasonable and Prudent Measure
U.S.C.	United States Code
WDFW	Washington Department of Fish and Wildlife
YBFWRB	Yakima Basin Fish & Wildlife Recovery Board
YTID	Yakima Tieton Irrigation District

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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 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at Ellensburg, WA.

1.2. Consultation History

In 2010, NMFS and the U.S. Bureau of Reclamation (Reclamation) completed consultation for the Cle Elum Dam Fish Passage Facilities Project (NMFS Tracking No. 2010/04694). The proposed action at that time included all construction activities (anticipated to be completed by 2018) and operation of the facilities through year 2020. NMFS' concurrence with Reclamation's determination that the proposed action was not likely to adversely affect Middle Columbia River (MCR) steelhead and their critical habitat was based on information that is now outdated. Specifically, since the completion of the original informal consultation, steelhead have been documented to occur in the proposed construction area and additional construction activities have been added to the proposed action. Construction has been ongoing for several years, but is scheduled to continue for 5 more years. In addition, Reclamation proposes to operate and maintain the facilities for the long term. Therefore, because new information reveals effects of the action that may affect listed species in a way not previously considered, and because the action has been modified in a manner that will cause an effect to the listed species or designated critical habitat that was not previously considered, the consultation is being re-initiated.

On September 21, 2010, Reclamation requested concurrence from NMFS that their proposed action was not likely to adversely affect MCR steelhead. The consultation is identified as NMFS Tracking No. 2010/04694.

On November 22, 2010, NMFS concurred, by letter, with Reclamation's determination of effect. The concurrence relied, in part, on information gathered in 2002–2006 that indicated steelhead spawned approximately 5 miles downstream of Cle Elum Dam.

In 2014, to fulfill a commitment made in the 2010 consultation, Reclamation staff surveyed the Cle Elum River for steelhead redds and determined that several redds had been constructed in close proximity to the dam, indicating that steelhead did occupy the action area that was considered in the 2010 consultation.

In 2016, construction commenced. As of January 2020, construction has occurred in upland areas and in Lake Cle Elum, but not in the Cle Elum River.

Since 2016, Reclamation has modified design and construction plans for the facilities that will be located within the Cle Elum River. Reclamation has discussed options for potential changes with NMFS' biologists and engineers from approximately 2016 through 2020.

On January 9, 2020, NMFS received a letter requesting initiation of formal consultation and a Biological Assessment (BA) from Reclamation. The consultation request was assigned NMFS Tracking No. WCRO-2020-00070.

On February 5, 2020, NMFS and Reclamation staff discussed anticipated further changes to the new proposed action that would change the anticipated effects of the action on fish in the Cle Elum River. The parties agreed to discuss the matter further and potentially amend the BA after Reclamation could more fully vet the anticipated changes with their engineers. This discussion was memorialized in a February 6, 2020, email from NMFS to Reclamation.

Between February and May, 2020, Reclamation considered potential changes to the proposed action with respect to in-water work in the Cle Elum River. However, Reclamation did not provide specific information regarding changes to the proposed changes because it was still considering several options.

On May 11, 2020, NMFS sent a letter to Reclamation closing out the consultation request for WCRO-2020-00070 due to insufficient information regarding in-water work. NMFS requested that Reclamation provide a new request for consultation when sufficient information could be provided.

On June 12, 2020, Reclamation submitted a new BA dated May 27, 2020, and a letter requesting initiation of formal ESA consultation. The consultation was assigned tracking number WCRO-2020-01573 and initiated on June 12, 2020.

On August 5, 2020, Reclamation and NMFS staff discussed project details related to in-water work.

On September 15, 2020, NMFS sent a draft of the opinion's Proposed Action section to Reclamation for review.

On September 23, 2020, NMFS sent a draft of the Incidental Take Statement's Terms and Conditions section to Reclamation for review.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 CFR 402.02). Reclamation proposes to fund and construct the Cle Elum Dam Fish Passage Facilities Project. Reclamation and the Yakama Nation will each participate in long term operation of the project.

Cle Elum Dam was constructed in 1933 and is a complete upstream barrier to fish passage. The objective of the proposed action is to construct both downstream juvenile and upstream adult passage facilities to allow restoration of native fish migration. The downstream juvenile facility is designed to provide passage over 63 feet of fluctuation in the stage of the Cle Elum reservoir to allow smolts to outmigrate from the reservoir to the river over an extended period in the spring. This juvenile facility has an innovative helix design with a multilevel intake system to transport fish downstream to a conduit through the right abutment of the dam and discharge into the Cle Elum River (Figure 1).

The upstream adult fish passage facility is designed as a permanent trap-and-haul system. The upstream passage facility includes a fish ladder and splitter wall in the stilling basin (the energy dissipation pool below the dam). The ladder will lead to an adult fish collection facility where fish can be counted, sampled, and loaded for transport above the dam. Additional features include site access roads and a bridge over the existing dam spillway.

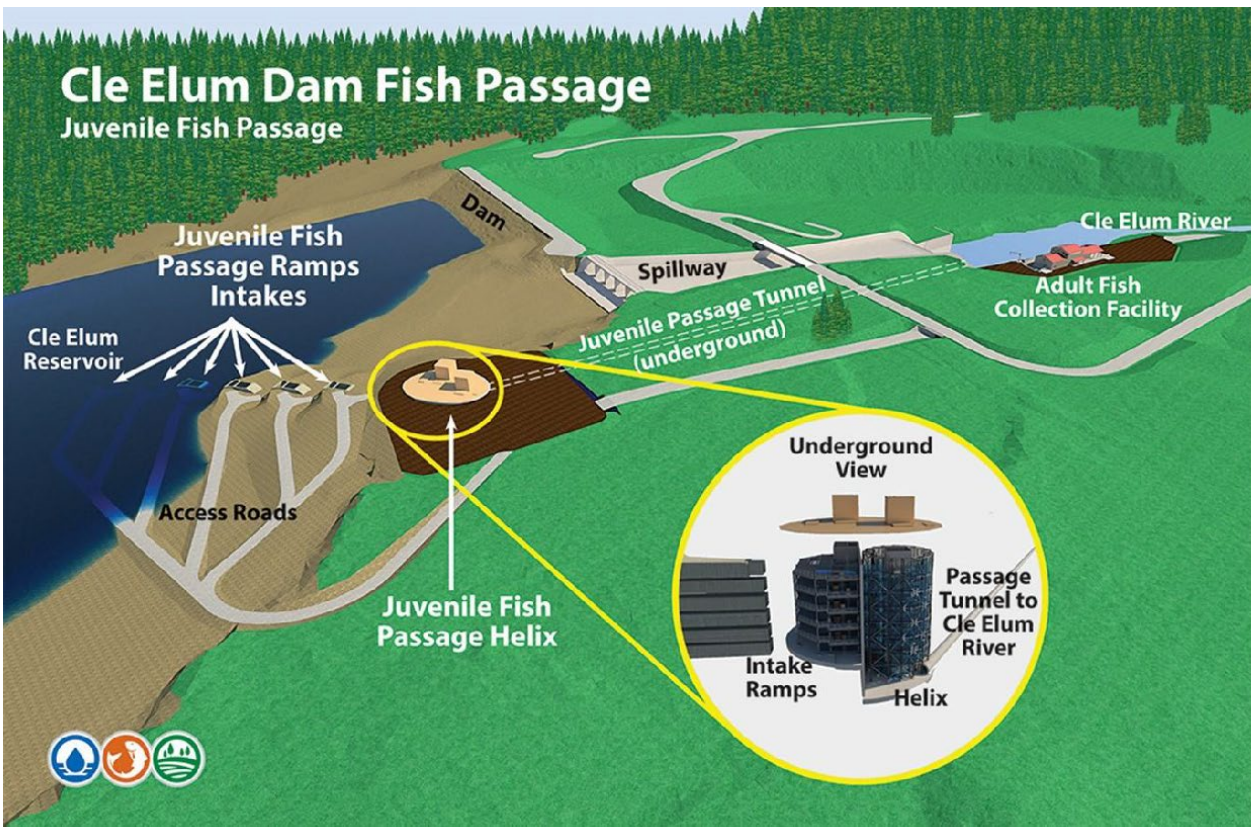

Figure 1. Illustration of facilities to be constructed for the Cle Elum Dam Fish Passage Facilities Project. (Reclamation 2020, their Figure 1).

Construction – Upland and Reservoir

Construction in the uplands and reservoir began in 2016 and is ongoing. Substantial progress has been made on the juvenile fish passage helix and underground passage tunnel. Construction was consistent with descriptions in the 2010 BA and concurrence letter, or was modified in a manner that did not pose risk to MCR steelhead.

Future activity in the reservoir includes completing construction of the juvenile facility, passage tunnel, and adult facility. These activities are described in the 2010 BA (Reclamation). Major components of this work include excavation and concrete pouring. Reclamation proposes to implement standard protective measures during this work to mitigate the risk of sediment and uncured concrete entering the reservoir or Cle Elum River.

Construction – Cle Elum River

Major construction activities downstream of the dam, in the stilling basin and Cle Elum River, are proposed to commence as early as 2021 (more likely 2022) and are described in the 2020 BA (Reclamation). These activities include instream construction related to installation of a concrete splitter wall within the stilling basin, excavation of the foundation for the right bank adult fish facility near the base of the dam, and connection of the juvenile and adult fish passage facility infrastructure. These activities will involve installation of a cofferdam and dewatering of a large section of the stilling basin and Cle Elum River downstream of the dam.

Reclamation proposes to conduct all work in the stilling basin and river between September 1 and April 15.

The proposed construction actions and sequencing include (Reclamation 2020):

1. Install dewatering wells in upland areas on the right (south) bank in June–August. These wells are intended to reduce groundwater upwelling into the work area and pumped water will be discharged to the river.

2. Reduce Cle Elum Dam water releases from the typical 1000–3000 cubic feet per second (cfs) to 500 cfs or less by September 1. The reduction in Cle Elum Dam discharge will be accompanied by an increase in discharge from Tieton and Bumping dams in the Naches basin to meet the water demand for irrigation in the lower Yakima basin. Reclamation conducts this ‘flip-flop’ operation every year, but will accelerate it by about 1–2 weeks to facilitate in-water construction in the stilling basin and Cle Elum River.

3. Install a temporary Helix Bypass Pipe on the right bank and an energy dissipation pool at its outlet in the river (Figure 2). Reclamation will install ecology blocks and large riprap in the pool to dissipate energy and reduce erosion. The plunge pool will be constructed by a tracked excavator and occupy 1,250 square feet. River sediments excavated during pool construction will be deposited on the right bank of the river with the expectation that they will be eroded and mobilized in future years.

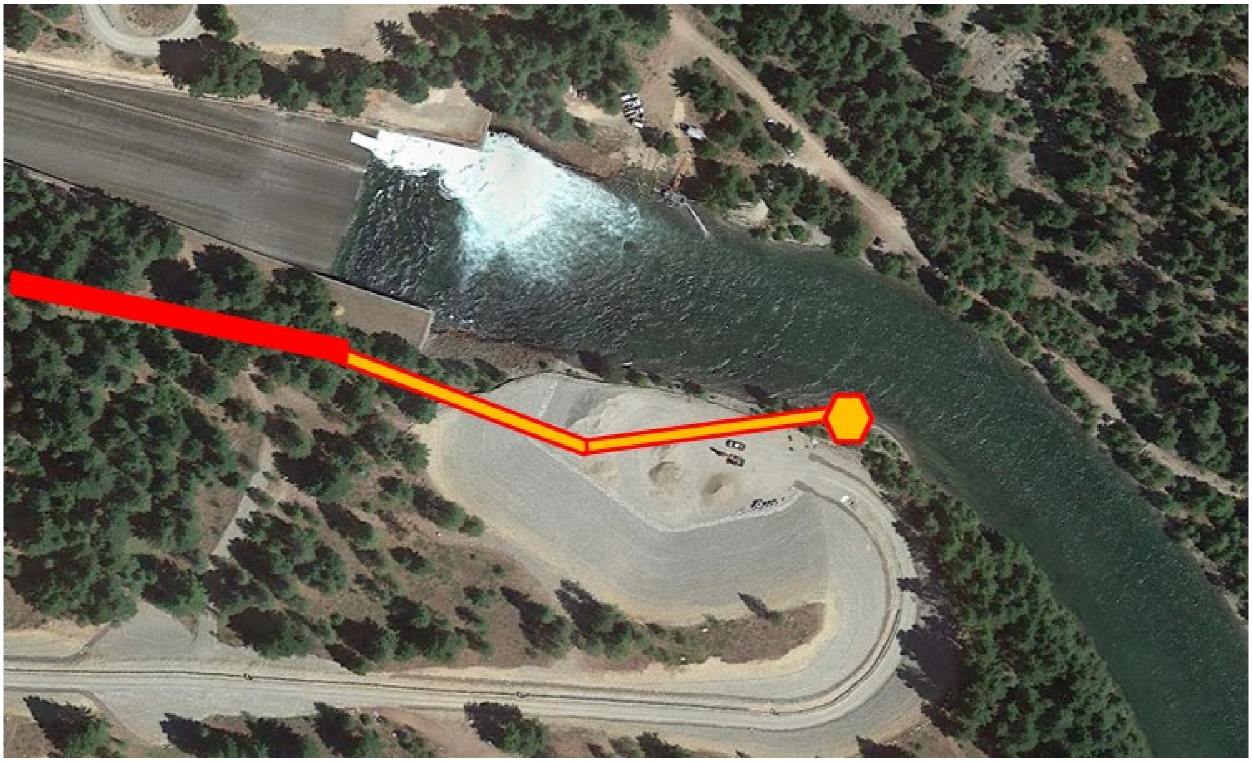

Figure 2. The Helix Bypass Pipe (yellow) will be connected to the Juvenile Passage Tunnel (red) and discharge into the river at the dissipation pool (yellow hexagon) (Reclamation 2020, their Figure 11).

4. Install a temporary crane pad in the river from the left bank (Figure 3). The pad will be comprised of supersacks, gravel, and/or riprap and measure approximately 40 feet by 40 feet (1,600 square feet) at its base. The top of the pad will be several feet above water level. The crane pad will not be constructed within a cofferdam.

Figure 3. Temporary crane pad (Reclamation 2020, their Figure 13).

5. Place the Outlet Works Diversion Conduit in the stilling basin and river. The conduit will be made of 8-foot-diameter pipe or a flume. The 700 foot-long conduit will be installed in the river from one or two cranes and assembled but not yet connected to the outlet of the dam, which will be discharging up to 500 cfs during placement of the conduit.

6. Construct approximately three-quarters of a cofferdam that will eventually span the channel near the downstream end of the conduit (Figure 4). The cofferdam will be constructed of super sacks and/or water-filled bladders and built over the conduit. The cofferdam will also include a drivable surface for equipment access. Several wells will be installed through the cofferdam. The cofferdam will be up to 50 feet wide at its base and approximately 6 feet tall. When fully constructed, the cofferdam will be 200 feet long, occupying approximately 10,000 square feet of riverbed.

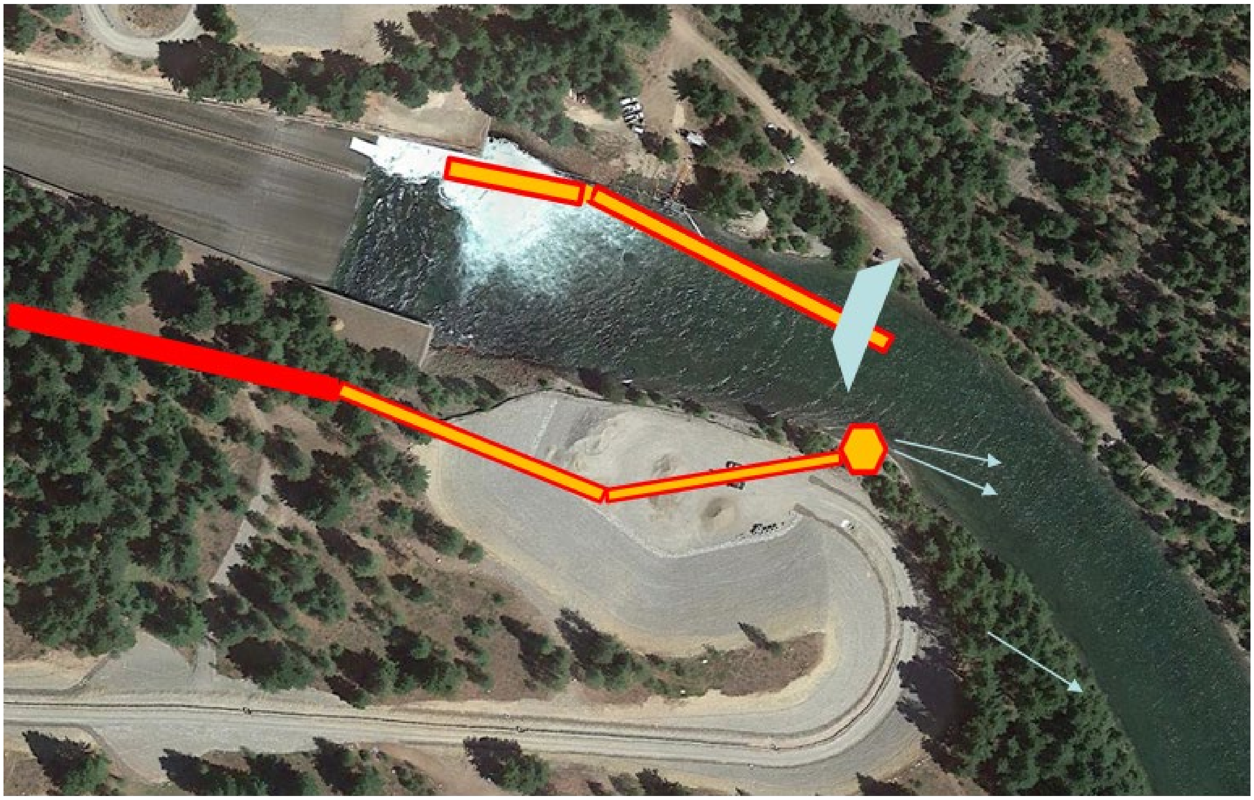

Figure 4. Outlet Works Diversion Conduit extends downstream from the dam outlet along the left (north) bank of the river, but has not yet been connected to the dam outlet. Approximately three-quarters of the cofferdam (gray) is shown extending across the conduit (Reclamation 2020, their Figure 15).

7. Connect the Outlet Works Diversion Conduit to the dam outlet works and complete the cofferdam. This will temporarily extend the discharge location from the dam outlet in the stilling basin to just downstream of the cofferdam. The conduit will be connected to the dam outlet while the outlet is discharging water to prevent major dewatering of the Cle Elum River.

   Discharge from the dam will be reduced from about 500 cfs to approximately 50–60 cfs. Groundwater well pumps will be operated to discharge approximately 10–20 cfs into the river. Reclamation also expects that groundwater upwelling into the stilling basin will amount to 10–20 cfs of additional water. In total, flow to the Cle Elum River will be reduced to a minimum of 80 cfs for 12–24 hours while the conduit is connected to the dam outlet. Once connected, water discharged from the dam will flow through the conduit and discharge downstream of the cofferdam. Discharge will be increased to the winter flow target, per normal seasonal operations, to 180–250 cfs depending on prevailing basin water conditions.

   The remainder of the cofferdam will be constructed, isolating the work area between Cle Elum Dam and the cofferdam from flowing water (Figure 5). A 400-square-foot energy dissipation pool will also be constructed at the outlet of the conduit from an excavator atop the cofferdam.

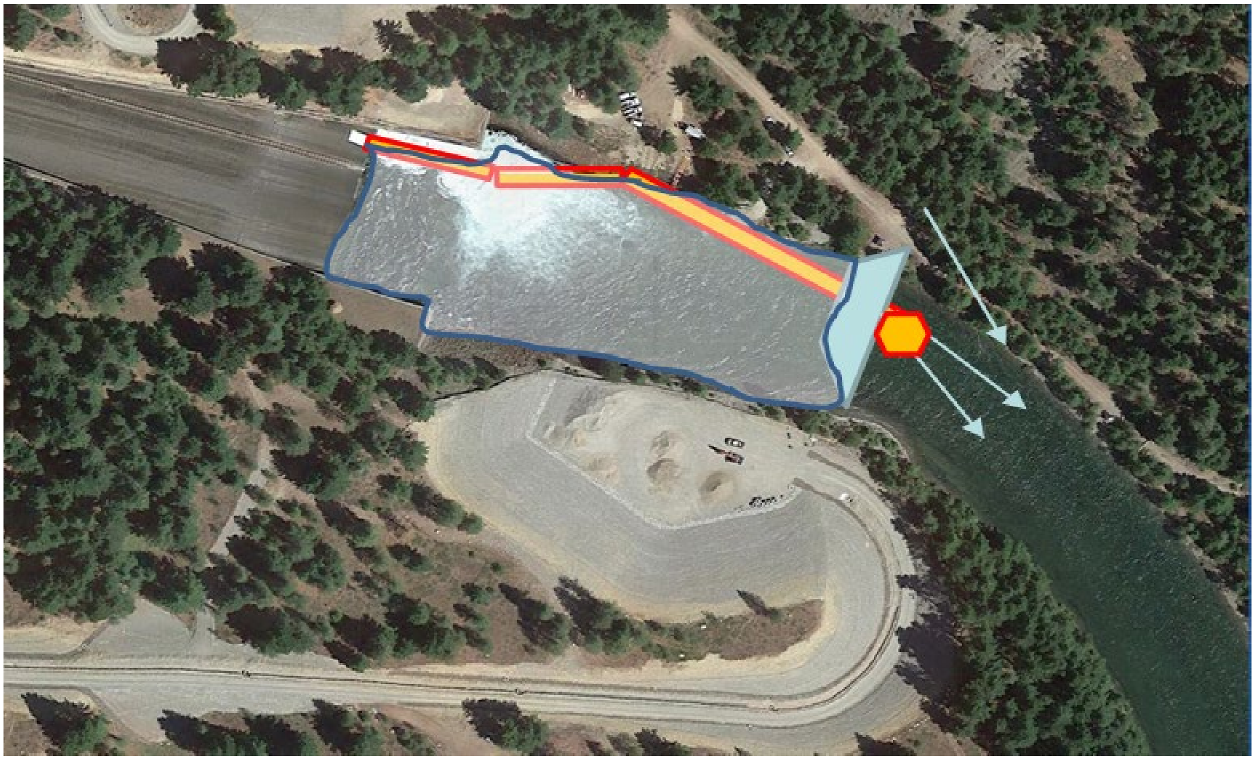

Figure 5. Outlet Works Diversion Conduit connected to dam outlet and discharging downstream of the channel-spanning cofferdam (Reclamation 2020, their Figure 18). The work area isolated from flowing water is located between Cle Elum Dam and the cofferdam and outlined in blue.

8. Begin dewatering the 700-foot by 200-foot (140,000-square-foot) work area between the dam and cofferdam. The groundwater pumps and additional screened submersible pumps will draw down the water level over a few days. Clean water will be discharged from the pumps into the river downstream of the cofferdam if the water is clear, as expected. If the water exceeds 5 nephelometric turbidity units (NTU) over background, it will be treated to reduce turbidity prior to discharge. One or more fish biologists will be on-site to observe fish movement as water levels drop and advise that pumping be slowed to allow fish time to volitionally move into residual pools.

9. Conduct fish salvage operations prior to complete dewatering. Over a period of several days and during progressive dewatering, Reclamation crews will capture fish in the work area. Techniques such as dipnetting and seining will be attempted. Electrofishing will be used as a last resort and is anticipated to be necessary in some parts of the work area due to substrate conditions. Reclamation proposes to follow the Washington Department of Fish and Wildlife (WDFW) or NMFS' electrofishing guidance (NMFS 2000). Captured fish will be identified, counted, and released. Any captured steelhead or salmon will be released downstream of the cofferdam. The work area will be dewatered to the extent possible after fish removal; the degree of dewatering will depend on the ability of groundwater and submersible pumps to keep up with water upwelling at the site.

10. Construct vehicle access road into the dewatered stilling basin from the left bank.

11. Construct the concrete splitter wall structure and repair existing stilling basin concrete. The splitter wall will parallel the bank and extend downstream from the dam's spillway.

12. Excavate the foundation for the adult fish collection facility on right bank.

13. Demolish portions of concrete on the right bank dam abutment and construct adult and juvenile fish passage facility connections (ladder entrance and intake pipes and screens). The intake pipes will eventually be connected to three T-screens, the design of which has been reviewed and approved by NMFS engineers. The water will be used to operate the adult collection facility, including the adult fish ladder.

14. Relocate rip-rap within the stilling basin and construct the right bank concrete support wall. Reclamation will armor 100 feet of the right bank extending downstream from the adult facility. The armor will consist of a combination of riprap repositioned from the stilling basin and a concrete support wall.

15. Remove the dewatering system, access road, crane pad, cofferdam, and Outlet Works Diversion Conduit. After all concrete in the dewatered area has cured, the temporary facilities will be deconstructed. The removal process is anticipated to occur from March through April 15.

    The crane pad and stilling basin access road will be removed by excavating fill material. However, some fill material, consisting of mostly angular rock, will be left in place so that the bed is not further disturbed to remove the fill. Next, the groundwater wells within the cofferdam will be removed per standard decommissioning procedures. After well decommissioning, the work area is expected to slowly begin filling with upwelling water. The cofferdam will be dismantled over a period of several days.

    The Outlet Works Diversion Conduit will be removed next. Flow through the conduit will be reduced and compensated by flows through the Helix Bypass Pipe (Figure 2) to ensure that discharge from the reservoir into the river will be maintained. The conduit will be removed by a single crane operating from the bank.

16. Final Site Cleanup. The upland wells will be decommissioned. Disturbed upland areas will be recontoured and treated with erosion control measures.

Long-term Operation – Juvenile Fish Passage Helix

Reclamation will operate the downstream passage facilities. Initially, downstream beneficiaries of the facility will be sockeye salmon smolts. Adult sockeye have been trucked to and released in Cle Elum Reservoir annually since 2009 and their smolts currently pass over the dam spillway when reservoir levels allow it.

The Cle Elum Juvenile Fish Passage Facilities consist of a multilevel intake structure, a helix structure, and an outlet tunnel that discharges to the river downstream of the dam. Operation of the downstream juvenile fish passage facilities will entail opening the intakes as reservoir levels rise and fall through the spring and summer. The facility is designed to allow volitional outmigration. Fish that occupy the upper portion of the water column are attracted by flow velocities near the multilevel intake, and then subsequently passed through the helix and tunnel outlet structures. Juvenile fish passage facilities will only be operational during those times when lake elevations are high enough to cover the operational range of the outlet facility which occurs at elevation 2,180 feet and above. This is a modification of the proposed action described in the 2010 BA (Reclamation 2010), which was set at a minimum elevation of 2,190 feet. Therefore, the current design will allow passage over a longer duration each year than the design that was considered in 2010.

The specific operational season of the juvenile passage facility will vary from year to year. Reclamation anticipates that in median water years, the facility will allow passage from early February through mid-August. In the driest 10% of years, passage will not be available until early May and cease by mid-July. In the wettest 10% of years, passage will be available by mid-November and last until the following September. These predicted operational seasons are based on past reservoir levels and do not reflect any future changes in precipitation, runoff, or water release schedules. Actual operational dates may vary and Reclamation will assess specific conditions and consider input from the fishery and irrigation interests in the Systems Operations Advisory Committee when making operational decisions.

Reclamation coordinated extensively with NMFS and other entities for many years during the design of the facilities. NMFS' fish passage engineers reviewed multiple iterations of designs and found them to be satisfactory.

Long-term Operation – Adult Facilities
The Yakama Nation's fisheries staff will operate the adult facility with support from Reclamation. The Yakama Nation has indicated that, eventually, it plans to transport all native fish species that enter the fish ladder into the reservoir according to the WDFW and Yakama Nation Fish Restoration Plan (Yakama Nation and WDFW 2010). The plan does not specify an annual schedule for operating the facility, how passage for each species will be phased in over time, or other details to implement passage activities.

Detailed operational plans will be developed before operation of the facility commences in 2025 or later. Reclamation and/or the Yakama Nation will apply for all permits necessary to operate the facility and handle trapped fish after developing operational plans. Per the BA (Reclamation 2020), Reclamation will ensure that "federal Section 10 Recovery Permits are obtained by Reclamation to cover the intentional take that will be associated with handling… fish species that enter the adult collection facility when it becomes operational."

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not. We considered that construction and operation of the passage facilities may precipitate the Yakama Nation modifying some of its fisheries management actions in the Yakima basin with respect to coho salmon, bull trout, and other species. However, at this time, it is not reasonably certain what those modifications would entail. Any changes regarding direct management of fish species that are related to this action will be more appropriately evaluated after an implementation plan for adult passage is developed and in conjunction with NMFS' consideration of the Section 10 permit application that will be prepared by the Yakama Nation and/or Reclamation.

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 provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

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

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

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

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

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

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

2.2. Rangewide Status of the Species and Critical Habitat

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

2.2.1. Status of the Species

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

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

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

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

"Productivity," as applied to viability factors, refers to the entire life cycle; i.e., the number of naturally-spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate. For species with multiple populations, once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany et al. 2000).

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

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

Species	Listing Status	Critical Habitat	Protective Regulations
Steelhead (*O. mykiss*)			
Middle Columbia River	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

Middle Columbia River Steelhead

The MCR steelhead Distinct Population Segment (DPS) was listed as threatened on March 25, 1999 (64 FR 14517), and its threatened status was reaffirmed on June 28, 2005 (70 FR 37160). The threatened status once again affirmed during 5-year status reviews on August 15, 2011 (76 FR 50448), and again on May 26, 2016 (81 FR 33468). The DPS is comprised of 17 independent populations within four Major Population Groups (MPGs) in Washington and Oregon. This DPS includes all naturally-spawned populations of steelhead (and their progeny) in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River Basin. Seven artificial propagation programs are considered part of the DPS: the Touchet River Endemic, Yakima River Kelt Reconditioning Program (in Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River), Umatilla River, and the Deschutes River steelhead hatchery programs.

The 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 re-entering 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 (Reisenbichler et al. 1992) fish that enter the Columbia River from June to August. Adult steelhead ascend mainstem rivers and their tributaries throughout the winter, spawning in the late winter and early spring. Fry emergence typically occurs between May and the end of June.

The areas affected by the proposed action are in the Upper Yakima and Naches river basins, which are occupied by steelhead from the Upper Yakima and Naches populations of the Yakima MPG. For the rest of the species status section we will focus on the Yakima MPG.

Abundance. Abundance estimates have been recently made for 16 of the 17 extant MCR steelhead populations. Seven of the 16 populations are currently above the average abundance thresholds that the Interior Columbia Basin Technical Recovery Team (ICTRT) identifies as a minimum for low risk. The remaining nine populations are at moderate or high risk of extinction due to low abundance.

The latest Northwest Fisheries Science Center (NWFSC) status review (NWFSC 2015) characterized two MCR steelhead populations as being at high risk of extinction in terms of abundance. The Naches River and Upper Yakima River populations were rated at moderate risk for integrated abundance and productivity. The remaining populations in the Yakima MPG are at low risk. Due to relatively high returns for most years since 2001, abundance of Satus Creek and Toppenish Creek populations are greater than the minimum abundance targets for viability (Table 2). Upper Yakima and Naches River returns had improved leading up to the 2015 review, but were still well below the targets (NWFSC 2015). However, since 2015, abundance has declined markedly. NMFS is currently conducting a status review for publication in 2021.

Productivity. Based on 20 full brood-year returns of MCR steelhead, most populations have replaced themselves, and a few have not, when only natural production is considered. Relative population status varies widely across the DPS. Based on a 2007 analysis, productivity is insufficient to meet recovery needs (ICTRT 2007a) for most populations. Estimates of required productivity increases required to reach a low risk of extinction depend on assumptions regarding future hydropower operations and ocean conditions.

Table 2. Summary of the Middle Columbia River steelhead Yakima River Group status and Interior Columbia Basin Technical Recovery Team viability criteria.

	Abundance and Productivity Metrics				Spatial Structure and Diversity Metrics			Rating
Population	**Minimum Abundance Target**	**Natural Spawning Abundance 2005–2014**	**Productivity (returns-per-spawner) 2005–2014**	**Integrated Abundance/ Productivity Risk**	**Natural Process Risk**	**Diversity Risk**	**Integrated Spatial Structure/ Diversity Risk**	**Overall Viability Rating**
Naches	1,500	1,244	1.83	Moderate	Low	Moderate	Moderate	Moderate
Satus	1,000	1,127	1.93	Low	Low	Moderate	Moderate	Viable
Toppenish	500	516	2.52	Low	Low	Moderate	Moderate	Viable
Upper Yakima	1,500	246	1.87	Moderate	Moderate	High	High	High Risk

The Upper Yakima population has a very high abundance/productivity gap, and the Naches has a high gap (NWFSC 2015), indicating that these populations are among the poorest performing in the DPS.

Spatial structure. The NWFSC (2015) uses the term "natural processes risk" instead of "spatial structure" and characterizes the risk to MCR steelhead populations as "very low" to "moderate" for all populations. The Naches population is rated low risk because seven of the eight historical major spawning areas are occupied. The only unoccupied major spawning area is the upper Tieton River which is currently blocked by Rimrock Dam (ICTRT 2005). The distribution across spawning areas of the Upper Yakima population continues to be substantially reduced from historical levels with only 11 of the 14 major spawning areas occupied and the population is at moderate risk. Impassable storage dams block significant portions of the Cle Elum and Kachess rivers, the uppermost reach of the Yakima River, and tributaries to these areas.

Diversity. The ICTRT (ICTRT 2007b) identified 20 existing populations in four major population groups as described previously. The Yakima River MPG consists of the Satus Creek, Toppenish, Naches, and Upper Yakima populations.

The NWFSC (2015) characterized most populations in the DPS and MPG as moderate risk. Risks due to the loss of life history and phenotypic diversity are inferred from habitat degradation, including passage impacts within the Yakima Basin.

Flow regulation by Reclamation has created a reduced out-migration window and a shift in the adult in-migration timing, both due to elevated temperatures in the lower river and flow modifications in the early migration season (ICTRT 2005). Risk to the Upper Yakima population is further elevated by flow management that affects rearing conditions in the mainstem Yakima River and passage issues at and below Roza Dam, in addition to historic stocking of out of basin rainbow trout in the Upper Yakima.

Limiting factors. The most significant factors limiting productivity of the MCR steelhead DPS include: (1) mainstem Columbia River hydropower adverse effects (i.e., modified hydrograph, increase in lentic conditions/decrease in riverine conditions—passage barriers, stream temperature, dissolved oxygen problems, and invasive species); (2) riparian degradation and large wood recruitment; (3) altered floodplain connectivity and function; (4) reduced streamflow;

(5) water quality; and (6) predation and competition (NMFS 2011a). Within the Yakima Basin, Reclamation's operation of the Yakima Project and subsequent diversion of irrigation water is the single largest limiting factor.

Recovery plan. In 2009, NMFS adopted a recovery plan for MCR steelhead that was developed by multiple organizations in both Washington and Oregon. Most important for this consultation is the Yakima Steelhead Recovery Plan that is part of the larger recovery plan. This plan outlined specific recovery actions that are intended to reduce threats associated with land and water management activities in the Yakima Basin.

Summary. The MCR steelhead DPS is not currently meeting the viability criteria described in the Mid-Columbia Steelhead Recovery Plan (NMFS 2009). To achieve viable status for the Yakima MPG, two populations should be rated as viable, including at least one of the two classified as large—the Naches River or the Upper Yakima River—neither of which currently meets viable status. The other two populations out of the four in the Yakima should be rated as maintained.

2.2.2. Status of Critical Habitat

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

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

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

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

Table 3 describes the PBFs of the habitat types within the full range of habitat designated as critical for the listed salmonid species. Range-wide, all habitat types are impaired to some degree, even though many of the watersheds comprising the fully designated area are ranked as providing high conservation value. The proposed action, however, affects only freshwater habitats.

Table 3. Physical and biological features of critical habitats designated for ESA-listed salmon and steelhead species considered in this opinion.

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

The PBFs of freshwater spawning and incubation sites include water flow, quality and temperature conditions and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.

The PBFs of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Interior Columbia Recovery Domain

Habitat quality in tributary streams in the Interior Columbia Recovery Domain range from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (NMFS 2009; Wissmar et al. 1994). Critical habitat throughout much of the Interior Columbia Recovery Domain has been degraded by intense agriculture, alteration of stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas.

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

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

2.2.3. Climate Change

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

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

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

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

2.3. Action Area

"Action area" means all areas 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 comprised of Reclamation's five storage reservoirs in the Yakima Basin and in the river reaches downstream of those dams to the confluence of the Naches and Upper Yakima rivers near Yakima, Washington. The storage reservoirs are: Cle Elum, Kachess, Keechelus, Rimrock, and Bumping reservoirs. The specific river reaches include the Upper Yakima River from Keechelus Dam to the confluence with the Naches River, the Kachess River from Kachess Dam to the Upper Yakima River, the Cle Elum River from Cle Elum Dam to the Upper Yakima River, the Tieton River from Tieton Dam to the Naches River, the Bumping River from Bumping Dam to the American River, the American River from the Bumping River confluence to the Naches River confluence, and the Naches River from the American River confluence to the Upper Yakima River confluence.

This expansive action area includes all waterbodies whose flow or depth are anticipated to be affected by Reclamation's management of flows to enable construction of the Cle Elum Dam Fish Passage Facilities Project. Effects in addition to this flow regulation will be concentrated in a much smaller portion of the action area within Cle Elum Reservoir and the Cle Elum River, including the stilling basin.

2.4. Environmental Baseline

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

The Yakima Basin Fish & Wildlife Recovery Board (YBFWRB) (2009) and Reclamation (2015) provided an overview of impacts within the Yakima basin that materially affect MCR steelhead and their critical habitat in the Yakima basin. For the following analysis, NMFS will draw from these earlier reviews, as well as more recent information, to focus on conditions and impacts specifically within the action area. As described in Section 2.3, the action area comprises all five major storage reservoirs in the Yakima Project, and the reaches of rivers downstream of those reservoirs to the confluence of the Yakima River with the Naches River.

2.4.1. Reservoirs

The five major storage reservoirs were created as part of the Yakima Project with the erection of Reclamation storage dams in 1910–1933. Four of the five dams were built at the site of natural lakes. All five dams block steelhead access to the reservoirs and their tributaries, which formerly provided over 90 miles of riverine habitat and four natural lakes. None of the reservoirs are designated critical habitat for MCR steelhead.

Habitat conditions within the reservoirs are influenced primarily by Yakima Project operations and by adjacent and upstream land management. Reclamation operates the reservoirs to fluctuate to meet water supply needs, resulting in highly degraded shoreline habitat; at most reservoir elevations, the shoreline directly adjacent is comprised of the reservoir bed which lacks vegetation or other quality habitat. In most cases, reservoir habitat is further degraded by reduced input of large woody debris (LWD) from tributaries due to historical and ongoing land management on USFS lands, and by removal of LWD at the dams by Reclamation.

Although reservoir habitat is degraded by ongoing project operations, maintenance of this degraded condition is not of consequence to MCR steelhead because they cannot access these locations.

2.4.2. Rivers

Altered Flows

Adequate flows are necessary for all life stages of steelhead to successfully contribute to maintaining the population and DPS. In a natural flow regime, flows in the action area would be dominated by snowmelt-driven discharge peaks in May or June that decline to groundwater driven base flows in August and September. Late autumn rainfall and minor snowmelt would augment summer base flow, with Chinook winds causing occasional winter high water events. Steelhead are adapted to these natural seasonal flow patterns, which maintained a variety of habitats and facilitated migratory behavior (YBFWRB 2009).

Ongoing operations of the Yakima Project dramatically affect flow patterns in the action area, reducing the productivity and life history diversity of steelhead (NMFS 2016). Project operations alter flows such that reduced spring flows cause high smolt mortality, and altered winter and summer flows reduce rearing success; improving survival and productivity of these life stages in the action area by improving the flow regime is essential to recovery (NMFS 2016).

Since the 1850s, water supply and delivery systems have been developed in the Yakima basin to serve irrigated agriculture mainly, and hydropower, domestic, and industrial users to a lesser degree (YBFWRB 2009). In the first half of the 20th century, the federal government authorized the Yakima Project, after which many private water rights were brought under the jurisdiction of Reclamation and new water rights were issued (YBFWRB 2009). The storage reservoirs and an extensive network of distribution facilities were constructed.

At present, the project is comprised of six major diversion dams, 420 miles of canals, 1,697 miles of lateral ditches, 30 pumping plants, 144 miles of drains, and 2 power plants (Reclamation 2015). The project also supplies water-to-water users in the basin that own and operate their water distribution infrastructure. In total, almost all water that is stored, released, and diverted in the Yakima Basin is managed as part of the Yakima Project; it is primarily the operation of the Yakima Project, in conjunction with precipitation and runoff patterns, that determines river flows in the action area.

Managed flow now provides discharge out of phase with the natural hydrograph, reducing the ability of the action area to support critical habitat functions and productivity of MCR steelhead (as reviewed by the YBFWRB 2009). The most significant changes in flow patterns are the creation of: (1) unnaturally low flows, (2) unnaturally high flows, (3) rapidly changing flow levels, (4) return flows, and (5) altered sediment and wood transport (YBFWRB 2009).

Reduced Flows. Yakima Project operations cause reduced flows throughout the rivers in the action area. Depending on which river reach is considered, project operations can reduce flows during any season of the year. Flows are reduced in most reaches during winter and spring (approximately November to June) throughout the action area because reservoirs capture more natural flow than they release at this time as they refill to provide irrigation water for the subsequent irrigation season. The hydrological effects of low winter and spring flows are relatively larger in reaches immediately downstream of storage dams; in areas further downstream, natural unregulated flows from undammed tributary streams combine with regulated flows such that the average flow reduction is proportionately lower than in the more heavily regulated reaches just downstream of project storage dams. Summer flow volumes are extremely varied in the Yakima basin due to Yakima Project operations, such that some river reaches have depressed summer flows compared to natural conditions and other reaches have elevated flows.

Reduced summer flows affect several life stages of steelhead. Low summer flows provide less habitat area and have been shown to reduce growth of rearing salmon (Davidson et al. 2010). Low flows often also cause water temperature to increase. Less habitat area and warmer water in summer occurs in the lower Naches River (YBFWRB 2009). These reduced flows degrade the productivity of rearing habitat.

Winter flows are generally depressed in river reaches affected by Yakima Project operations because most winter flows in excess of minimum required reservoir releases are detained in the reservoirs until the following irrigation season. Studies from other basins indicate that in winter, the ability of fish to swim, feed, avoid predators, and conduct other basic behaviors declines (Brown et al. 2011). The ability for salmonids to occupy good rearing habitat in winter is critical and the energetic cost of forced swimming is high enough that it depletes lipids and may result in mortality (Brown et al. 2011). Research in the Snake River basin indicates that dam operations that reduce winter flows reduce the number of juvenile *O. mykiss* that persist until the following spring (Mitro et al. 2003). Physical habitat modeling for the Yakima Basin indicates that winter habitat for subyearlings is particularly limited in parts of the Upper Yakima and Naches rivers (Bovee et al. 2008, p. 140, 145, 150). NMFS interprets the collective literature on winter flows and salmonids to conclude that winter rearing success is correlated to winter flows generally, that stable winter low flows and winter median flows are most important to providing stable winter habitat, and that high flow events in winter can be harmful to steelhead juveniles by forcing them from their established habitat, forcing them to expend energy that in some cases reduces their growth and/or survival.

On balance, NMFS expects that the severely reduced winter base flows reduce rearing success significantly, and the reduction in winter peak flows is of some benefit to rearing survival in some years, but insufficient to fully offset the extensive negative effects from reduced base flows. Reclamation has increased minimum winter flows in the river reaches immediately downstream of storage dams in recent years, which NMFS expects has increased winter survival. Although these modifications have reduced the impact of Yakima Project operations on rearing Upper Yakima and Naches steelhead to some degree, current operations remain severely out of phase with the hydrological patterns that steelhead are adapted to and rely on to carry out essential life functions, which results in poor rearing success and low productivity.

Spring flows are reduced by project operations throughout the action area. As with winter flows, reduced spring flows can reduce the success of rearing steelhead, though reducing the highest of peak flows can offer some degree of protection to the same fish. On balance, reducing spring flows limits rearing success.

The impact of reduced spring flows on outmigrating steelhead smolts in the Yakima basin is significant. Reduced flows during the spring outmigration, lasting from approximately March 15 to June 15, kill a significant share of steelhead smolts. There is a clear relationship between flow and survival at and just downstream of Reclamation's Roza Diversion Dam in the Upper Yakima River (Courter et al. 2015), such that operations of the storage dams and Roza diversion dam result in significant numbers of steelhead smolts killed. It is likely that there is a generally similar effect in the Naches River, though it is probably less pronounced because diversion dams on the Naches do not appear (superficially) to be as dangerous for smolts.

Since approximately 2015, Reclamation has modified operations at Roza Dam to reduce the impact of hydropower diversions on smolts during April and May, although NMFS predicts that even with this modest improvement, Yakima Project operations kill an average of 22% of Upper Yakima steelhead smolts at Roza Dam and in the Roza Reach immediately downstream of the dam. Additional smolts are killed at other project dams and the river reaches between dams.

Increased Flows. Yakima Project operations increase flows far above natural levels in specific river reaches during part of each irrigation season. Affected reaches include the Upper Yakima from Keechelus to Roza dams, and the Tieton, Naches, and Cle Elum rivers. Increased flows are hypothesized to be harmful to specific life stages for various reasons, as summarized by the

YBFWRB (2009). Steelhead fry emergence in the Upper Yakima River coincides with increased flows in early summer, and Pearsons et al. (1993) posited that flow alteration caused low densities in young-of-the-year steelhead in areas with high redd densities and that increased flows may contribute to lower growth in the Upper Yakima compared to other rivers. Habitat modelling has also indicated that high flows in the Upper Yakima significantly reduce the area of the river that is usable by rearing fish by increasing water velocity so much that only the river margins can be effectively used. Numerous observations of habitat conditions in the Upper Yakima River confirm that large areas of the river have uniform high velocities with little cover during summer months, and that these areas appear much better for rearing at lower flows that are more similar to unregulated flows. These effects of high flows are most likely to occur in combination with degraded floodplains and levees, which prevent higher flows from spreading out among multiple natural channels.

Rapid Changes in Flow. Project operations cause rapidly declining flows in late summer associated with 'flip-flop' operations. These operations reduce flows significantly in the Upper Yakima and Cle Elum rivers in late August to early September, and then in the Tieton and Naches rivers in October. Rapidly declining flows do occur in a natural flow regime, but rarely occur in late summer, when very young steelhead would be exposed. There have been numerous observations of juvenile fish being stranded and dying in pools that are isolated by rapidly declining flows (YBFWRB 2009). Further, reductions in flow in the Yakima can reduce the macroinvertebrate population that steelhead rely on for food (Arango 2001). Rapid drops in flow in the Yakima basin also appears to prevent riparian cottonwood forests from successfully regenerating (Jamieson and Braatne 2001), which appears to affect at least the Naches River and the Wapato reach of the Yakima River but may also affect the Upper Yakima River.

In the last 20 years, Reclamation has modified 'flip-flop' operations to more gradually reduce flows in the Upper Yakima River and increase flows in the Tieton and Naches rivers. This modification has probably slightly reduced stranding of rearing juveniles in side channels, and possibly contributed to reducing the impact of flow management on macroinvertebrates. However, negative effects of 'flip-flop' remain widespread and NMFS is not aware of any efforts to re-establish a flow regime that will aid regeneration of cottonwoods that steelhead rely on to form the base of the riparian forest community through much of the action area.

Fish Passage

Steelhead movement within the action area is wholly or partially obstructed at a number of water management facilities, most of which are components of the Yakima Project. In total, these obstructions reduce the spatial extent of steelhead occupation, delay migrating adults en route to spawning, and kill some steelhead juveniles as they attempt to migrate out of the basin.

Storage Dams. The five Yakima Project storage dams collectively block steelhead from accessing the five major reservoirs and 88.4 miles of tributary streams (Reclamation 2005), truncating the range of the Naches and Upper Yakima populations of MCR steelhead. In addition to blocking habitat that could contribute to population productivity and abundance, the dams limit the spatial diversity of these populations, leaving them more vulnerable to catastrophic events. Further, by blocking a large proportion of the high elevation habitat within each population, the dams limit the ability of the populations to adapt to climate change by shifting their ranges upstream into cooler waters.

NMFS (2016) identified four dams as a priority for passage for MCR steelhead, including the Cle Elum and Rimrock dams in the action area. The Opal Springs and McKay dams were the other priorities in the DPS and are outside of the range of the Yakima MPG.

Diversion Dams. Several large water diversion facilities are located in the action area and are typically comprised of a diversion dam, canal, fish screen, fish ladder, and associated infrastructure. Many smaller diversions are present throughout the action area that lack channel-spanning dams. The impact of diversion dams on MCR steelhead varies with flow, such that the effects of altered flow and fish passage at diversion dams are intertwined.

At least some diversion dams in the action area impair adult passage. Steelhead access to the Yakima River upstream of Easton Dam is likely compromised by passage conditions at Easton Dam. The dam appears to inhibit adult steelhead passage to at least some extent. Recent radiotelemetry studies (Karp et al. 2009; Fredricksen pers. comm.) have documented a small percentage of Upper Yakima steelhead approaching Easton Dam, and none have passed the dam. However, spring-run Chinook salmon, which migrate later in the year, regularly ascend the fish ladder at the dam; this indicates that under some conditions (possibly operational or hydraulic conditions that occur more often when spring-run Chinook salmon migrate), Easton Dam is passable to adult salmonids. Recent data highlights the need to monitor, evaluate and improve passage facilities at Easton and Nelson Dams (NMFS 2016).

Smolts may be injured or killed at diversions through several mechanisms including canal entrainment, physical trauma, and increased exposure to predation. NMFS estimates that about 25% of Upper Yakima population smolts die in the Roza Reach of the Upper Yakima River and at Roza Dam combined, based on the models developed by Courter et al. (2015). It appears that about half of the mortality occurs at Roza Dam itself. Significant concerns have been noted recently at the Yakima Tieton Irrigation District (YTID) and Nelson–Cowiche dams, which could have large impacts on smolts in the Naches population. The continued operation and maintenance of these facilities has a major depressive effect on MCR steelhead and a major impact to the freshwater migration PBF of the designated critical habitat.

Floodplain Development

Historically, most reaches of the Naches and Yakima rivers within the action area were complex networks of channels covered by dense riparian forest. In many areas, river channels have been leveed, armored, realigned, and shortened, severely diminishing natural river-floodplain interactions (YBFWRB 2009) upon which the maintenance of productive aquatic habitat relies (Spence et al. 1996). Modification of the river channels and disconnection from the floodplain have generally been a result of actions to protect agricultural lands, transportation infrastructure, residences, and other development from inundation and/or erosion. In some cases, gravel pits have been excavated into the floodplain and diked off from the river.

Effects of floodplain development in the action area include: (1) an extensive restriction of the channel migration zone, reducing or eliminating large wood and sediment recruitment and other processes which help create aquatic habitat; (2) blocked access to the floodplain, impairing or preventing many ecological processes (e.g., fish access to off-channel habitats, nutrient exchange, hyporheic zone function); (3) an extensive reduction in riparian zone vegetation and function, including the food, shade, and overhead cover it provides for fish; (4) reducing the quantity of in-stream habitat and simplifying the habitat such that it provides less cover for rearing steelhead (YBFWRB 2009); and (5) decreased water quality due to pollutants delivered from developed floodplain areas.

The effects of floodplain development in the action area are generally worsened by the altered flows that have resulted from Yakima Project operations. For example, reduced flows in spring and summer often lead to warmer water temperatures, and this effect is more severe when floodplain development has removed shading and reduced hyporheic flow interactions.

In recent decades, a number of efforts have been made by various entities to reduce the impacts of floodplain development in the action area. These projects may be pursued solely for habitat restoration purposes or to reduce the vulnerability of local communities to flood damage. Projects often involve bioengineering of armored banks, relocating levees farther landward in the floodplain, and/or reconnecting floodplain channels to the river. Major projects of this type have been carried out in parts of the Naches River, the Yakima River in the vicinity of the City of Yakima, and the lower Cle Elum River. These actions have not and will not fully restore all of the habitat quantity and function that MCR steelhead experienced historically, but have reduced to some extent the impact of historical and ongoing impacts to floodplain habitats.

In total, floodplain development across a large extent of the Yakima and Naches rivers has significantly reduced the capacity of the affected reaches to support rearing steelhead, reducing growth, and ultimately survival. Floodplain development has severely degraded the freshwater rearing PBF to the extent that it has reduced the conservation value of critical habitat. To the extent that floodplain development increases water temperatures during the spring outmigration, it likely reduces smolt survival and contributes to degradation of the freshwater migration PBF for designated critical habitat.

Water Quality Impairment

Multiple river reaches throughout the action area are listed pursuant to Section 303(d) of the Clean Water Act as having impaired water quality. The Cle Elum River is listed for high temperature, the Upper Yakima River for temperature, dissolved oxygen, pH, and pesticides, and the Naches River for temperature and pH (Ecology 2019).

Degraded water quality conditions reduce habitat quality in a number of river reaches in the action area (YBFWRB 2009). Intensive agricultural production has left a legacy of contamination, which may slowly diminish over time (YBFWRB 2009), although return flows from agriculture continue to introduce contaminants to steelhead habitat.

High water temperatures are caused by a combination of: (1) warm inputs from tributary streams due to land management practices; (2) unnaturally low flows caused by storage and diversion of water by the Yakima Project operations; and (3) floodplain development that limits shading of the river and limits hyporheic interactions, which would otherwise cool the river during warm periods. High temperatures throughout much of the action area exceed optimal conditions for salmonids. Temperatures in the action area are generally not high enough to lead to direct mortality of fish, but are high enough to reduce growth, contributing to reduced smolt size. Smaller smolts are less likely to survive to adulthood.

Kelt Reconditioning Program

The Yakama Nation has operated a BPA-funded steelhead kelt reconditioning program since 2001 to increase the rate of repeat spawning by adult steelhead. Approximately 36% of reconditioned kelts survive to spawn a second time (NMFS 2016), which appears higher than the survival rate of non-reconditioned kelts. Therefore, it is likely that the program has increased steelhead abundance in the Yakima MPG and will continue to do so in the future. The program is operated downstream of the action area, but affects spawning rates in the action area.

Focus on the Construction Area

Within the construction area, the defining anthropogenic feature is Cle Elum Dam. The dam impounds Cle Elum Reservoir upstream of it and prevents access of steelhead to the reservoir and its tributaries. Reclamation manages water releases from the reservoir. Water is typically released from a gate deep in the reservoir, flows through a tunnel, and is discharged near the base of the dam into the stilling basin. Water can also enter the stilling basin via the dam's top spillway, which is active when the reservoir is at full pool. The stilling basin is essentially a very large concrete pool in the Cle Elum River to dissipate energy of the turbulent water before it flows down into the river's natural path. The river substrate in the construction area just downstream of the stilling basin is dominated by large cobble.

Reclamation generally captures incoming flows in the reservoir during fall through late spring, reducing flows compared to natural rates in the Cle Elum River. Beginning in late spring or early summer, dam releases are rapidly increased from 180–250 cfs up to 2000–3000 cfs to serve irrigation needs downstream. Essentially, the Yakima Project uses the Cle Elum River as a conduit to deliver water from the reservoir to areas downstream, where the water is diverted from the river into the distribution and irrigation network. Flow is then reduced fairly rapidly in late August to early September as Reclamation taps other sources of water in the Naches River for the late irrigation season. This 'flip-flop' operation was instituted in 1981 to protect spring Chinook salmon redds in the Upper Yakima. Cle Elum Dam operations create an unnatural hydrograph for steelhead in the construction area.

In recent years (since the 2010 consultation for the subject project), steelhead have expanded their spawning range upstream to nearly the stilling basin (Reclamation 2020), although the steep increase in flows during summer months is likely to make the area function poorly as rearing habitat for very young steelhead that would emerge in early to midsummer.

NMFS estimates that the Cle Elum River in the construction area supports 0.0013 juvenile steelhead per square foot. Although juvenile steelhead density information for the Cle Elum River is not available, NMFS estimated density as follows: (1) Use estimates of 100–225 mm *O. mykiss* abundance from 3 years of mark-recapture studies in a nearby reach of the Upper Yakima River (unpublished data provided by WDFW 2020), and divide by total river reach length; (2) Double the calculated density as an attempt to correct for the bias of electrofishing on small fish (WDFW 2020 pers. comm.) and use the resulting density as an estimate of steelhead parr; (3) Estimate the density of steelhead young-of-the-year by applying a ratio of 2.42 young-of-the-year to parr, which was observed from multiple years of data collection across average Upper Columbia rivers and streams (Mullan et al. 1992); and (4) Add the estimated densities of steelhead parr and young-of-the-year for an estimate of total density of juvenile steelhead for all size classes.

The density of steelhead juveniles in the stilling basin is unknown. The stilling basin is essentially a very large artificial pool in the river. Stilling basins are well known for harboring large numbers of fish that are most often enumerated only when stilling basins are dewatered for maintenance or repair. Although it is unclear how many juvenile steelhead occupy the Cle Elum stilling basin, NMFS will conservatively assume that several hundred do so.

2.4.3. Climate Change in the Yakima Basin

Climate change is expected to affect MCR steelhead and their habitat in the Yakima Basin. Recent studies evaluating responses of salmonid populations or habitat to changing climate conditions consistently predict negative impacts (Hardiman and Mesa 2014), except at extreme northern latitudes. A number of studies conclude that aquatic habitat in the Yakima Basin is highly susceptible to climate change, based on the basin's current hydrology and the status of salmonid populations (Mastin 2008; Reclamation and Ecology 2012; Donley et al. 2012; Wade et al. 2013).

Increased air temperatures will raise stream temperature, and reduce dissolved oxygen. In the Upper Yakima River, models predict that high stream temperatures (21°C) may occur at least twice as often in the 2040s as historically (Mantua et al. 2009). Increased air temperature is also expected to significantly affect river flows in the Yakima basin as more rain falls instead of snow and because higher air temperatures will cause earlier snowmelt in the basin's headwaters (Reclamation and Ecology 2012).

The change in runoff is expected to increase average unregulated fall and winter flows, as more rainfall replaces snowfall. Unregulated river flows in spring and summer are expected to decline greatly by the 2040s. Spring flows were predicted to decline by 10.7% by Reclamation and Ecology (2012) due to reduced snowpack; Mastin (2008) similarly showed decreased river flows starting in March or April, depending on location in the basin. Changes in unregulated summer flows will be severe, with a decrease of 44–76% in runoff in July, depending on reservoir (Mastin 2008), or an average of 50% decline across reservoirs (Reclamation and Ecology 2012). However, river flows during the irrigation season are likely to be even lower than these predictions in at least some years, because agricultural withdrawals are expected to increase in response to climate change (Donley et al. 2012); this prediction would presumably apply to river reaches below the major diversion dams, such as the Yakima River below Roza Dam and the Tieton River below the YTID diversion dam.

Climate change in the basin is likely to impact rearing success of MCR steelhead. Changed water temperatures have been shown to directly reduce growth rates of Yakima Basin steelhead juveniles with a bioenergetics model. However, indirect growth-suppressing effects resulting from impacts to food quality and availability for steelhead are expected to be more important (Hardiman and Mesa 2014).

Rearing success will also be impacted through reduced summer and spring flows. Lower flows will reduce the habitat area available for MCR steelhead and for their food sources. In addition to less quantity of habitat, the quality of habitat and food production for rearing steelhead may be affected. For example, reduced flows have been shown to reduce growth rates of several species of salmonids (Deegan et al. 1999; Nislow et al. 2004; Harvey et al. 2006) by reducing prey drift rates (Harvey et al. 2006) and reducing the number of suitable foraging sites (Nislow et al. 2004).

Climate change is also likely to affect the success of juvenile steelhead as they migrate out of the Yakima Basin. There is ample evidence that river flows during the spring smolt outmigration affect survival in the Yakima Basin (Pyper and Smith 2005; Watson 2011; Neeley 2012; Courter et al. 2015). Spring flows have been significantly reduced by operation of the Yakima Project's storage and diversion dams, with resultant reductions in smolt survival. In general, the reservoirs are filled to capacity during the spring as they capture runoff from headwaters that would otherwise flow downstream and support smolt survival.

Modelling that accounts for project operations in a climate change scenario predicts that, on average, median spring flows would decrease by 12% in the Keechelus reach and 22% in the Easton reach (Reclamation and Ecology 2018), which would be expected to reduce smolt survival through the Upper Yakima River. Modelling for other parts of the action area were not reported, but it is reasonable to assume that project operations would similarly interact with changing climate to reduce typical spring flows throughout the action area, reducing smolt survival even more severely than current project operations do.

Increased water temperature during the smolt outmigration is likely to reduce survival. In the lower Yakima River, increasing water temperature often coincides with reduced smolt survival (Pyper and Smith 2005; Neeley 2012), likely because predators of juvenile salmonids are more active as temperatures warm. Although this pattern has not been shown in the cooler action area, it seems reasonably likely to manifest as temperatures warm. Therefore, in addition to reducing smolt survival via reduced spring flows, climate change would further reduce survival by increasing the temperature of those flows.

Adult steelhead are likely to be affected by a warming climate by delaying their entry into the Yakima Basin as they migrate upstream. Adult steelhead typically begin entering the basin as the lower river cools in September (YBFWRB 2009). In warm years, entry appears to be delayed. Warmer temperatures are expected to make these delays more frequent and longer. There is potential for this to reduce survival or spawning success of adult steelhead, though as of yet there is not clear evidence that these problems occur in the Yakima basin.

When considering all life stages with temperature and flow projections, steelhead populations in the Yakima basin are highly sensitive to climate change and expected to have high exposure to potential in-basin impacts (Wade et al. 2013). Climate change will aggravate the existing water scarcity in the Yakima basin by reducing habitat connectivity, exposing fish to extreme thermal impacts, and reducing flows below their already diminished levels (Donley et al. 2012). As described above, these impacts will accrue during the rearing, smolt migration, and adult migration life stages. Donley et al. (2012) concluded that in the absence of major efforts to restore instream flows, there is insufficient flow to satisfy needs of ESA-listed salmonids and agricultural water demand; the Yakima Basin was their most striking example of this conflict.

Options for ameliorating some effects of climate change in the Yakima Basin include taking measures to maintain hydrological connectivity (Donley et al. 2012; Wade et al. 2013) and there is considerable potential in the Yakima Basin to ameliorate climate impacts through flow restoration and water policy changes (Donley et al. 2012).

2.4.4. Environmental Baseline Summary

Middle Columbia River steelhead from the Upper Yakima and Naches populations inhabit the action area and depend on it to support critical life functions. Human development, especially an expansive and intensive agricultural system relying on active management of river flows, has severely degraded the action area such that current conditions appear insufficient to support recovery of MCR steelhead. The ability of the action area to support steelhead differs across river reaches and life stages.

Storage dams have eliminated steelhead access to many miles of formerly productive habitat in the Upper Yakima and Naches populations. Rearing success has been significantly reduced for Upper Yakima and Naches steelhead. Most of the impact to rearing habitat quality is caused by Yakima Project operations that alter flows, floodplain development, and excessive water temperature caused by a combination of altered flows and floodplain development. Smolt survival is impacted by the facilities and flow management that comprise the Yakima Project.

Climate change will generally worsen conditions in the action area by adding to the flow alteration caused by the Yakima Project and by increasing water temperature. Climate change is expected to impact rearing conditions, particularly in summer. Reduced spring flows and increased water temperature are likely to further increase mortality of outmigrating smolts, making recovery more difficult.

Within the construction area, physical habitat is dominated by the dam and stilling basin, and flows in the river are generally very high in the summer, and low in other seasons, compromising rearing habitat quality.

2.5. Effects of the Action

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

2.5.1. Effects on ESA-Listed Species

Construction – Upland and Reservoir. Construction in the uplands and reservoir began in 2016 and is ongoing. Standard protective measures have been used and will continue to be used to mitigate the risk of sediment and uncured concrete entering the reservoir or Cle Elum River. Even with these measures, it is expected that there could be a very slight increase in fine sediment quantities that enter the Cle Elum River, although no major episodes have been reported since construction began. Very slight increases are not expected to meaningfully affect any MCR steelhead residing in the stilling basin or Cle Elum River.

Construction – Cle Elum River. Work proposed to construct facilities in the stilling basin and Cle Elum River has the potential to affect steelhead via basinwide flow management, on-site flow management, fish salvage and dewatering, suspended fine sediment, exclusion from the work area and altered bank habitat.

Basinwide Flow Management

Reclamation will deviate from their typical flow management patterns to facilitate construction. The first change will be conducting the 'flip-flop' operation 1–2 weeks earlier than normal, which will reduce Cle Elum River flows rapidly by September 1. Flows in the Upper Yakima River from the Cle Elum River confluence to the Naches River confluence will be reduced as a result. At the same time, flows into the Tieton and Bumping rivers will be increased, which will lead to increases in the downstream reaches of the Naches River. The changes in flows will offset in the Yakima River below the confluence of the Upper Yakima and Naches Rivers.

Under typical operations, unnatural and excessive summer flows in the Cle Elum and Upper Yakima rivers reduce rearing habitat productivity for juvenile steelhead (YBFWRB 2009) by creating fast, deep waters when juveniles need slow, shallow water. As a result, during summer, much of the habitat in these rivers is not suitable for rearing. In the Tieton and Naches rivers, typical operations provide lower than normal summer flows until early September, when flows are increased and then decreased rapidly about 6 weeks later, reducing rearing productivity in the main channel and likely causing increased stranding in off-channel areas during the October dewatering.

The proposed action to begin the basinwide 'flip-flop' operation 1–2 weeks earlier will essentially return the Cle Elum River and Upper Yakima River to more natural low rates sooner than normal, and cause an extended period of excessive unnatural flows in the Tieton, Bumping, and Naches rivers. The consequence will be to improve rearing productivity for 1–2 weeks in the Cle Elum and Upper Yakima rivers (approximately 77 river miles), and degrade rearing productivity for 1–2 weeks in the Tieton, Bumping, and Naches rivers (approximately 83 river miles). The change in flow over such a large area is likely to meaningfully affect feeding and sheltering behavior for many juvenile steelhead to the degree that growth rates of many individuals will be slightly affected. Growth is closely linked to survival of juvenile salmonids (Spence et al. 1996), such that the proposed action will cause a small increase (less than 1%) in outmigrants from the Upper Yakima population in the year following construction and a similar decrease in outmigrants from the Naches population in the year following construction.

On-Site Flow Management

Reclamation will reduce flow into the Cle Elum River to facilitate connection of the Outlet Works Diversion Conduit (Step 7 in Proposed Action), and then increase flow after the conduit is connected. This activity will reduce flows in the Cle Elum River from several hundred (up to 500) cfs down to a minimum of 80 cfs for up to 24 hours, and then increase flows to typical fall flows of 180–250 cfs.

The reduction in flows to 80 cfs will dewater shallower areas in the river, likely causing the stranding of those fish that do not move to the deeper channel as flows drop. Stranded fish would either die from asphyxiation or, if trapped in shallow isolated pools for 24 hours, be more vulnerable to predators. Impacts will be limited to those individual fish that are killed because the short duration of dewatering will not have a big enough effect on feeding to materially affect growth rates of those fish that survive.

The number of fish that will be killed by dewatering is difficult to quantify without detailed information about river bathymetry and other information. As most fish are expected to follow flow cues and move to areas that remain wetted, NMFS expects that few individual fish will be killed.

Fish Salvage and Dewatering

After cofferdam completion, the stilling basin and adjacent portion of the Cle Elum River, a 140,000-square-foot area, will be dewatered. The water will be drawn down in stages to allow for progressively more aggressive fish salvage efforts as the water stage drops. Fish salvage efforts will proceed from dipnetting and seining to electrofishing. The goal of fish salvage efforts is to relocate fish from the area to be dewatered downstream to the Cle Elum River. NMFS does not expect any adult steelhead to be in the Cle Elum River system when fish salvage occurs in September. Therefore, only juveniles are expected to be affected.

Many factors influence the success of fish salvage efforts, including water depth, habitat complexity, temperature, salvage methods, crew experience, and care of fish after capture. At best, all fish are captured without injury and successfully released. However, in many cases some fish are difficult to capture, sustain injuries, and experience high stress after capture before release.

The proposed action provides for several days of dewatering in stages and progressively aggressive capture techniques, which increase the chances for a successful effort. The relatively simple habitat in the stilling basin should also contribute to a high capture rate, particularly if water is concentrated in the stilling basin while the cobble-strewn riverbed is dewatered. However, large salvage areas generally pose problems related to handling, measuring, holding, and relocating large numbers of stressed fish. It is unclear if Reclamation will have a large enough crew available to efficiently capture, process, and release fish with minimum holding times.

NMFS conservatively estimates that 80% of juveniles in the area will be captured and released without ill effects, that 10% will be captured and experience external or internal injury including injurious levels of stress during holding and handling, and that 10% will not be recovered and ultimately killed by dewatering. Those fish that are injured or experience injurious levels of stress would be even less likely to survive the challenges of outmigration and so would ultimately die as a result of their injuries.

The NMFS estimate of 0.0013 juvenile steelhead per square feet of the Cle Elum River, when applied to the entire 140,000-square-foot area to be dewatered, yields a total estimate of 182 juveniles in the dewatered area. However, as described in Environmental Baseline, NMFS expects that juvenile density may be much higher in the stilling basin than in a 'normal' reach of the Cle Elum River. Therefore, NMFS will assume that 500 juveniles occupy the entire work area to be dewatered. Assuming the fates of these fish from the previous paragraph, NMFS therefore expects that:

- 400 juvenile steelhead will be captured and released without long-term effects;
- 50 juvenile steelhead will be captured and ultimately die as a result of injury or stress induced by capture or high stress during holding; and
- 50 juvenile steelhead will die because they cannot be effectively salvaged from the work area.

Mechanical Injury and Death

Juvenile steelhead may be crushed during fill and excavation in areas containing fish that will not be subject to dewatering. Construction of the Helix Bypass Pipe dissipation pool (1,250 square feet), Outlet Works Diversion Conduit dissipation pool (400 square feet), crane pad (1,600 square feet), and cofferdam (10,000 square feet) will fill and/or excavate a total of 13,250 square feet of riverbed, potentially crushing some juveniles. Installation of the support brackets for the conduit are not expected to crush any fish.

Most fish in the disturbed areas are expected to avoid injury and death by fleeing the disturbance footprint. However, it is likely that some fish will unsuccessfully flee or will seek refuge within the riverbed cobbles in the footprint, and subsequently be crushed. NMFS conservatively estimates that up to 25% of fish occupying the 13,250 square feet of excavation/fill area will be injured or killed.

The NMFS estimate of 0.0013 juvenile steelhead per square feet of the Cle Elum River, when applied to the entire 13,250-square-foot area to be filled or excavated without previous fish exclusion, yields a total estimate of 17 juveniles in the footprint of fill and excavation. Assuming that 25% of these fish will be injured or killed, and rounding up, NMFS expects that five individuals will be injured or killed by mechanical trauma.

Water Quality

The proposed action will affect water quality during in-water work, including crane pad installation, cofferdam installation, dissipation pool excavation, and demobilizing from the site and reintroducing dam discharge water into the work area. These activities will either introduce small quantities of fine sediment to the river or resuspend fine sediments that currently exist as part of the riverbed. Increased suspended sediment loads will be episodic until the cofferdam is completed in September, and then once again during cofferdam removal in early April and during the next several high flow events.

Increased suspended sediment can be detrimental to juvenile salmon and steelhead in several ways including avoidance of the area, abandonment of cover, stress, and reduced growth rates (Newcombe and Jensen 1996). Increased suspended sediment can also positively affect juveniles by making it more difficult for their predators to see them. NMFS expects that the turbidity levels generated by this action will be sufficient in the action area to cause temporary behavioral changes to steelhead that include changes in feeding and movement of fish within turbidity plumes (Berg and Northcote 1985). However, NMFS does not expect any fish to be injured or killed by exposure to turbidity caused by this action due to the scale of the action and because fill will be “clean” meaning very low in the proportion of fine sediments.

Additional impairment of water quality may result from accidental releases of fuel, oil, and other contaminants that can in some cases injure or kill aquatic organisms. Such releases, while rare, are reasonably likely to occur from the use of heavy equipment. Petroleum-based contaminants, such as fuel, oil, and some hydraulic fluids, contain polycyclic aromatic hydrocarbons (PAH), which can kill salmon at high levels of exposure, and can cause sublethal, adverse effects at lower concentrations (Meador et al. 2006). NMFS anticipates PAH releases of only very small quantities (ounces) are likely with each accidental release or spill, and therefore effects among fish are likely to be minimal given the high flow rate of the river and potential for rapid dilution. Spills or releases larger than a few ounces are not reasonably certain to occur. Dewatering and worksite isolation, as well as concrete curing standards proposed by Reclamation, will ensure that uncured concrete in contact with the river will not meaningfully impact pH.

Exclusion from the Work Area

The dewatered in-water work area and the footprint of the cofferdam will prevent juvenile steelhead from accessing and rearing in a 150,000-square-foot area from September to early April during construction. Fish that would otherwise use the area will instead occupy downstream areas. This would lead to slightly higher densities in these areas and increased competition for food and cover.

After construction is completed, fish that return to the area would encounter a riverbed that has been subject to heavy disturbance by fill and excavation, and most importantly months of dewatering that will kill almost all benthic macroinvertebrates that juvenile steelhead eat. Because existing habitat is poor and very simplified, fill and excavation are not expected to materially change substrate conditions. Prey density will gradually increase over time, although recolonization will be slower than for most river disturbances because the source water for the site is a reservoir, which will have a different macroinvertebrate community than the riverbed.

NMFS estimates that forage may be reduced in the formerly dewatered area for the two summers following construction. In all, including construction, the 150,000-square-foot area will be unsuitable for rearing for 2 years. The area is large enough and likely used by enough individuals that eliminating access and degrading rearing habitat quality for a period of 2 years is likely to reduce growth of at least some individual steelhead juveniles. Reducing growth of juvenile salmonids generally reduces their ability to survive to maturity. Ultimately, the consequence of exclusion from the work area and degrading habitat within it for 2 years will be the death of a small number of individual fish.

This area is likely to have increased fine sediments in the upper layers of river substrate for the first spring spawning season after construction; after that, high summer flows would clean most of the gravel. It is possible that steelhead would attempt to spawn in this area during the first season after construction. However, given the apparent low density of adult steelhead spawning in the 7.8 miles of accessible Cle Elum River, it is unlikely that steelhead would spawn in this specific relatively small area during the first year after construction.

Altered Bank Habitat

The proposed action will result in the armoring of approximately 100 feet of the right bank of the Cle Elum River with 50 feet each of riprap and concrete wall just downstream of the adult facility.

Placement of riprap along 50 linear feet of streambank will change bank structure, directly affecting habitat available to salmonids. While research indicates habitat use of riprapped banks by yearling and older trout species may be equal to or higher than that at natural banks, riprap generally does not provide the habitat required to support multiple age classes of salmonids (Schmetterling et al. 2001). Occupation of riprapped banks by subyearling trout, coho salmon, and Chinook salmon is typically lower than unmodified banks (Beamer and Henderson 1998; Peters et al. 1998). Peters et al. (1998) found that salmonid densities are usually lower at stabilized banks than natural banks with the exception of those bank stabilization projects that used only LWD. Density responses varied by species, season, and age-class. Peters et al. (1998) also found that juvenile salmonid densities were generally lower at riprapped banks during all seasons, although trout larger than 200 millimeters were found at greater densities at riprap than natural banks. NMFS expects that densities along the concrete wall are generally lower than that for riprap, as concrete wall offers even less habitat complexity such as cover and variable velocity than does riprap.

The shoreline that will be armored is already low in habitat complexity and offers marginal rearing habitat. In the context of the already poor habitat comprised of the concrete stilling basin, adjacent existing riprap, and very high flows during the summer rearing season, an additional conversion of 100 feet of simplified bank to even simpler bank is not expected to meaningfully affect steelhead.

Long-term Operation – Juvenile Fish Passage Helix.
Reclamation will operate the downstream passage facilities such that some water released from the reservoir is routed through the Juvenile Fish Passage Helix instead of the deepwater outlet or

spillway. This will slightly change hydraulics in the stilling basin, but not in a meaningful way. Helix discharges will be from the surface of the reservoir, which may be warmer than deepwater discharges. However, helix operation will typically occur when river temperatures below the dam are cool, such that very minor warming would be inconsequential.

Middle Columbia River steelhead cannot use the helix because MCR steelhead do not have access to the reservoir. Any effects of steelhead transiting the helix will be considered when NMFS considers a future federal action to trap steelhead and release them above the dam.

Long-term Operation – Adult Facilities. It is difficult to analyze the effect of operation of the adult facility on MCR steelhead because an operations, passage protocol, and fish handling plan has not been developed yet. Reclamation and/or the Yakama Nation will not operate the adult facility until developing an implementation plan and applying for and receiving a permit from NMFS under Section 10 of the ESA. The issuance of a Section 10 permit would constitute a future federal action. As such, any effects that are a consequence of issuing a permit to operate the facility will be considered by NMFS as part of the Section 10 review and associated section 7(a)(2) consultation.

2.5.2. Effects to Critical Habitat

The effects of the proposed action on designated critical habitat for MCR steelhead are generally analogous to the effects described above as effects to the species, since many of the effects to the species occur as a result to the action affecting the critical habitat that the species depends on. Exceptions include the effects of fish salvage and mechanical injury and death, which are not manifested as effects to critical habitat.

Designated critical habitat within the action area for MCR steelhead considered in this opinion consists of the following PBFs: freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors. The effects of the proposed action on these PBFs are listed below for each component of each affected PBF. The effects to PBFs are summarized here because a more thorough explanation of effects of the action on habitat is included above, in Section 2.5.1, Effects on ESA-Listed Species.

1. Freshwater spawning sites
    a. Substrate – The proposed action will disturb much of the substrate within the portion of the Cle Elum River in the in-water work area. Excluding the stilling basin, which does not support spawning, the affected area is estimated at 110,000 square feet. After construction concludes, the riverbed may have more fine sediments near the surface, reducing its quality for successful spawning. This condition may last as long as one full spawning season after construction, after which high summer flows would winnow fine sediments and restore the area to its pre-construction quality before the next spawning season.
    b. Water quality – The proposed action is expected to cause one to several events of increased suspended sediment loads during the spawning and incubation season following construction as fine sediment exposed in the work area is mobilized by

high flows. NMFS anticipates that one or several sediment pulses would be insufficient to meaningfully affect the ability of the critical habitat to support spawning.

c. Water quantity – The proposed action would not cause any changes in water quantity during the spawning or incubation season.

d. In sum, the proposed action will negatively affect the freshwater spawning sites PBF for one spawning season following construction in an area of approximately 110,000 square feet.

2. Freshwater rearing sites

a. Floodplain connectivity – The proposed action would not meaningfully affect floodplain connectivity.

b. Forage –The proposed action is expected to reduce forage availability in the in-water work area during construction and afterward for a period totaling 2 years. Access to forage across much of the action area will be affected during the construction year as basinwide flow is managed to facilitate construction. Flow reduction in the Cle Elum and Upper Yakima rivers will create more normal depth and velocities in the river, and allow juveniles to forage across much of the riverbed, instead of being confined to very narrow bands of habitat along the banks. Conversely, access to forage in the Bumping, Tieton, and Naches rivers will worsen as high flows force juveniles out of their foraging areas to the edges of the rivers. These effects will be widespread and persist for 1 to 2 weeks.

c. Natural cover – The proposed action would not meaningfully affect natural cover.

d. Water quality – The proposed action may cause episodic increases in suspended sediment and petrochemical contamination in the vicinity of in-water work. However, the severity and extent of the effect will be insufficient to meaningfully affect the PBF.

e. Water quantity – Flow management to facilitate construction will affect the PBF. Flow reductions in the Cle Elum and Upper Yakima rivers will create more normal depth and velocities in the rivers, and make more area suitable to support successful rearing. Conversely, rearing suitability in the Bumping, Tieton, and Naches rivers will be decreased. These effects will be widespread and persist for 1 to 2 weeks.

f. In sum, the proposed action will negatively affect the freshwater rearing PBF in the Naches basin for 1 to 2 weeks and positively affect the PBF in the Upper Yakima Basin at the same time. In addition, there will be a 2-year impact to the PBF at the site of in-water work in the Cle Elum River.

3. Freshwater migration corridors

a. Free of artificial obstruction and excessive predation – The proposed action would affect the PBF by obstructing access to the work area during construction in September through early April. The area represents 1.1% of the normally accessible lower Cle Elum River, and the PBF will not be affected at a time when it would normally support upstream migration. Juvenile steelhead are not present upstream of the work area. Therefore, the effect to the PBF is minimal.

b. Natural cover – The proposed action would not affect natural cover relevant to freshwater migration corridors.

c. Water quality – The proposed action may cause a minimal increase in petrochemical contamination and episodic increases in suspended sediment levels that would not meaningfully affect the ability of the critical habitat to support freshwater migration.

d. Water quantity – The acceleration of the 'flip-flop' operation would change flow quantities in regulated reaches of several rivers, although it is not expected to meaningfully affect the PBF.

e. In sum, the proposed action will reduce the function of the PBF only minimally and during the construction period of September to April 15.

2.6. Cumulative Effects

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

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

As described in the Environmental Baseline, many factors affect MCR steelhead and their critical habitat in the action area. Operations of the Yakima Project, the existence of the project's storage dams, and floodplain development are the largest contributors to the state of habitat in the basin. The future effects of the Yakima Project are not considered in this opinion and are federal, and thus not cumulative effects. Likewise, no cumulative effects are anticipated that would alter the impact of storage dams. Most meaningful cumulative effects therefore are related to floodplain development.

In the Yakima Steelhead Recovery Plan, the YBFWRB (2009) reports that rapid population growth and development is occurring in Yakima County. In many areas, forest and agricultural lands are being converted to residential, commercial, and industrial uses. This development is often located adjacent to streambanks, which can result in the reduction or elimination of riparian zones and increased flood hazards. The probability of conflict between new land uses and floodplain and stream channel functions (which sustain fish habitat and conveyance of water and sediment) is high (YBFWRB 2009). Development of the floodplain in the action area is expected to continue, though impacts will be ameliorated to some degree through more modern floodplain and environmental protection regulations. NMFS anticipates that the general pattern is similar in Kittitas County, and therefore throughout the action area.

Various habitat restoration projects have been implemented annually throughout the Yakima basin and NMFS assumes that they will continue. Some of these projects do not require federal authorization or funding, and therefore they will create cumulative effects. Perhaps one to three of these projects per year are constructed in the regulated reaches that comprise the action area. These actions typically provide localized habitat benefits and, to some degree, counteract the negative effects of continued development of floodplain areas and maintaining floodworks.

In total, cumulative effects will generally perpetuate the existing conditions in the action area that were described in the Environmental Baseline (Section 2.4).

2.7. Integration and Synthesis

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

Ongoing climate change will have varied effects across the range of MCR steelhead and their critical habitat, but will generally impose additional barriers to survival and recovery. The environmental baseline in the action area has been significantly altered by development of the Yakima basin's agricultural economy. The largest impacts have been blocked access to habitat by storage dams, altered flows in most of the accessible medium to large rivers in the basin, smolt mortality at diversion dams, floodplain development, and water quality impairment. Cumulative effects are anticipated to perpetuate conditions in the action area, although the effects of climate change are expected to further impact critical habitat and steelhead throughout the basin.

The proposed action has the potential to affect MCR steelhead in several ways. Although some effects are minor, others are expected to have consequences for MCR steelhead.

2.7.1. Middle Columbia River Steelhead

The MCR steelhead DPS is not currently meeting the viability criteria described in the Mid-Columbia Steelhead Recovery Plan (NMFS 2009). Two of the populations in the DPS, the Upper Yakima and Naches populations, will be affected by the proposed action. Both populations are far short of abundance and productivity needed to sustain viable populations, with the Upper Yakima being at much more risk than the Naches. The spatial structure of each population has been impacted since historical times, but only the Upper Yakima's spatial structure is poor enough to prevent it from meeting viability targets for recovery. Ongoing climate change will generally impose additional barriers to survival and recovery.

The most widespread effects of the proposed action will be caused by changing water releases at Reclamation's storage dams in the basin to facilitate construction. Altering flows in many miles of river for 1–2 weeks is expected to improve survival of juvenile steelhead in the Upper Yakima population and reduce survival of juveniles in the Naches population. Although impossible to quantify with precision given available information, NMFS expects the 1–2 week change in flow management to change smolt abundance the following year by no more than 1% for each population.

In the Cle Elum River, fish salvage and dewatering are expected to affect 500 juveniles, of which 100 may be injured or killed. Another five individuals are estimated to be killed by crushing during fill and excavation. Fish stranding resulting from reduced flows while connecting the Outlet Works Diversion Conduit and impacting prey items in the work area for 2 years due to dewatering is expected to involve a few additional fish. In sum, activities in the work area are expected to reduce the abundance of steelhead by somewhat more than 105 juveniles, and reduce the productivity of the 150,000-square-foot work area for 2 years. The area of reduced productivity is about 1% of the Cle Elum River, which itself is a small percentage of the productive habitat for the population, such that the action will not meaningfully reduce productivity at the population scale.

Within the context of basinwide flow alteration that will increase smolt abundance across the Upper Yakima population, the death of a little over 105 juveniles in the Cle Elum is relatively small; probably smaller than the anticipated gains in abundance anticipated as a result of lower flows in the Cle Elum and Yakima Rivers. Although reducing smolt abundance from the Naches population during a single outmigration year is a meaningful impact, the accompanying increase in smolts from the Upper Yakima population should more than compensate for the impact at the MPG scale because the Upper Yakima is at greater risk of extinction than the Naches population. For the action proposed in this opinion, NMFS expects that the proposed action will cause a one-time reduction in the abundance of the Naches population, probably cause a one-time increase in the abundance of the Upper Yakima population, and very slightly reduce productivity of the Upper Yakima for 2 years. In total, these effects will not adversely affect MCR steelhead to the degree that the likelihood of survival and recovery in the wild is appreciably reduced.

2.7.2. Critical Habitat

Critical Habitat designated for MCR steelhead is, in general, not functioning well enough to support recovery of the DPS. Water storage and diversion projects have drastically altered the critical habitat in the Columbia River and some of its tributaries, including the Yakima River. Floodplain development and land management have had significant impacts in some tributaries. Critical habitat in the Columbia River estuary has been degraded by conversion of a formerly complex ecosystem to industrial, transportation, recreational, agricultural, and urban uses. The freshwater migration corridors and estuarine areas PBFs have been severely degraded. Freshwater rearing sites have generally been degraded in areas with heavy agricultural and urban development. Climate change will have a range of effects on critical habitat; some effects are uncertain, though in general, climate change is likely to negatively affect critical habitat. Ongoing climate change will generally continue to reduce the ability of critical habitat to support recovery, although it is not expected to have a meaningful impact over the 2-year period during which effects of the proposed action would occur.

The proposed action will reduce the ability of critical habitat to support the freshwater spawning PBF in 110,000 square feet, or approximately 1%, of the Cle Elum River, for one spawning season. The action will impact the freshwater rearing PBF across many river reaches in the Naches basin for 1–2 weeks and improve the same PBF at the same time across many river reaches in the Upper Yakima basin. In addition, there will be a 2-year impact to the freshwater rearing PBF at the site of in-water work in the Cle Elum River. The freshwater migration PBF will be affected only minimally during construction.

NMFS expects that the proposed action will cause a diminishment in the value of critical habitat for the conservation of MCR steelhead in the Naches basin for 1–2 weeks, cause a temporary improvement in the value of critical habitat in the Upper Yakima basin for 1–2 weeks, and cause a 2-year diminishment in the value of 1% of the critical habitat in the Cle Elum River. The large-scale effects are expected to be of short duration, and the more severe effect in the Cle Elum River covers a small spatial extent and is expected to recede after 2 years and not cause a long-term diminishment in the value of critical habitat. Therefore, for the action proposed in this opinion, NMFS expects that the proposed action will not appreciably diminish the value of conservation of 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, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological 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 the opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

Basinwide Flow Management
Reclamation will accelerate their typical annual flow management operation to facilitate construction. The 'flip-flop' water management operation will be executed up to 2 weeks earlier than normal, and will rapidly increase flows in the Tieton, Bumping, and Naches Rivers. Abnormally high flows in the Tieton, Bumping, and Naches Rivers will harm juvenile steelhead by reducing their growth.

On-Site Flow Management
Reclamation will reduce flow into the Cle Elum River to facilitate connection of the Outlet Works Diversion Conduit. This activity will reduce flows in the Cle Elum to a minimum of 80 cfs for up to 24 hours, and then increase flows to typical fall flows of 180–250 cfs. Decreased flows during the 12–24 hour-long period are anticipated to kill juvenile steelhead by dewatering and kill others by trapping them in isolated pools, such that some will be killed by predators.

Fish Salvage and Dewatering
Reclamation will dewater the work area between the cofferdam and Cle Elum Dam, and attempt to salvage the trapped juvenile steelhead. This activity is estimated to result in the capture and safe release of 400 juvenile steelhead, the capture and injury and eventual death of an additional 50 juvenile steelhead, and the killing of a further 50 juvenile steelhead that are unable to be captured.

Mechanical Injury and Death
Reclamation will conduct filling and excavation activities in areas without previous fish salvage over a total of 13,250 square feet of riverbed. This activity is estimated to crush and injure or kill five juvenile steelhead.

Exclusion from the Work Area
Reclamation will prevent steelhead juveniles from rearing in the footprint of the dewatered worksite and cofferdam, resulting in harm to steelhead juveniles over a period of 2 years. The area to be excluded is 150,000 square feet of Cle Elum River and stilling basin.

It is difficult if not impossible to predict and/or observe the number of fish harmed from Basinwide Flow Management, On-Site Flow Management, Mechanical Injury and Death, and Exclusion from the Work Area. Therefore, NMFS uses surrogate measures for incidental take associated with these take pathways. The surrogates are causally linked to the take pathways and are readily measured indicators of the potential for and intensity of adverse impacts to ESA-listed species.

The amount and extent of take will be exceeded if any of the following surrogates and/or direct measures of take are exceeded:

- Rapid increases in flow in the Tieton, Bumping, or Naches rivers as a result of 'flip flop' operations that occur more than 2 weeks earlier than in a typical year.

- Flow in the Cle Elum River is less than 80 cfs at any 1 time or less than 180 cfs for more than 24 hours.

- Capture of juvenile *O. mykiss* up to 225 mm fork length during fish exclusion exceeds 450 fish, or if more than 50 captured *O. mykiss* up to 225 mm in fork length are injured or killed, or if more than 50 *O. mykiss* up to 225 mm in fork length are unable to be captured and observed to be dead via asphyxiation or other means.

- More than 13,250 square feet of the bed of the Cle Elum River is filled and/or excavated without prior dewatering and fish salvage. This measure is based on the designed size of the Helix Bypass Pipe dissipation pool (1,250 square feet), Outlet Works Diversion Conduit dissipation pool (400 square feet), crane pad (1,600 square feet), and cofferdam (10,000 square feet). Installation of brackets to support the conduit pipe is not considered excavation or fill because it is not expected to cause take.

- The total area of Cle Elum River and stilling basin that is dewatered and the total area of the cofferdam, cumulatively, exceed 150,000 square feet.

Although the surrogates are largely coextensive with the proposed action, they nevertheless function as effective reinitiation triggers because they are readily observable. If at any time the level or method of take exempted from take prohibitions and quantified in this opinion is exceeded, reinitiation of consultation will be required.

2.9.2. Effect of the Take

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

Reclamation shall:

1. Minimize incidental take resulting from dewatering and fish salvage.
2. Minimize incidental take by developing and implementing a monitoring and reporting program to confirm that the terms and conditions in this ITS are effective in avoiding and minimizing incidental take from proposed activities and that the amount and extent of take is not exceeded.

NMFS believes that full application of project minimization 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 listed species due to completion of the proposed action.

2.9.4. Terms and Conditions

The terms and conditions described below are non-discretionary, and the Bureau of Reclamation or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). Reclamation 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. At least 90 days before dewatering activities begin, Reclamation shall:
        i. Identify a lead fish biologist for dewatering activities. The lead biologist will have experience in dewatering and fish salvage.
        ii. Identify all equipment and supplies needed for dewatering activities, including electrofishers, dipnets, seines, blocknets, buckets, aerators, batteries, etc. in sufficient sizes and numbers to support the dewatering effort.
        iii. Identify at least three qualified fish biologists to lead fish salvage crews. Qualified biologists will have experience in electrofishing and fish identification.
        iv. Ensure that the construction schedule allows at least 3–5 days for fish salvage activities.
    b. At least 10 days before dewatering activities begin, Reclamation shall inform NMFS of the anticipated dewatering and fish salvage schedule.
    c. During dewatering and fish salvage activities, Reclamation shall:
        i. Ensure personnel are on-site for timely capture, handling and release of fish. At a minimum, three crews of four people each (including at least one qualified fish biologist per crew) will be available for fish salvage. One crew will be dedicated to handling, counting, and releasing fish to minimize holding times of captured fish.
    d. Reclamation shall consider if some fish can be 'herded' out of the work area before completion of the cofferdam. If feasible, Reclamation shall herd fish to encourage fish to leave the work area by swimming downstream without capture. Herding may be feasible when the cofferdam is approximately three-quarters complete, immediately following connection of the Outlet Works Diversion Conduit to the dam outlet works. A herding operation could be conducted without the minimum personnel requirement identified above.

2. The following terms and conditions implement RPM 2:
    a. Within 90 days after construction is completed, Reclamation shall provide NMFS a post-project monitoring report including, at a minimum, the following information:
        i. Project name and NMFS Tracking No: Cle Elum Dam Fish Passage Facilities Project (Splitter Wall), WCR-2020-01573.
        ii. Description of accelerated 'flip-flop' operations, including dates on which operations began and calculation of how much earlier flows in the Tieton,

Bumping, and Naches rivers were increased compared to typical annual operations.

iii. Description of the flow rates in the Cle Elum River during the duration of the project, including evaluation by Reclamation if river flows were less than 80 cfs at any one time or less than 180 cfs for more than 24 hours.
iv. Number of *O. mykiss* up to 225 mm fork length that were captured and released without injury. Fork length can be estimated, instead of directly measured, to reduce handling stress for captured fish.
v. Number of *O. mykiss* up to 225 mm fork length that were captured and observed injured or dead. Fork length can be estimated, instead of directly measured, to reduce handling stress for captured fish.
vi. Number of *O. mykiss* up to 225 mm fork length that were unable to be captured and observed to be killed by asphyxiation from dewatering or other means.
vii. Total square footage of fill and excavation activities in the Cle Elum River conducted without prior fish salvage and dewatering, exclusive of installation of brackets for the Outlet Works Diversion Conduit.
viii. Total area occupied by the cofferdam and dewatered work area upstream of the cofferdam.

b. The monitoring report should be delivered to NMFS' Interior Columbia Basin Office at 304 S. Water Street #201, Ellensburg, WA 98926.

2.10. Conservation Recommendations

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

1. Provide any turbidity monitoring data collected during construction activities to NMFS as part of the monitoring report referenced in Term and Condition 2. Turbidity information will help NMFS assess potential effects of in-water work during consideration of future projects.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Cle Elum Dam Fish Passage Facilities Project (Splitter Wall).

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the federal agency or by the Service where discretionary federal agency involvement or control over the action has been retained or is authorized by law and 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 identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. Data Quality Act Documentation and Pre-Dissemination Review

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

3.1. 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 Reclamation. Other interested users could include the Yakama Nation and others interested in the conservation of the affected ESUs/DPSs. Individual copies of this opinion were provided to Reclamation. The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

3.2. 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.

3.3. 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 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 reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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