Kachess Dam Safety of Dams Modification Environmental Assessment

Biological Assessment – Final

US Department of the Interior
Bureau of Reclamation
Columbia-Pacific Northwest Regional Office
1150 N. Curtis Road
Boise, ID 83706

April 2022

Mission Statements

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Table of Contents

Tables

Page

Figures

Page

Appendixes

Acronyms and Abbreviations

Acronym	Full Phrase
°C	degrees Celsius
°F	degrees Fahrenheit
BA	biological assessment
BMP	best management practice
BTWG	Bull Trout Working Group
CFR	Code of Federal Regulations
cfs	cubic feet per second
cSEL	cumulative sound exposure level
dbh	diameter at breast height
dB	decibel
DPS	distinct population segment
Ecology	Washington Department of Ecology
EFH	essential fish habitat
ESA	Endangered Species Act of 1973
FMO	foraging, migration, and overwintering
Lmax	average maximum noise level
LWD	large woody debris
MCR	Middle Columbia River
mg/L	milligrams per liter
Mid-C RU	Middle Columbia River Recovery Unit
MPI	Matrix of Pathways and Indicators
MPG	major population group
NMFS	National Marine Fisheries Service
NRF	nesting, roosting, or foraging
NSO	northern spotted owl
NTU	nephelometric turbidity unit
OHWM	ordinary high-water mark
PBF	physical and biological feature
PCE	primary constituent element
Reclamation	Bureau of Reclamation
SR	spawning and rearing
USFWS	US Fish and Wildlife Service

WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington Department of Transportation

Chapter 1. Introduction

1.1 Purpose and Background

The purpose of this biological assessment (BA) is to determine the effects of the Kachess Safety of Dams Project (the Proposed Action) on species that are federally protected under the Endangered Species Act of 1973 (ESA), as amended. The BA is intended to fulfill Section 7(c) of the ESA and is intended to determine whether the Proposed Action would be likely to jeopardize the continued existence of federally listed species or result in the destruction or adverse modification of designated critical habitat, as defined in the Endangered Species Consultation Handbook (US Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS] 1998).

Kachess Dam, located about 14 miles northwest of Cle Elum, Washington, was constructed from 1910 to 1912. It was one of the first dams constructed by the US Reclamation Service, and it increased the storage capacity of a large natural lake. The 115-foot-high, earth-filled Kachess Dam created a reservoir with an actively managed capacity of 239,000 acre-feet.

The Bureau of Reclamation (Reclamation) has identified seepage and internal erosion issues through the dam embankment along the outlet works conduit, which conveys water from the reservoir to the Kachess River downstream. In other words, water seeping through the dam embankment and the soils surrounding the conduit is carrying soil materials with it and leaving behind voids. This "internal erosion" creates a risk of a potential dam failure. Reclamation is proposing this project to filter and monitor the seepage to prevent eroded soils from exiting the dam.

The purpose of and need for the proposed project are:

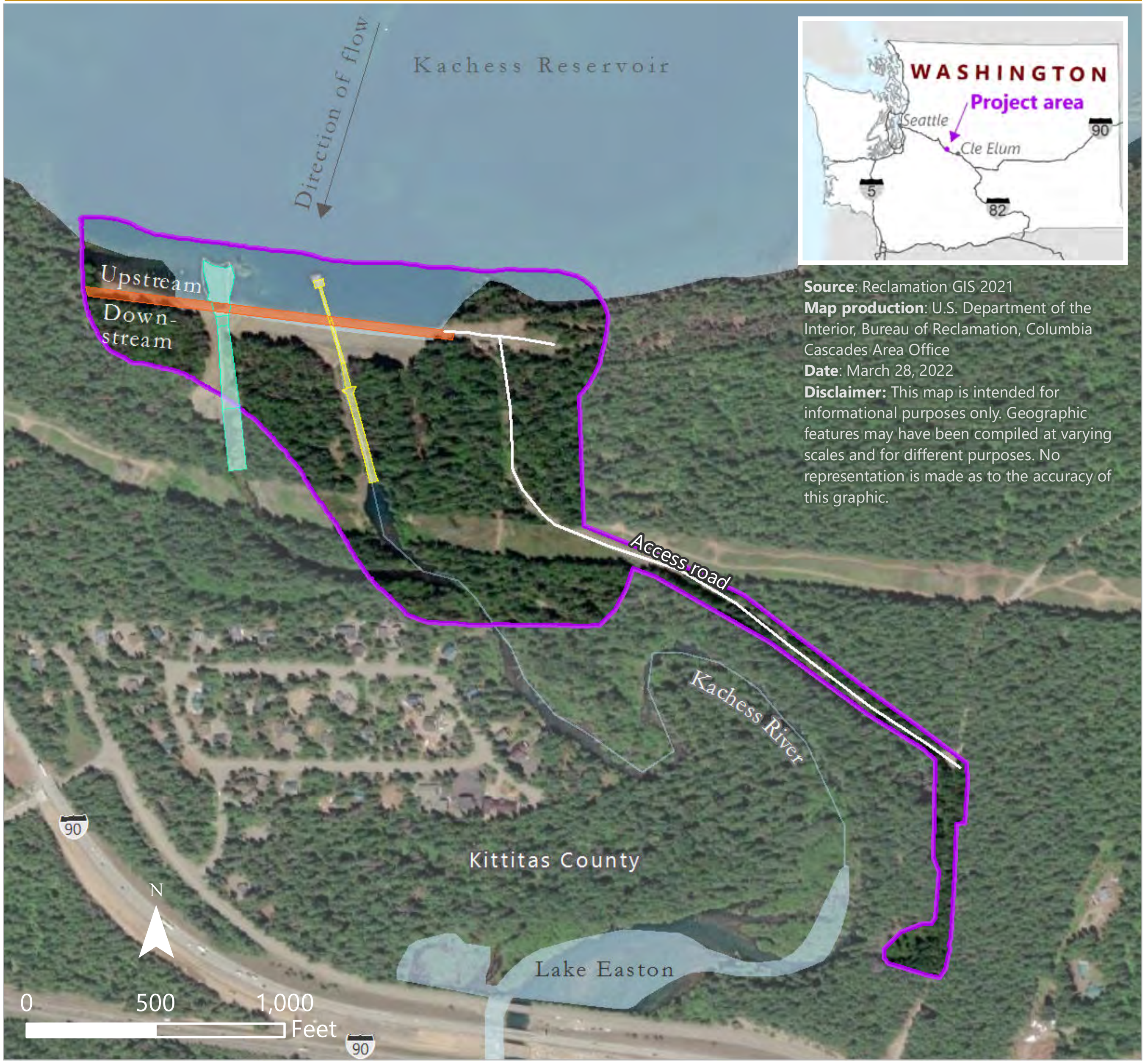
1) To implement cost-effective measures to reduce risks, per Reclamation's Public Protection Guidelines
2) To maintain water deliveries to irrigation districts, tribes, and others throughout the Yakima Basin
3) To minimize impacts on listed species and their designated critical habitats
4) To maintain water flows for endangered species to the extent possible

As part of its safety of dams program mission, Reclamation is committed to ensuring its dams do not present unacceptable risk levels to people, property, and the environment. These requirements result in a need for Reclamation to implement corrective action to bring static and hydrologic risks at Kachess Dam below public protection guidelines while minimizing impacts on the environment.

1.2 Project Area

The project area is on and near the Kachess Dam, located about 14 miles northwest of Cle Elum, Washington. The project area includes the Kachess Dam surface water intake, spillway, and all areas of construction. An overview of the project area is depicted in **Figure 1**.

Figure 1
Project Area



Existing permanent infrastructure

- Dam
- Outlet works
- Spillway
- Access road and aboveground electric line

Project area

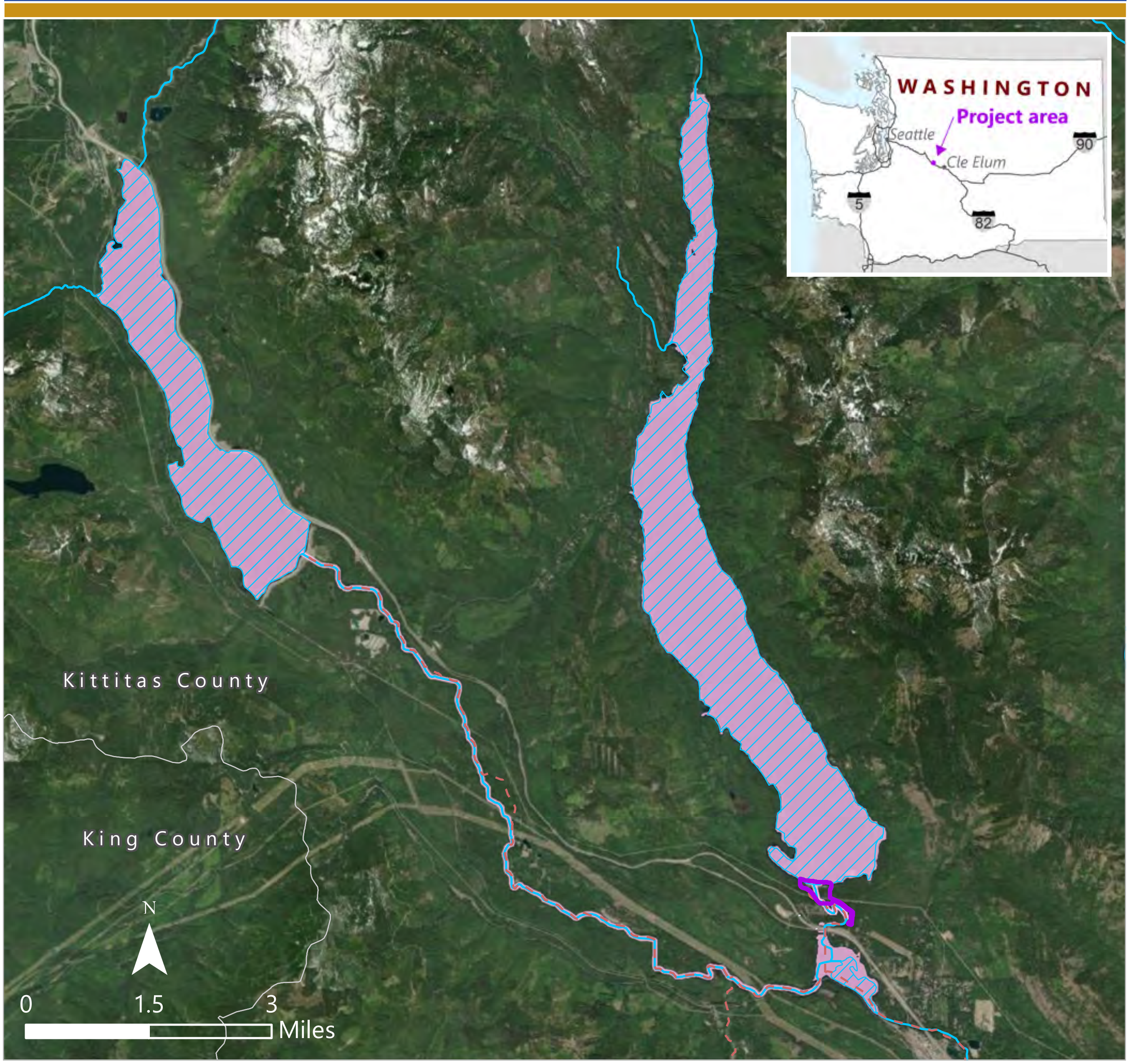
1.3 Action Area

The action area is defined as all areas affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations [CFR] 402.02). In delineating the action area, Reclamation evaluated the farthest-reaching physical, chemical, and biotic effects of the action on the environment.

The action area for listed fish species (Bull Trout and steelhead) is depicted in **Figure 2**; **Figure 3** provides a closer view of the listed fish species' action area in relation to the project area. The action area extends from Kachess Reservoir (4,389 acres) downstream through the Kachess River to Easton Dam for a total of 0.8 miles (4.9 acres with a 25-foot buffer around the linear reach); from Lake Easton (218 acres) upstream through the upper Yakima River to Keechelus Dam for a total of 10.6 miles (63 acres with a 25-foot buffer around the linear reach); and it includes the Keechelus Reservoir (2,379 acres). The actual length of the Kachess River's reach varies based on water levels at Lake Easton, which are controlled based on irrigation operations; the analysis uses the length of the reach when Lake Easton is high or 0.8 miles (as described later in this document, the actions that would affect the bottom of the reach would coincide with the time when Lake Easton is not in drawdown). The total acreage of the action area, including a 25-foot buffer around both linear reaches to account for indirect effects such as erosion, is 7,054 acres. This area covers the project area, in which all construction activities would take place, and it also accounts for the area over which flows or reservoir levels would be affected by decreasing Kachess Reservoir outflow and increasing Keechelus Reservoir outflow to compensate for water demands during the Proposed Action.

The action area for listed terrestrial wildlife species (northern spotted owl [NSO]) analyzed in this document is depicted in **Figure 4**, and a close up of this area is shown in **Figure 5**. The action area for listed terrestrial wildlife species analyzed in this document (NSO) includes the project area plus a 1.8-mile buffer around the project area, to evaluate habitat modification effects for a total of 7,258 acres. To evaluate noise, disturbance, and other potential effects, a 0.25-mile buffer was also identified, for a total of 382 acres (**Figure 4**).

Figure 2
Bull Trout and Steelhead Action Area

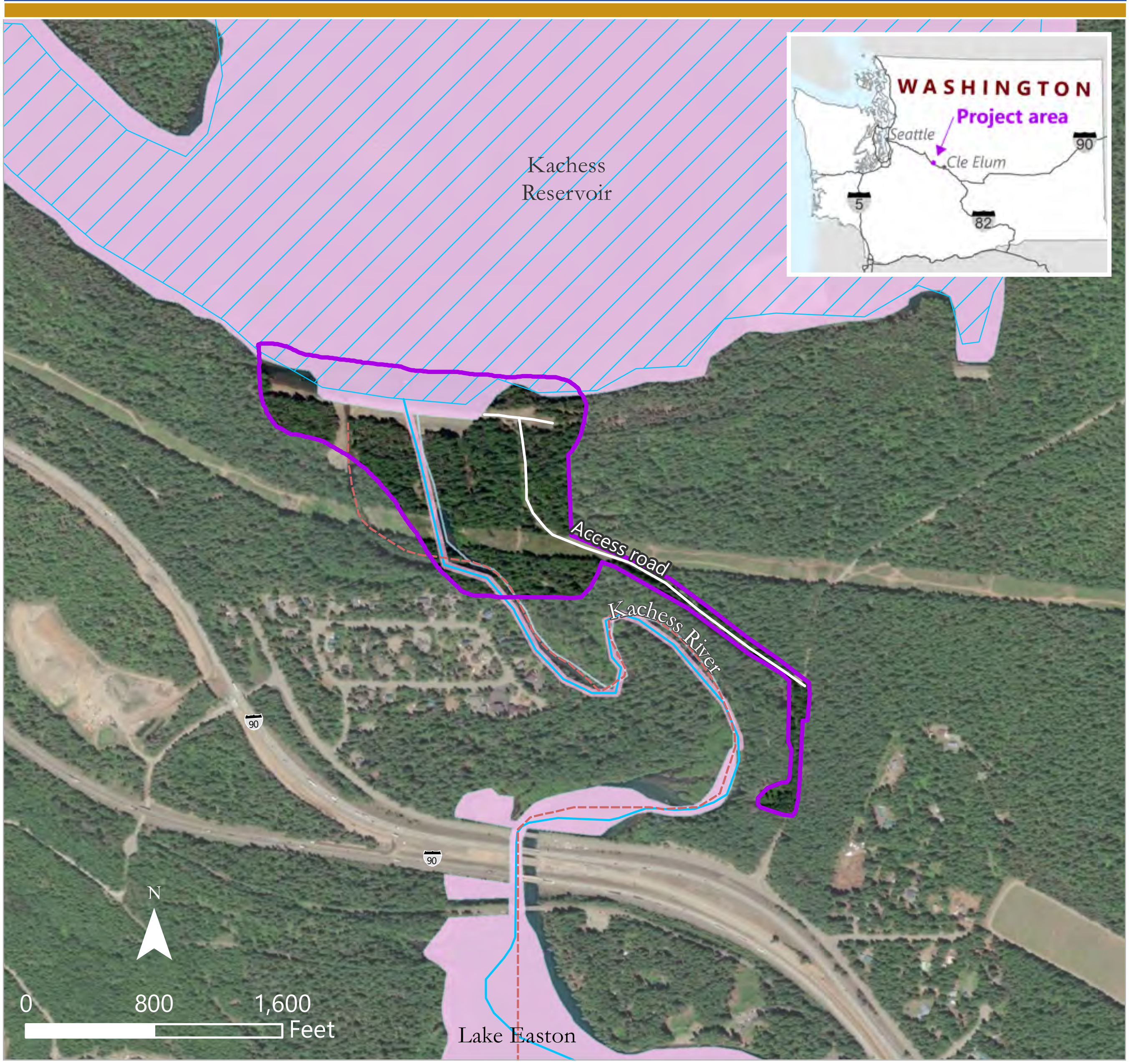


Bull trout and steelhead action area
Bull trout critical habitat
Steelhead critical habitat
Project area

Source: Reclamation GIS 2021, FWS GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: April 07, 2022
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

— BUREAU OF —
RECLAMATION

Figure 3
Bull Trout and Steelhead Action Area in the Project Area



Bull trout and steelhead action area

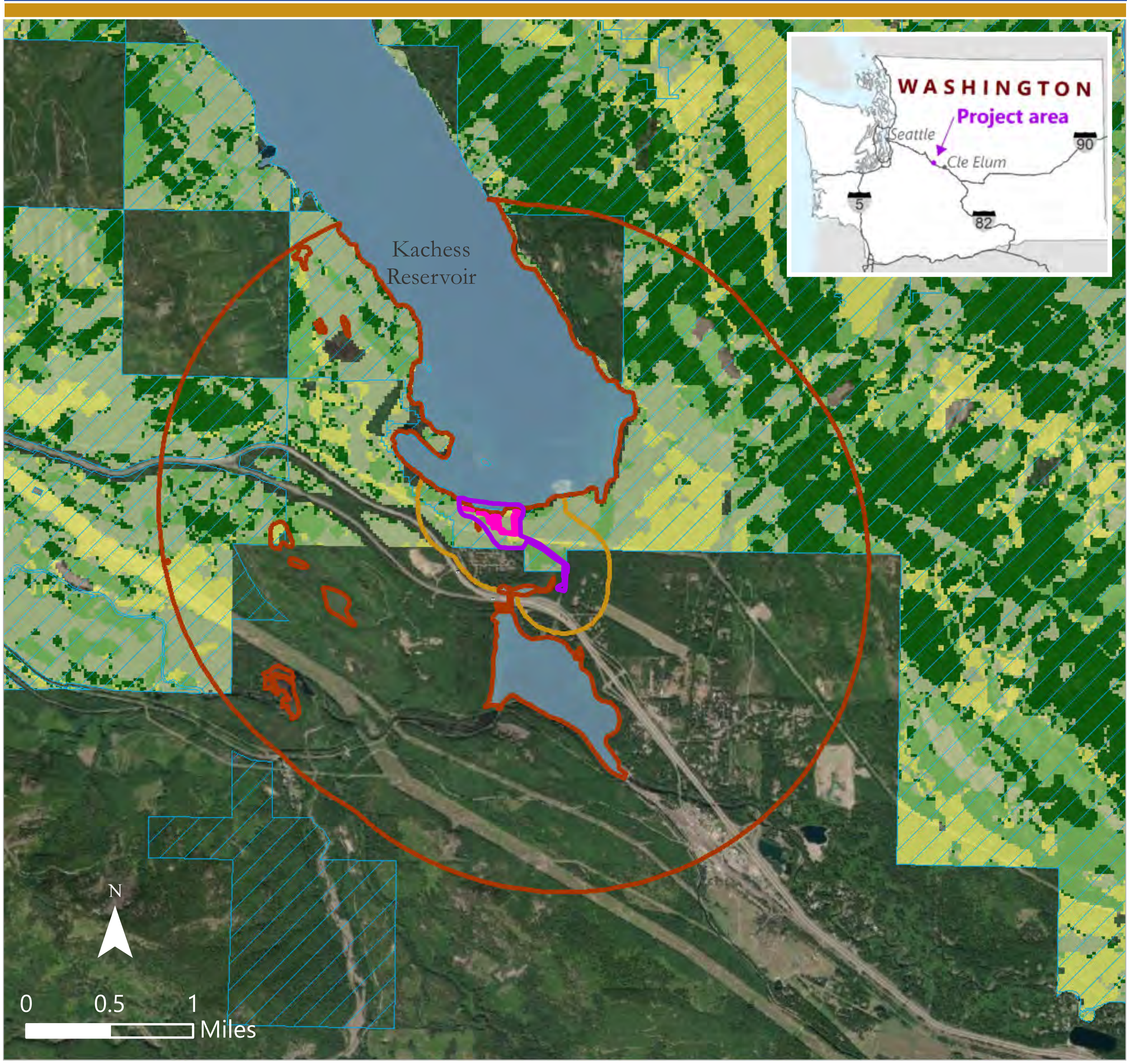
Bull trout critical habitat

Steelhead critical habitat

Project area

Source: Reclamation GIS 2021, FWS GIS 2021
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: April 07, 2022
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic.

Figure 4 Northern Spotted Owl Action Area and Habitat Suitability



Northern spotted owl action area

Noise disturbance buffer

Northern spotted owl habitat suitability

Highly suitable

Suitable

Marginal

Unsuitable

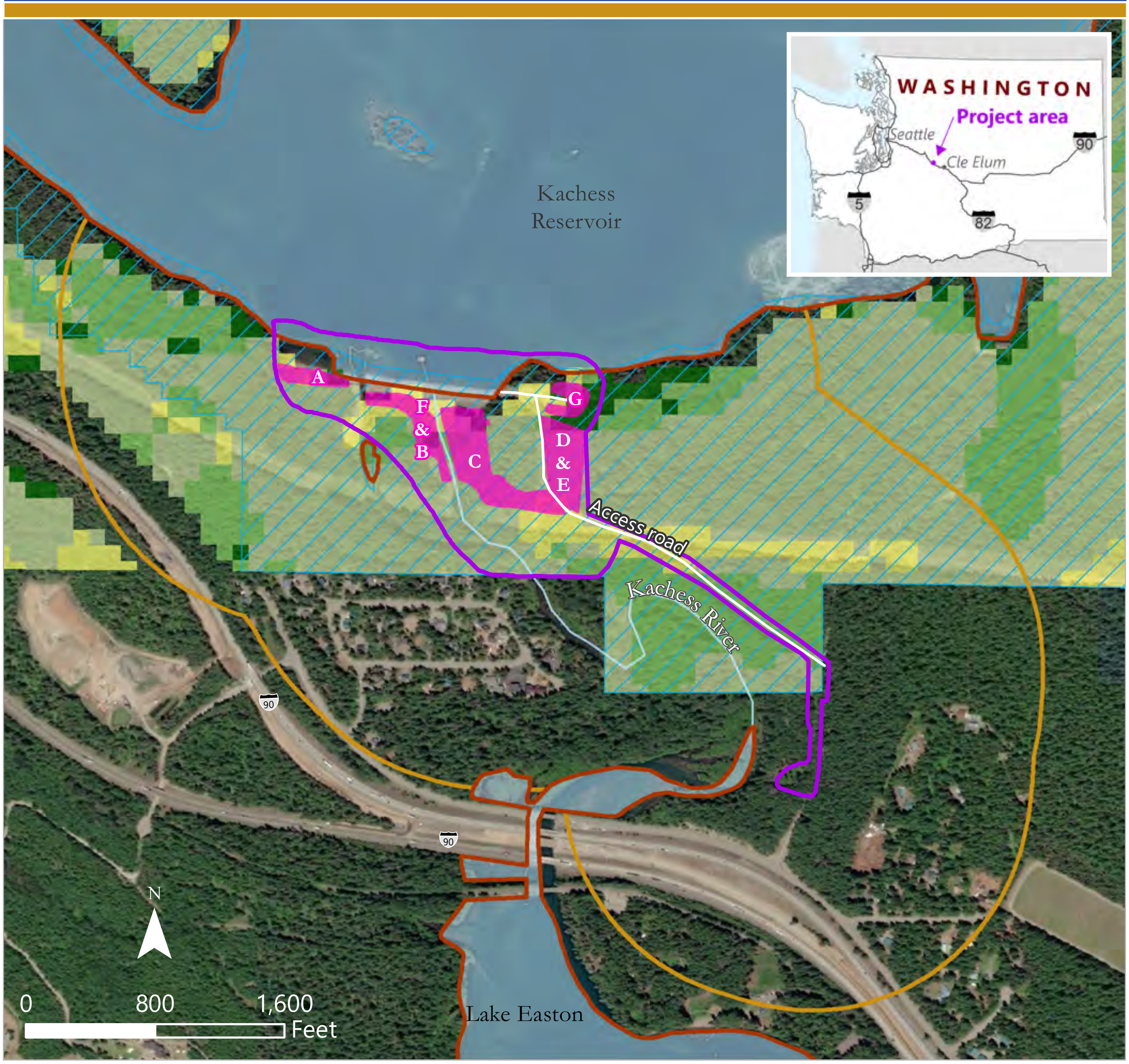
Northern spotted owl critical habitat

Tree clearing and grubbing

Project area

Source: Reclamation GIS 2021, FWS GIS 2021, USFS 2022
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: March 28, 2022
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic. Northern spotted owl suitability is only available for Forest Service lands.

Figure 5
Northern Spotted Owl Action Area and Habitat Suitability in the Project Area



Northern spotted owl action area
Noise disturbance buffer
Northern spotted owl habitat suitability
Highly suitable
Suitable
Marginal
Unsuitable

Northern spotted owl critical habitat
Tree clearing and grubbing
A: 0.8 acres
F & B: 1.6 acres
C: 3.6 acres
D & E: 2.5 acres
G: 0.7 acres
Project area

Source: Reclamation GIS 2021, FWS GIS 2021, Forest Service 2022
Map production: U.S. Department of the Interior, Bureau of Reclamation, Columbia Cascades Area Office
Date: March 28, 2022
Disclaimer: This map is intended for informational purposes only. Geographic features may have been compiled at varying scales and for different purposes. No representation is made as to the accuracy of this graphic. Northern spotted owl suitability is only available for Forest Service lands.

1.4 Evaluated Species

As identified by the USFWS's Information for Planning and Consultation, there are seven threatened or endangered species, and two critical habitats in the action area vicinity. Listed species and critical habitat with potential to be affected by the Proposed Action are analyzed in detail in this BA and are summarized in Error! Not a valid bookmark self-reference..

Reclamation determined that the Proposed Action would not affect the following species: Canada lynx (*Lynx canadensis*, threatened), gray wolf (*Canis lupus*, proposed endangered), marbled murrelet (*Brachyramphus marmoratus*), and yellow-billed cuckoo (*Coccyzus americanus*, threatened). These species are either not present in or near the action area, or suitable habitat is not present there. These species and their critical habitats are not addressed further in this BA.

Table 1
Listed Species and Critical Habitats

Species or Critical Habitat	Status	Effect Determination[1]
Bull Trout (*Salvelinus confluentus*)	Threatened	Likely to adversely affect
Bull Trout critical habitat	N/A	Likely to adversely affect
NSO (*Strix occidentalis caurina*)	Threatened	Likely to adversely affect
NSO critical habitat	N/A	Likely to adversely affect
Middle Columbia River steelhead (*Oncorhynchus mykiss*)	Threatened	Likely to adversely affect
Steelhead critical habitat	N/A	Likely to adversely affect

[1] See **Chapter 5** for the effects analysis and **Chapter 6** for the effect determination summaries.

Chapter 2. Proposed Action

2.1 Proposed Action

Reclamation is proposing to reduce the risk of a dam failure by improving the outlet works to filter and monitor the seepage to prevent eroded soils from exiting the dam. Improvements would require the following key activities:

- Preparing the site, including tree clearing and grubbing (phase 1)
- Constructing an access road (phase 1)
- Developing staging areas to support construction and long-term maintenance (phase 1)
- Site electrical upgrades (phase 1)
- Fabrication and delivery of pipes (phase 1)
- Extending and lining the conduit (phase 2)
- Low-flow bypass connection (phase 2)
- Installing a diaphragm filter around the conduit (phase 2)
- Installing a stability berm on top of the filter (phase 2)
- Installing an auxiliary drain below the outlet channel (phase 2)
- Revegetation after construction activities (post-project; **Appendix F**)

Information on the timing, location, and elements of these of these activities is provided in the following sections.

2.1.1 Phases and Timing of Activities

The activities listed above would occur over two phases between April 2023 and July 2025. Construction sequencing would occur as described in the following sections.

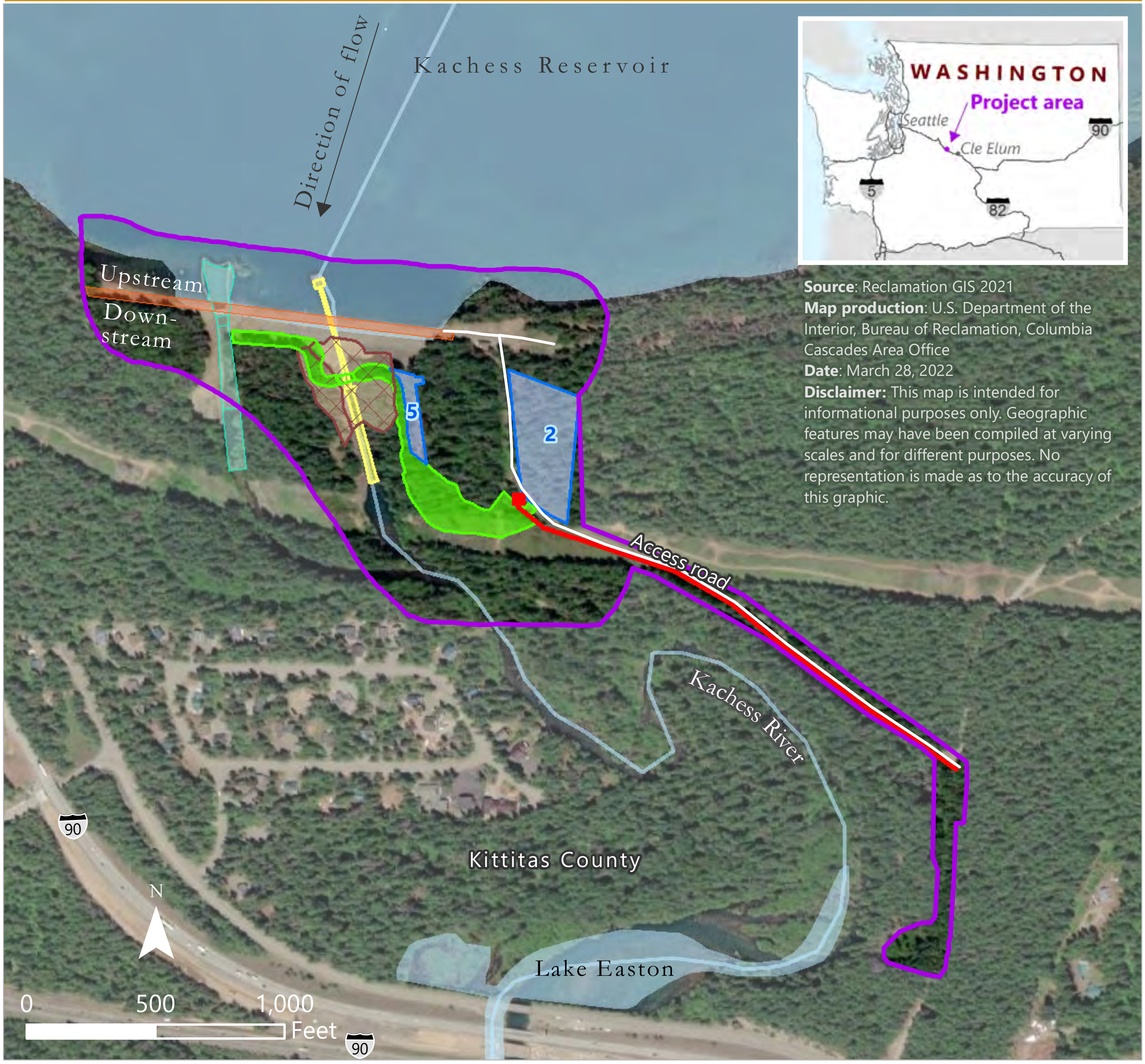
Phase 1 construction (May 2023 to February 2024)

During the first phase of construction, Reclamation would work on developing the access road and contractor use areas (**Figure 6–Figure 7**). Accordingly, this phase of construction would involve clearing, grubbing, and removing trees on the site. **Figure 8** shows areas where Reclamation would perform tree clearing and grubbing. As shown in the figure, the tree clearing and grubbing areas would be located along the outlet works, which is a manmade, concrete-lined channel. Other tree removal areas are located away from the water or by the dam (**Figure 8**).

Reclamation would make efforts to retain and maintain large trees around the edges of tree clearing and grubbing areas where retention of such trees would not impair construction or equipment mobility.

BUREAU OF RECLAMATION

Figure 6
Proposed Action: Temporary Disturbance



Proposed temporary infrastructure

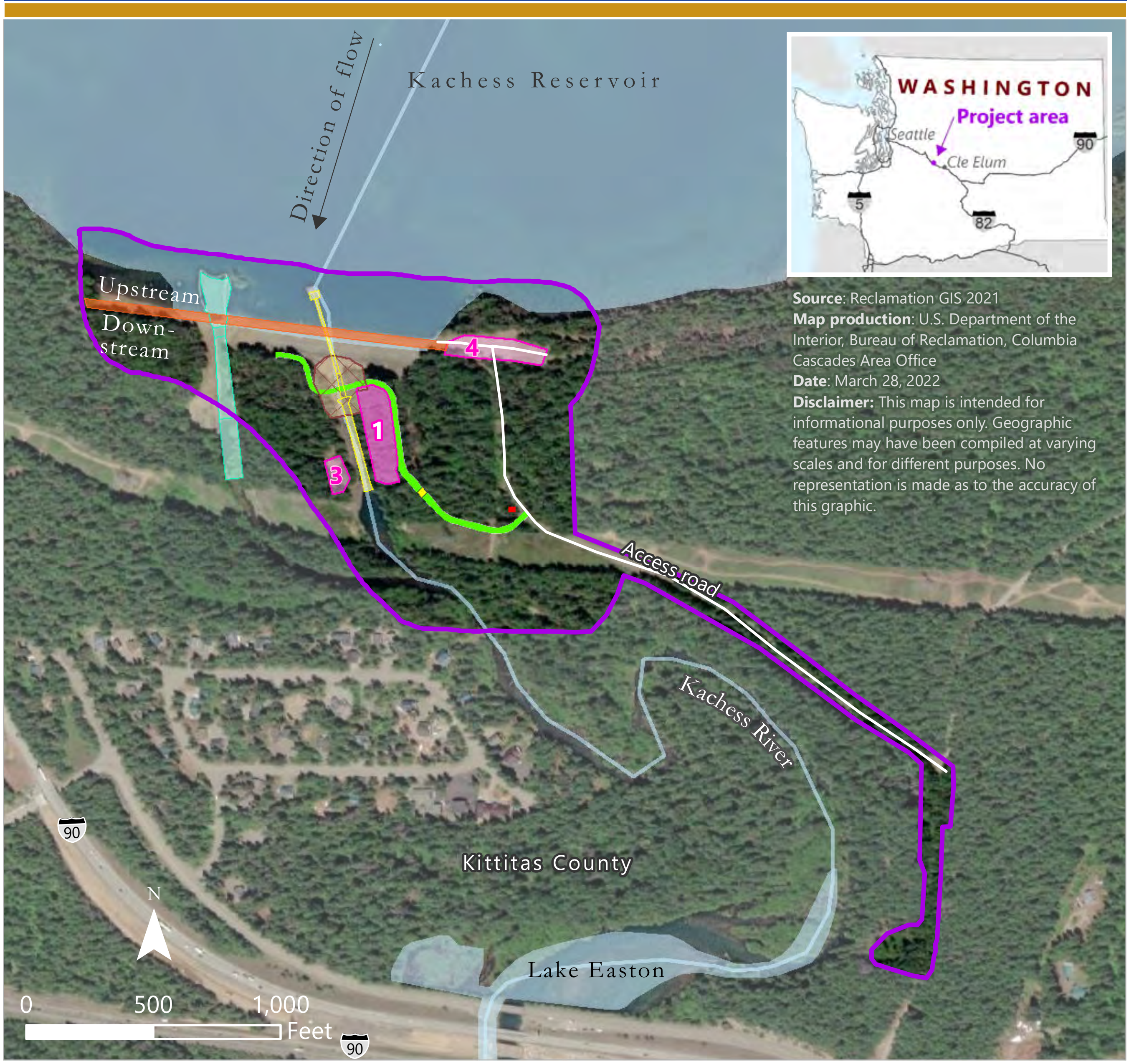
- Outlet works (extend and line the conduit)
- Access road
- Contractor use area
- Excavation
- Buried electric line

Existing permanent infrastructure, no structural or operational changes

- Dam
- Spillway
- Access road

- Project area

Figure 7
Proposed Action: Permanent Infrastructure



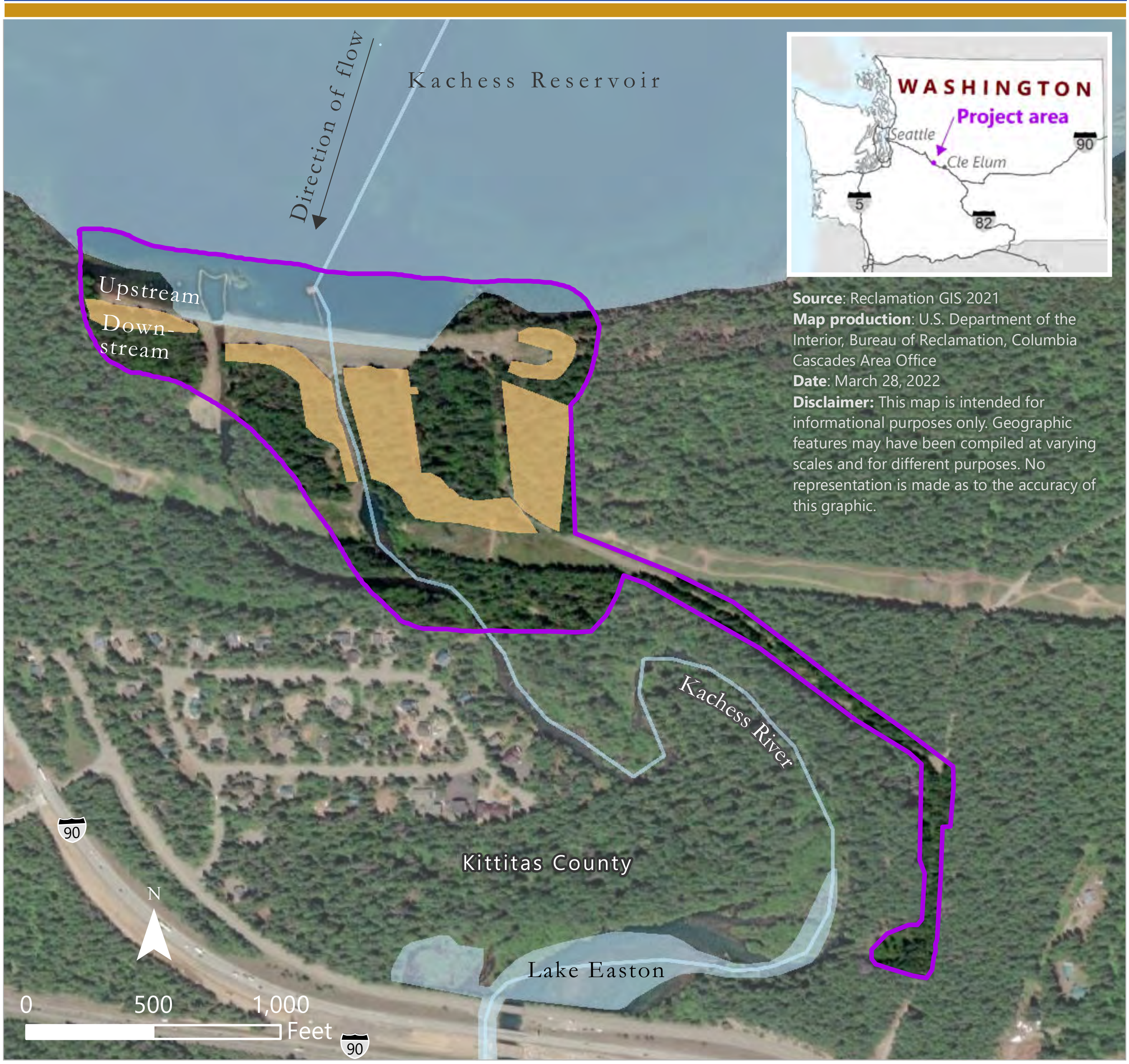
Proposed permanent infrastructure
- Fish passable culvert
- Electric building
- Access road
- Outlet works
- Operation and maintenance area
- Stability berm

Existing permanent infrastructure, no structural or operational changes
- Dam
- Spillway
- Operation and maintenance area
- Access road and buried electric line

Project area

BUREAU OF RECLAMATION

Figure 8
Proposed Action: Tree Clearing and Grubbing



Tree clearing and grubbing

Project area

Reclamation plans to work on tree clearing, chipping, and shredding between May and June 2023 for site access. Tree hauling to the US Forest Service lot would occur between June and July 2023. Access road construction would occur from July to early October 2023. Contractor use areas would be developed from May to July 2023.

Most tree hauling would occur after most of the access road is constructed; this would allow heavy equipment to access the affected areas and trees to be hauled away without using the crest of the dam. Reclamation would rely on 40- to 45-foot commercial trucks and trailers to haul trees from the area to a US Forest Service site for stockpiling. Reclamation would use equipment at the stockpile area to unload trucks. If space is limited at the stockpile area, Reclamation could also employ other equipment to stack trees at the stockpile area. Electrical upgrades would also be performed during this phase; they would involve burying electrical lines and are described in more detail below.

Work during this phase would occur in the tree clearing and grubbing areas, as indicated in **Figure 8**, and in the contractor use, access road, and electric line areas, as indicated in **Figure 6–Figure 7**. There would be no in-water work during this phase.

During January to February 2024, Reclamation would focus on fabrication and delivery of pipes to the project area. Work during this phase would occur in the contractor use and access road areas, as indicated in **Figure 6–Figure 7**. There would be no in-water work during this phase.

Phase 2 (January 2024 to July 2025)

During the second and final phase of construction (January 2024 to July 2025), Reclamation would work on replacing the outlet works. Excavation of the foundation for the conduit extension would occur between January and February 2024. Reclamation would expect sand delivery to occur in May 2024, but this schedule could be revised closer to the actual construction. The remaining elements of phase 2 would occur after May 2024, with refinements to this schedule occurring closer to the actual construction date.

During this phase, there would be a need for conduit outages to repair the low-flow bypass. This is discussed in more detail below (**Section 2.1.2, Project Elements, Low-Flow Bypass Pipe Connection**, and **Section 2.1.3, Operation and Management During Construction**).

Most construction during phase 2 would be conducted within the outlet works. This is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish except in the case of backwatering. A cofferdam will be placed in the lower end of the outlet channel to prevent any backwatering of the work area if water elevation in the stilling basin rises (**Figure 9**).

Figure 9. Outlet Works Diagram

2.1.2 Project Elements

Further details on the various elements of the Proposed Action are described below.

Site preparation and disturbance areas, including tree clearing and grubbing (phase 1)

- Tree clearing, chipping, and shredding would occur between May and June 2023 to prepare sites that would serve as the access road, operation and management areas, and contractor use areas (**Figure 6–Figure 7**). Tree hauling to the US Forest Service lot would occur between June and July 2023. Details on the amount and size of trees removed are described in **Appendix D**. All activities associated with this project element would occur out of water in the tree clearing and grubbing areas (**Figure 8**).
- Over the course of the project, Reclamation anticipates that the maximum disturbance area would be approximately 11 acres, with 4 acres of permanent disturbance from the project. **Figure 6** depicts the temporary disturbance associated with the Proposed Action, and **Figure 7** depicts the permanent infrastructure associated with the Proposed Action. The modified embankment dam, stability berm, and outlet works would resemble a T-shaped mound (construction on these elements would occur during phase 2).
- The other 7 acres would be reclaimed through restoration after completion of the project (see restoration below). All earth areas capable of supporting vegetation, which the project has exposed or disturbed, would be graded to a stable grade and revegetated. Where seeding is expected to have a moderate or high probability of success, the site would be seeded with a suitable native seed mix and protected from erosion with weed-free mulch or another

suitable biodegradable erosion-control protection. Reclamation would collaborate with the US Forest Service on revegetation practices to develop the revegetation plan.

Access Road—Downstream Toe Approach Road (Phase 1)

- Current access to the toe of the dam is via the crest of the dam. Due to the access road approach, it would likely not allow the passage of large earth-moving equipment.
- Reclamation anticipates constructing the downstream toe approach road as part of the first phase of construction; this would include tree removal and establishment of contractor use areas. The new road would be approximately 1,000 feet long with gravel surfacing. There are no plans to pave this road once construction is complete. It would be equipped with a guardrail and would be 24 feet wide at the shoulders. All existing roads would remain, and the downstream toe approach road would be constructed.
- The slope of the proposed cuts (and the proposed fill) would be more gradual and stable than what is currently in situ. Geotechnical designers would review and approve the stability of both the cut and fill slopes for the entire length of the new access road (including the areas near and above the wetlands). Standard erosion-control measures would be implemented. Example measures include drainage ditches, culverts, hydromulching[1] or similar measures along the cut slope to control turbidity, an energy dissipation cobble-lined area along the groin of the fill slope to control erosion of the existing slope, revegetation, and others. Drainage features would be designed so they do not discharge additional water into any of the designated wetlands.
- All activities associated with this project element would occur out of water in the access road area (**Figure 6–Figure 7**).

Staging Areas/Contractor Use Areas (Phase 1)

- This project would use two existing contractor use areas. These areas are located at the crest of the dam and to the right of the existing outlet channel. They are labeled as Areas 4 and 3, respectively, in **Figure 8**. The new contractor use areas along the left side of the outlet channel and the downstream toe approach road would be constructed and surfaced with gravel. They are labeled as Area 1 in **Figure 7** and Areas 2 and 5 in **Figure 6**. In addition to the already existing, permanent contractor use areas (Areas 3 and 4 in **Figure 7**), the new contractor use area along the left side of the outlet channel (Area 1 in **Figure 7**) would be permanent and would be fenced to provide an additional storage yard for the facility. The remaining new contractor use areas (Areas 2 and 5 in **Figure 6**) would be restored by seeding them. See **Figure 6–Figure 7** for maps of existing and new contractor use areas and to see which would remain after construction is complete.
- All activities associated with this project element would occur out of water in the staging areas shown in **Figure 6–Figure 7**.

[1] Hydromulching, which is sometimes also called hydroseeding or hydraulic mulch seeding, is a method of planting grass in which a mixture of water, fiber mulch, tackifier (an adhesive substance), and seeds is sprayed over an area to prevent soil erosion and to promote revegetation. The mixture is applied to the area from a mounted tank and is sprayed through hoses to promote even application.

Site electrical upgrade (phase 1)

- A reliable source of electrical power would be required to power the pumps in the inspection well at the downstream end of the filter drain. Accordingly, the site would receive an electrical upgrade via an in-kind replacement of its current generators. The existing overhead electrical lines would be buried beneath the existing approach road, and the existing engine generator set would be replaced. Additional power capacity would be provided by upgrading from a 240-volt, single-phase system to a 480-volt, three-phase system; however, this change would not include a power capability upgrade. The generators would be used as backup power.
- All activities associated with this project element would occur out of water in the electrical upgrade area, which would parallel the access road (**Figure 6–Figure 7**).

Fabrication and delivery of pipes (phase 1)

- Fabrication and delivery of pipes to the project area would take place during the second phase of construction (January to February 2024). Work during this phase would occur in the contractor use and access road areas, as indicated in **Figure 6–Figure 7**.

Conduit extension and liner (phase 2)

- Because of the placement of the diaphragm filter and stability berm, the conduit would be extended downstream by about 100 feet from its current position to accommodate those additions. To place the extension, a 100-foot-long trench would be excavated. The width of the excavation would range from approximately 34 feet at its narrowest point to approximately 250 feet at its widest point. A new concrete encasement would be placed around a 10-foot-diameter liner pipe, and a new transition section would be constructed at the relocated outlet works portal structure. Work on this project element would take place during phase 2 (January 2024 to July 2025).
- Construction would occur within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish except in the case of backwatering. However, Reclamation would employ a cofferdam to prevent backwatering, which would exclude fish from the outlet works during construction. The location of cofferdam and excavation area within the outlet channel are shown in **Figure 9**.

Low-Flow Bypass Pipe Connection (Phase 2)

- The Kachess Dam low-flow bypass is currently in need of repair. To repair the bypass, Reclamation must remove the existing valve and replace it with a new plunger valve. Reclamation recognizes that currently to maintain or operate the conduit the bypass can not be flowing. To remedy this situation and to help maintain flows for future operation and maintenance, Reclamation plans to extend this bypass piping to help limit issues related to maintaining flows and operation and maintenance activities. Reclamation has also recognized that the most reliable source of flow during construction would be the usage of a low-flow bypass and extensions during construction. To facilitate this reliable source of flow, Reclamation would need to attach temporary piping to route these flows around the constructions site. Up to four conduit outages would be needed for:
    1. Replacing the existing valve
    2. Connecting the permanent bypass piping

3. Connecting the temporary bypass piping extension
4. Removing the temporary bypass

- To repair the bypass, Reclamation is prepared to have a maximum of four, up to 12-hour conduit outages, which is when the low-flow bypass and the gates of the Kachess Dam will need to be closed, and the outlet works would need to be shut off. This does not preclude passing water over the spillway or pumping water when needed. During these outages, Reclamation plans to maintain at least 10 cfs of minimum flows in the Kachess River either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years.
- If Reclamation is not able to either pass water over the spillway or pump during one of the four possible conduit outages, dewatering the Kachess River below the project area could occur, in which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The need for this to occur will depend on reservoir storage and water year, but it would only occur when the reservoir is less than 2,245 feet and during the March–December work window. This dewatering event would coincide with when Easton Lake gates are raised, when it is not dewatered in the winter, to lessen the distance of the impact. This would most likely occur in the fall, but based on water year, there is a chance this might need to take place in the spring or summer. It is anticipated that one dewatering event would be needed and would take place for a time period not to exceed 12 hours. If it is necessary to dewater the Kachess River, at least 30 calendar day advance notice of the event will be given to USFWS, NMFS, WDFW, and other interested parties.
- See **Section 2.1.3** for more information regarding the conduit outages that would be necessary to conduct bypass repair.
- Work on the pipe connection would occur within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish except in the case of backwatering. However, Reclamation would employ a cofferdam to prevent backwatering, which would exclude fish from the outlet works during construction (**Figure 9**).

Diaphragm Filter (Phase 2)

- The current outlet works structure would be demolished and removed via excavation, while a four-sided diaphragm filter[2] would be placed just downstream of the original outlet location. Also, a 12-inch-diameter drainpipe would be attached. Because of the removal of the existing outlet works structure, no significant excavation into the embankment would be necessary to install the new filter. It would extend 10 feet below the base of the extended conduit and part way up the embankment. Work on this project element would take place during phase 2 (January 2024 to July 2025).
- Work on this element would occur within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish except in the case of

[2] A diaphragm filter is a designed zone of filter material constructed around a conduit. It is a standard defensive design measure to prevent problems associated with seepage or internal erosion in earth fill surrounding a conduit.

backwatering. However, Reclamation would employ a cofferdam to prevent backwatering, which would exclude fish from the outlet works during construction (**Figure 9**).

Stability Berm (Phase 2)

- A stability berm would be constructed from compacted fill material sourced from the excavation (which would consist of a mixture of clay, sand, gravel, and cobbles) that would overlay the filter zone. There would be enough excavated material to build the stability berm without importing any additional materials from off-site. The stability berm's purpose would be to prevent a blowout of the filter under certain adverse hydraulic conditions. It also would indirectly protect the diaphragm filter from surface erosion.
- Per Reclamation design standards (Reclamation 2011), the berm height could be up to one-half of the reservoir height.
- Work on this project element would take place during phase 2 (January 2024 to July 2025).
- Work on this element would occur within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish except in the case of backwatering. However, Reclamation would employ a cofferdam to prevent backwatering, which would exclude fish from the outlet works during construction (**Figure 9**).

Drainage system and inspection well (phase 2)

- The filter drain would be installed from the upstream left end of the conduit and extend along the farthest downstream extent to the inspection well.
- The auxiliary drain would be 12 inches in width with a typical depth of 10 feet below the outlet channel. The drainpipe would be installed near the left side of the outlet channel using trenching methods. Trenching would expand to approximately 35 feet at its widest and approximately 3 feet at its narrowest. At its upstream end, the drain would terminate at an auxiliary inspection well that is being included as part of an effort to improve monitoring in this area. At its downstream end, the drain would discharge into the stilling basin just to the left of the end of the concrete liner.
- A pair of pumps would be installed at the bottom of the well, about 20–30 feet below the surface, to ensure any collecting seepage is drained properly. Theses pumps would be triggered at a specified depth of water in the bottom of the well. One of them would be designated as the backup.
- Work on this project element would take place during phase 2 (January 2024 to July 2025).
- Work on this element would occur within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish except in the case of backwatering. However, Reclamation would employ a cofferdam to prevent backwatering, which would exclude fish from the outlet works during construction (**Figure 9**).

Restoration (Post-Project)

- The 7 acres of non-permanent disturbance would be reclaimed through restoration after project completion (see restoration, below). All earth areas capable of supporting vegetation, which this project has exposed or disturbed, would be graded to a stable grade and revegetated. Where seeding is expected to have a moderate or high probability of success, the site would be seeded with a suitable native seed mix and protected from erosion with weed-free mulch or another suitable biodegradable erosion-control protection. Reclamation would collaborate with the US Forest Service on revegetation practices to develop the revegetation plan (the draft plan is included as **Appendix F**).

2.1.3 Operation and Management During Construction

Reclamation does not anticipate reservoir-level restrictions to occur, and construction of the extension and lining of the outlet works would be timed to avoid major issues with water deliveries.

To repair the bypass, Reclamation is prepared to have a maximum of four, up to 12-hour conduit outages, which is when the low-flow bypass and the gates of the Kachess Dam will need to be closed, and the outlet works would need to be shut off. This does not preclude passing water over the spillway or pumping water when needed. During these outages, Reclamation plans to maintain at least 10 cfs of minimum flows in the Kachess River either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years.

To increase the likelihood of providing 10 cfs to the Kachess River during the conduit outages, Reclamation would rely on the following strategies:

- Time outages to coincide with times when the spillway can provide water.
- Provide incentives to the contractor to limit the duration and frequency of outages.
- Secure the necessary materials before 2024 to facilitate rapid installation while eliminating the potential for schedule impacts from availability or shipping issues.
- Communicate with the NMFS and USFWS early and often about reservoir and water year predictions.

In addition, if Reclamation plans to employ pumps to maintain minimum flows when passing water over the spillway is not possible, Reclamation would employ pumps in the following fashion:

- Reclamation would place the pumps in the intake of the spillway or on the dam crest.
- Reclamation would maintain the pumps to ensure risks are not imposed on the reservoir and the dam.
- Reclamation would most likely propose to use two pumps with a capacity of 5 cfs each. Reclamation would require redundancy to limit any risk associated with pump outages and shutdowns.
- With redundancy, there would be an estimated four pumps; two would be primary and two would be backup pumps.
- All pumps would have NMFS-compliant fish screens.
- Reclamation would place intake lines to limit the effects on the dam face or reservoir bed.

If Reclamation is not able to either pass water over the spillway or pump during one of the four possible conduit outages, dewatering of the Kachess River below the project area could occur, in which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The need for this to occur will depend on reservoir storage and water year, but it would only occur when the reservoir is less than 2,245 feet and during the March–December work window. This dewatering event would coincide with when Easton Lake gates are raised, when it is not dewatered in the winter, to lessen the distance of the impact. This would most likely occur in the fall, but based on water year, there is a chance this might need to take place in the spring or summer. It is anticipated that one dewatering event would be needed and would take place for a time period not to exceed 12 hours. If it is necessary to dewater the Kachess River, at least 30 calendar day advance notice of the event will be given to USFWS, NMFS, WDFW, and other interested parties.

Target flows will be maintained at all times below Easton Dam. Flow releases may be made from Keechelus Dam while Kachess outflows are reduced in order to maintain target flows at Easton. Flow releases will be coordinated with Yakima Field Office River Operations, the System Operations Advisory Committee, and others to minimize impacts to instream flow and other operational goals.

Reclamation estimates that stopping releases from the reservoir (at 30 cfs) for up to 12 hours would result in Kachess Reservoir holding approximately 30 acre-feet of water. This could result in a temporary increase in the reservoir's elevation by approximately 0.005 inches for one such event. This change in water level is outside the accuracy of water surface elevation instruments. If necessary, the Keechelus Reservoir would be used to compensate for water deliveries; accordingly, the Keechelus Reservoir would have to release an extra 30 acre-feet of water, which would lower the reservoir level by approximately 0.005 inches.

In the case of a single dewatering event without supplementing water via the spillway or pumping, the construction contractor would adhere to a dewatering plan. **Appendix C** provides a draft plan; the plan would be finalized in coordination with the USFWS, NMFS, and Washington Department of Fish and Wildlife (WDFW). Information regarding fish handling and removal is provided under Conservation Measures (**Section 2.1.6**) and the Dewatering Plan (**Appendix C**). Final details of the salvage will be agreed upon after discussing with all parties and considering site conditions, temperatures, and equipment needs based on the time of year.

Although the term "dewatering event" is used in this document to describe the case of a single conduit outage without supplementing water via the spillway or pumping, it is unlikely that the reach will be completely dewatered. One reason is that seepage from the dam and groundwater recharge would continue. Additionally, a previous monitoring study showed that the stream held water during a flow reduction conducted several years ago. The study showed that the trapezoidal shape of the stream channel results in the flow becoming a narrower band with few isolated side channels, when flow was reduced (see **Section 3.1** for more details; Reclamation 2019b).

Reclamation does not anticipate groundwater removal to occur during the main excavation. There is no plan to pump down the groundwater table. Instead, Reclamation would pump water out from the bottom of the well to a discharge point immediately above the excavation site. Water would flow to the outlet channel (as groundwater seepage flows).

2.1.4 Operation and Management after Construction

Reclamation is currently consulting with the USFWS on the operation and maintenance of Reclamation facilities in the Yakima River Basin (Yakima Project). Effects from the associated operation and management of Kachess Dam due to the Proposed Action will be covered in Yakima Project Consultation, and Reclamation has already submitted a BA (unpublished). The USFWS has stated that it has sufficient information for this consultation and is working on a draft biological opinion (unpublished). Reclamation will not be analyzing the operation and management of the larger Yakima River Basin Integrated Water Resource Management Plan (Reclamation 2012) in the current BA due to concerns with changing the Proposed Action of the consultation already in progress.

2.1.5 Materials and Equipment

During construction, Reclamation would rely on the following equipment:

- For phase 1: dozers, forklifts, chainsaws, log chippers, log shredders, trucks and trailers, cranes, front-end loaders, screens, motor graders, water trucks, and compactors
- For phase 1: 425 feet of 10-foot diameter pipe, trucks, and cranes
- For phase 2: trucks; front-end loaders; off-road trucks, cranes, and dozers; and concrete trucks

For phase 1, gravel would be imported, likely from Cle Elum. This would be done with the following equipment and schedules:

- Street legal, 15-ton trucks, using either a side, belly, or end dump with pups (trailers)
- Delivery would consist of approximately 140 loads, with 3 hours per trip, 3 trips per day per truck on a 10-hour day. Thus, 5 trucks would take 9 workdays.

Phase 1 (pipe fabrication and delivery) would include the following equipment and schedules:

- Pipe would be delivered on 40- to 45-foot commercial tractor/trailers, with 40 feet of pipe per truck consisting of 11 truckloads over 3 days.

For zone 3 sand delivery during phase 3, sand would be delivered from a commercial source, likely in Cle Elum. This would be done with the following equipment and schedules:

- Street legal, 15-ton trucks, using either a side, belly, or end dump with pups (trailers)
- In order to deliver 520 truckloads in 5 days, Reclamation likely would require 8–10 trucks over 17–21 working days from May to June.

For installation of concrete around the pipe downstream of the conduit during phase 3, concrete is expected to come from Cle Elum or Ellensburg. This would be done with the following equipment and schedules:

- About 69 trucks would be required for delivery of concrete.
- Constructing formwork and installing rebar would occur for about 3 months from March 18 to June 9.
- Typically, a contractor may place 100 cubic yards of concrete in a day, usually for 4 hours in the morning. Adjacent placements must be scheduled 7 days apart for proper curing.

Accordingly, concrete would be placed on about 6 days during this period. About 13 truckloads would be required.

- Assuming concrete is placed over a 4-hour period, 5 trucks would come from Cle Elum or 8 trucks would come from Ellensburg each day for 6 days over the 3 months.

2.1.6 Conservation Measures

Conservation measures are actions to benefit or promote the recovery of listed species that a federal agency includes as an integral part of the Proposed Action. These actions would be taken by the federal agency or the contractor and serve to minimize or compensate for project effects on the species under review. These may include actions taken prior to the initiation of consultation, or actions that the federal agency has committed to complete a BA or similar document (USFWS and NMFS 1998).

To minimize impacts on listed species and critical habitat, Reclamation would implement the conservation measures described below.

Biological resources general

- Conduct an environmental awareness training for all employees, contractors, and site visitors to educate on-site personnel about sensitive biological resources and relevant measures and regulations that protect biological resources.
- A qualified biologist or natural resource professional along with the construction contractor would provide environmental training for all project workers and staff to inform personnel of the regulatory compliance requirements and responsibilities for conserving environmental resources. This program would include, but not be limited to, special status species information and conservation; worker compliance responsibilities; noncompliance penalties or significant risks of litigation; and best management practices (BMPs) and conservation measures described in this section, such as project speed limits, weed control, avoidance of wildlife buffers, species reporting, debris control, and hazardous waste management.
- Reclamation and its contractors by extension would implement the following pollution and erosion-control measures:
    a. Identify a project contact (name, phone number, and address) that would be responsible for implementing pollution and erosion-control measures.
    b. List and describe any hazardous material that would be used at the project site, including procedures for inventory, storage, handling, and monitoring; notification procedures; specific cleanup and disposal instructions for different products available on the site; proposed methods for disposal of spilled material; and employee training for spill containment.
    c. Temporarily store any waste liquids generated at the staging areas under cover on an impervious surface, such as tarpaulins, until they can be properly transported to and treated at an approved facility for treatment of hazardous materials.
    d. Follow procedures based on BMPs to confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, cement, grout, washout facility, welding slag, petroleum products, or other hazardous materials generated, used, or stored on-site.

e. Follow procedures to contain and control a spill of any hazardous material generated, used, or stored on-site, including notification of proper authorities. Ensure materials for emergency erosion and hazardous materials control are on-site (for example, silt fence, straw bales, or oil-absorbing floating boom whenever surface water is present).

f. Follow BMPs to confine vegetation and soil disturbance to the minimum area and the minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action area.

g. Do not allow any uncured concrete or form materials to enter the active stream channel.

h. Take steps to cease work under high flows, except for efforts to avoid or minimize resource damage.

Aquatic ecosystems and aquatic special status species

- Consult all local, state, and federal regulations for the development of an appropriate buffer distance between the development site and any wetland or waterway.
- Prepare and carry out a temporary erosion and sediment control plan and a spill prevention control and containment plan, commensurate with the size of the project, to prevent pollution caused by surveying or construction operations (NOAA Fisheries 2017).
- Perform construction activities by methods that would prevent entrance, or accidental spillage, of solid matter, contaminants, debris, or other pollutants or wastes into streams, flowing or dry watercourses, lakes, wetlands, reservoirs, or underground water sources.
- When not in use, store vehicles and equipment containing oil, fuel, or chemicals in a staging area. For staging and construction areas, comply with all permits received through the Army Corps of Engineers and other relevant agencies and accordingly employ sediment control and other mitigation measures identified through consultation and permitting.
- Do not stockpile or deposit excavated materials or other construction materials near or on stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff or can in any way encroach upon the watercourse.
- Take measures to ensure no petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into waters of the United States.
- Do not permit the use of acids for cleaning or preparing concrete surfaces for repair.
- Keep spill prevention and cleanup kits on-site when heavy equipment is operating within 25 feet of the water.
- Check equipment daily for leaks and complete any necessary repairs prior to commencing work activities around the water (NOAA Fisheries 2017).
- Have a supply of emergency erosion-control materials on hand and install and maintain temporary erosion controls in place until site restoration is complete (NOAA Fisheries 2017).
- Control pollutants by using sediment and erosion controls, wastewater and stormwater management controls, construction site management practices, and other controls, including state and local control requirements.

- Establish methods for controlling sediment and erosion that address vegetation practices, structural control, silt fences, straw dikes, sediment controls, and operator controls, as appropriate.
- Institute stormwater management measures as required by federal, state, and local laws and regulations, including velocity dissipators, and solid waste controls that address controls for building materials and off-site tracking of sediment.
- Use methods of dewatering, unwatering, excavating, or stockpiling earth and rock materials that include prevention measures to control silting and erosion, and that would intercept and settle any runoff of sediment-laden waters.
- Prevent wastewater from general construction activities, such as drain water collection, aggregate processing, concrete batching, drilling, grouting, or other construction operations, from entering flowing or dry watercourses without the use of approved turbidity control methods.
- Divert stormwater runoff from upslope areas away from disturbed areas.
- Mark boundaries of clearing limits associated with site access and construction to avoid or minimize disturbance of riparian vegetation, wetlands, and other sensitive sites (NOAA Fisheries 2017).
- During three out of four potential conduit outages, supply water to the Kachess River at a minimum of 10 cfs on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. Screen all pumps according to the most recent NMFS screening guidelines.
- In the case of a potential single conduit outage without supplementing water via the spillway or pumping, ensure the construction contractor adheres to a dewatering plan. A draft plan is provided in **Appendix C**, and Reclamation will finalize the plan in coordination with the USFWS, NMFS, and WDFD. As stated in the plan, conduct fish handling and removal in accordance with fish exclusion protocols developed by the Washington Department of Transportation (WSDOT 2016) and as requested by the NMFS and USFWS. Ensure a fish biologist with the experience and training necessary to handle ESA species coordinates all fish handling and rescue activities. Do not use electroshocking until all areas to be electro-fished are isolated and all adult or subadult-sized fish are herded from the area. Work closely with staff biologists, USFWS Endangered Species Office and Mid-Columbia Fish and Wildlife Conservation Office biologists, and NMFS biologists to ensure species are handled to the most minimal extent possible.
- Develop an appropriate water quality monitoring plan in cooperation with the USFWS and NMFS prior to implementation. Conduct turbidity monitoring during all phases of construction. Ensure the construction contractor measures the duration and extent of the turbidity plume (visible turbidity above the background) generated by turbidity-generating construction, including after rain, prior to completing vegetation reclamation. Should observed turbidity exceed allowable levels at the point of compliance specified below, temporarily stop in-water construction until turbidity has cleared. Then recommence in-water construction at a slower rate to minimize generated turbidity. Conduct monitoring and additional temporary work stoppages, as needed.

  Take turbidity measurements in nephelometric turbidity units (NTUs) and submit the data to the USFWS following project construction. In accordance with Washington Administrative

Code (WAC) 173-201A-200(1)(e)—Aquatic life turbidity criteria, for the salmonid rearing and migration category, do not exceed the following maximum allowable turbidity levels:

- 10 NTUs over background when the background is 50 NTUs or less, or
- a 20 percent increase in turbidity when the background turbidity is more than 50 NTUs.

Modify the turbidity criteria established under WAC 173-201A-200(1)(e)—without specific written authorization from the Washington Department of Ecology (Ecology)— to allow a temporary area of mixing during and immediately after necessary in-water construction activities that result in the disturbance of in-place sediments. This temporary area of mixing is subject to the constraints of WAC 173-201A-400(4) and (6). It can occur only after the activity has received all other necessary local and state permits and approvals, and after the implementation of appropriate BMPs to avoid or minimize disturbance of in-place sediments and exceedances of the turbidity criteria. A temporary area of mixing shall be as follows:

- For waters up to 10 cfs flow at the time of construction, the point of compliance shall be 100 feet downstream from the activity causing the turbidity exceedance.
- For waters between 10 cfs and 100 cfs flow at the time of construction, the point of compliance shall be 200 feet downstream of the activity causing the turbidity exceedance.
- For waters above 100 cfs flow at the time of construction, the point of compliance shall be 300 feet downstream of the activity causing the turbidity exceedance.
- When reintroducing flow, slowly reintroduce water to prevent the loss of surface water downstream as the dewatered streambed absorbs water and to prevent a sudden release of suspended sediment.

Terrestrial ecosystems and vegetation

- Preserve and protect the natural landscape and existing vegetation not required or otherwise authorized to be removed.
- Minimize, to the greatest extent practicable, clearings and cuts through vegetation.
- Do not use trees for anchorages except in emergency cases or as approved by Reclamation. Where approved, wrap the trunk with a sufficient thickness of approved protective material before placing the rope, cable, or wire.
- Before bringing construction equipment on-site, clean it to remove dirt, vegetation, and other organic material to prevent introduction of noxious weeds, and invasive plant and animal species.
- Implement contractor cleaning procedures to at least the level described in the Reclamation Cleaning Manual (Reclamation 2010). Inspect construction equipment following procedures described in the Reclamation Cleaning Manual before allowing the equipment on-site.
- Regrade and reclaim temporary contractor use areas with an appropriate native seed mix according to a revegetation plan. Develop the revegetation plan in collaboration with the US Forest Service and consistent with the USFWS project biological opinion.

Wildlife and terrestrial special status species

- Implement all terms and conditions for listed species from the project biological opinion.

- Collaborate with the US Forest Service for placement of removed trees and vegetation for wildlife habitat improvement. Should the WDFW have input on this plan, accept and consider the input for inclusion. Notably, ensure Reclamation supports the reuse in the habitat project, even though Reclamation would have no role in the placement of salvaged trees in specific projects.
- Schedule all necessary vegetation removal, trimming, and grading of vegetated areas outside the bird breeding season (generally March 1 to August 31) to the maximum extent practicable.
- Avoid construction activities during the bird breeding season (generally March 1 to August 31) to the extent practicable.
- When project activities cannot occur outside the bird nesting season (generally March 1 to August 31), conduct pre-disturbance surveys prior to scheduled activity to determine whether active nests are present within the wildlife analysis area and buffer any active nesting locations found during surveys. Ensure a qualified biologist conducts the surveys no more than 7 days prior to disturbance activities. If active nests are detected during these surveys, ensure the qualified biologist establishes a no-activity buffer zone around the nest based on species, project disturbance level, topography, existing disturbance levels, and habitat type until fledging has occurred. If a bird establishes a new nest during ongoing project activities, do not remove or modify the nest vegetation, but do not require a buffer zone. If there is a pause in project activities greater than 7 days, conduct an additional nesting bird survey.
- In coordination with USFWS, implement a modified protocol for surveying proposed management activities that may impact NSO to assess potential NSO status. This modified survey approach includes results from 2021 NSO disturbance only surveys for the focus project area, conducting in 2022 at least six visits to cover a 1.8-mile buffer around project activities for habitat modification activities, and conducting spot checks in years 2023 and 2024. See Appendix E: NSO Modified Survey Memorandums and the 2012 NSO Revised Survey Protocol (USFWS 2012b) for details.

  If NSOs are detected during any surveys, inform the USFWS as soon as possible.

  Results of the 2022 NSO survey and 2023 spot checks will determine if a seasonal timing restriction is required for year 2023 during the NSO early nesting season (March 1 to July 31). If the 2022 NSO survey and 2023 spot checks do not detect NSO, then phase 1 can begin as soon as 2023 spot checks are complete (likely mid-April to May 1). A positive NSO detection would require follow-up visits to determine the status. If follow-up surveys determine NSO residency or a NSO pair, then a timing restriction from March 1 to July 31, 2023, would be implemented during phase 1. This would minimize or preclude the ability to remove trees with intact rootwads for habitat improvement projects (requires tree clearing to begin by at least June 1), but tree clearing could still be accomplished during phase 1 and not delay the project schedule.

  In spring 2024, conduct spot checks. These can occur concurrently with other project activities because habitat removal would have already been completed, and disturbance activities will be ongoing and continuous from the previous year. In the unlikely event a NSO establishes residency in the 0.25-mile disturbance buffer, Reclamation would immediately coordinate with the USFWS for emergency take authorization.

- Areas cleared for temporary use within NSO suitable or critical habitat could be replanted with overstory trees in coordination with a local USFWS biologist and a replanting plan developed with the US Forest Service. The areas cleared for permanent use cannot be replanted with overstory trees.
- Reclamation would have a biologist on-site to mark any trees over 30 feet diameter at breast height (dbh) to work with the contractor to see if trees can be retained without inhibiting the construction of the project. Reclamation would also work with the USFWS, WDFW biologists, and Okanogan-Wenatchee National Forest US Forest Service biologists to determine the appropriate amount of woody debris to leave in areas that will not be operationally maintained.

Chapter 3. Status of Listed Species and Critical Habitat

This assessment examines the status of each species that the Proposed Action would adversely affect. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution," as described in 50 CFR 402.02. The assessment also examines the condition of critical habitat throughout the designated area.

3.1 Status of the Species: Bull Trout

In 1999, the USFWS listed the coterminous US population of Bull Trout as a threatened species under the ESA (64 *Federal Register* 58910, November 1, 1999). The 1999 listing also included adding the Coastal-Puget Sound and Saint Mary-Belly River populations. Previously, the Columbia, Klamath, and Jarbridge River populations were listed in 1998 (63 *Federal Register* 31647, June 10, 1998; 64 *Federal Register* 17110, April 8, 1999). Throughout its range, the Bull Trout is threatened by the combined effects of habitat degradation, fragmentation, and alteration (associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, and poor water quality), incidental angler harvest, entrainment, and introduced nonnative species (64 *Federal Register* 58910).

Detailed discussions of Bull Trout conservation needs, life history, diet, reproductive biology, population dynamics, and genetic and phenotypic diversity are included in the Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015a). In recognition of available scientific information relating to their uniqueness and significance, six segments of the US population of the Bull Trout are considered essential to the survival and recovery of this species; these segments are identified as the following recovery units: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake (USFWS 2015a).

The Yakima Bull Trout Action Plan (Reiss et al. 2012) is a locally developed, up-to-date summary of information on Bull Trout populations in the Yakima River Basin, including information on the population status, trend, and distribution; information on the habitat; a detailed analysis of threats by life stage for each population; and specific monitoring and restoration actions that address those threats. In 2016, the Yakima Bull Trout Working Group (BTWG) began updating the actions identified in the Bull Trout Action Plan to ensure they are complete, up-to-date, and linked with the 2015 Recovery Plan. As of August 2017, all the actions in the Yakima Bull Trout Action Plan had been reviewed and updated, and the 2017 Action Plan Update presents updated actions and next steps for recovery (BTWG 2017). These additional documents are incorporated by reference.

3.2 Status of Critical Habitat: Bull Trout

The USFWS first issued proposed critical habitat rules for several mainstem and tributary reaches of the Yakima River Basin in November 2002 (67 *Federal Register* 71235). In October 2004, the USFWS designated a wide area of Bull Trout critical habitat; this area included 1,748 miles of stream habitat and 61,235 acres of lakes and marshes within the Klamath and Columbia River Basins (69 *Federal Register* 59995). For the Middle Columbia River Basin (Critical Habitat Unit 20), critical habitat designations were listed for 269 stream miles, all within the Yakima River Basin.

In September 2005, the USFWS issued a revised final designation for Bull Trout critical habitat and reduced the amount of critical habitat designated in the Middle Columbia River Basin to 188 stream miles (70 *Federal Register* 56212). In response to a lawsuit, the USFWS voluntarily remanded the 2005 final rule. On October 18, 2010, the USFWS issued the final rule for the revised critical habitat designation for Bull Trout in the coterminous United States (75 *Federal Register* 63897).

The final designated critical habitat rule issued in 2010 increased designated stream habitat by 3 percent relative to that designated in 2004 (75 *Federal Register* 2270). Under the new final rule, critical habitat units are organized by recovery units, with the Mid-Columbia Recovery Unit including the Yakima River (Critical Habitat Unit 11). The 2010 listing identifies the Yakima River as a critical habitat unit, with 557.3 stream miles and 15,530.9 acres of lakes and reservoirs designated as critical habitat. The mainstem Yakima River and the Kachess and Cle Elum Rivers below their respective reservoirs are included in the designation. Key reservoirs and reservoir tributaries also designated as critical habitat in the 2010 final designation include Keechelus, Kachess, and Cle Elum Reservoirs; Box Canyon Creek; the Kachess River and Mineral Creek up to natural waterfalls in these systems upstream of Kachess Dam; and Gold Creek up to a natural waterfall fish passage barrier upstream of Keechelus Dam. **Figure 2** and **Figure 3** show Bull Trout critical habitat in the action area and project area, respectively.

The final critical habitat designation in 2010 (75 *Federal Register* 63897) lists a total of nine primary constituent elements (PCEs) that are designed to incorporate what is essential for Bull Trout conservation in the Klamath River and Columbia River Basins. PCEs include, but are not limited to, space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, and rearing (or development) of offspring; and habitats that are protected from disturbance (69 *Federal Register* 59995). The nine PCEs listed in the final rule include water temperature, channel complexity, substrate quality, hydrology, springs/seeps/groundwater, migratory corridors, food base, competition, and permanent water sources (USFWS 2010).

The condition of Bull Trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historical range, the Bull Trout occurs in low numbers in many areas. Overall, Bull Trout abundance is “stable” range-wide (USFWS 2015b, p. iii). However, 81 core areas have 1,000 or fewer adults, with 24 core areas not having surveys conducted to determine adult abundance (USFWS 2008a, p. 22; USFWS 2015a, p. 2). In addition, 23 core areas have declining populations, with 66 core areas having insufficient information (USFWS 2008a, p. 22; USFWS 2015a, p. 2). These values reflect the condition of Bull Trout habitat. The decline of Bull Trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species (63 *Federal Register* 31647, June 10, 1998; 64 *Federal Register* 17112, April 8, 1999).

There is widespread agreement in the scientific literature that many factors related to human activities have impacted Bull Trout and its habitat, and they continue to do so. Among the many factors that contribute to degraded PCEs, those that appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows (USFWS 2021a):

- Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7)
- Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii-v, 20–45)
- The introduction and spread of nonnative fish species, particularly brook trout (*S. fontinalis*) and lake trout (*S. namaycush*), as a result of fish stocking and degraded habitat conditions, which compete with Bull Trout for limited resources and, in the case of brook trout, hybridize with Bull Trout (Leary et al. 1993; Rieman et al. 2006)
- In the Puget Sound and Olympic Peninsula geographic regions where anadromous Bull Trout occur, degradation of main stem river foraging, migration, and overwintering (FMO) habitat, and the degradation and loss of marine nearshore foraging and migration habitat due to urban and residential development
- Degradation of FMO habitat resulting from a reduced prey base, roads, agriculture, development, and dams

3.3 Status of the Species: Northern Spotted Owl

The NSO was listed as threatened under the ESA in 1990 due to widespread habitat loss and inadequacy of existing regulatory mechanisms to provide for its conservation (50 CFR 17; USFWS 1990). The revised recovery plan identifies three main threats to the NSO: current and past habitat loss and competition with barred owl. The plan also describes a recovery strategy that includes habitat conservation and active forest management as means to address these threats (USFWS 2011).

Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the NSO can be found in the revised recovery plan (USFWS 2011). The revised recovery plan identifies discrete recovery units throughout the NSO's entire range such that each unit provides an essential survival and recovery function for the species. The recovery units are intended to assist managers in reestablishing or maintaining (1) historical or current genetic flow between NSO populations, (2) current and historical NSO population and habitat distribution, and (3) NSO meta-population dynamics. The recovery units correspond to 12 physiographic provinces within the NSO's range (USFWS 1992). These physiographic provinces are based largely on the regional distribution of major forest types and state boundaries from southern British Columbia, Canada, south to Marin

County, California. Most of these physiographic provinces are assessed for demographic trends (USFWS 2011).

3.4 Status of Critical Habitat: Northern Spotted Owl

Critical habitat for the NSO was originally designated in 1992. The critical habitat designation was revised in 2012 (USFWS 2012a), following the publication of the final revised recovery plan. Critical habitat for the NSO now includes over 9.5 million acres of federal lands in California, Oregon, and Washington. The USFWS reduced critical habitat for the NSO in January 2021 by over 3 million acres across the species' range (primarily on Oregon and California Railroad Revested lands). After a review of the best available scientific and commercial information, the USFWS is proposing to withdraw the January 15, 2021, final rule and instead, propose to revise the species' designated critical habitat by excluding approximately 204,797 acres in Oregon (USFWS 2021b). There are 177.9 acres of NSO designated critical habitat in the action area, and 42.8 acres are directly within the project area (**Figure 4** and **Figure 5**).

The 2012 final rule (77 *Federal Register* 71876) includes four physical and biological features (PBFs, formerly referred to as PCEs) specific to the NSO; these are the PBFs of critical habitat essential to a species' conservation. In summary, PBF 1 is forest types that may be in early-, mid-, or late-seral stages and that support the NSO across its geographical range; PBF 2 is nesting and roosting habitat; PBF 3 is foraging habitat; and PBF 4 is dispersal habitat (see 77 *Federal Register* 71876, December 4, 2012; pp. 72051–72052, for a full description of the PBFs).

3.5 Status of the Species: Middle Columbia River Steelhead

The Middle Columbia River (MCR) steelhead trout distinct population segment (DPS) was listed as threatened on March 25, 1999 (64 *Federal Register* 14517), and its threatened status was reaffirmed on June 28, 2005 (70 *Federal Register* 37160). The threatened status was once again affirmed during 5-year status reviews on August 15, 2011 (76 *Federal Register* 50448) and again on May 26, 2016 (81 *Federal Register* 33468). This DPS includes naturally spawned anadromous steelhead trout originating below natural and human-made impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River, Washington. This DPS excludes steelhead from the Snake River Basin. Middle Columbia River steelhead are part of the Middle Columbia River Recovery Sub-domain, which is one of three sub-domains comprising the Interior Columbia River Recovery Domain. The recovery domains represent geographic recovery planning areas for ESA-listed salmonoid species.

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 saltwater before reentering freshwater, where they may remain up to a year before spawning (Howell et al. 1985). All steelhead upstream of the Dalles Dam are summer-run (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. Steelhead spawning is widely distributed throughout the areas accessible to them, except in the Lower Yakima River and its tributaries (below the Satus Creek confluence).

Steelhead currently cannot access the watersheds above Tieton, Bumping, Cle Elum, Kachess, and Keechelus Dams, and a number of significant tributaries (such as Wenas, Manastash, and Naneum Creeks) in the Upper Yakima population area (NMFS 2009). Although spawning has not been documented in the Kachess River below Kachess Dam, it is feasible for steelhead to spawn there. This is because it is accessible to them and there are juveniles present in the area. The spawning period in this area would likely be in April–May.[3] Fry emergence typically occurs between May and the end of June, and juvenile steelhead generally rear in the areas near where they were spawned (NMFS 2020). In the lower reaches in the Naches River, emergence timing is likely between May and mid-July (City of Yakima 2020). After spending 2 to 3 years rearing in freshwater, steelhead smolts outmigrate from the subbasin from early spring through June.

More detailed information on the biology, ecology, status, and trends of the species is available in the listing regulations, referenced above; the Middle Columbia River Steelhead Distinct Population Segment ESA Recovery Plan (NMFS 2009); the most recent 5-year status review (NMFS 2016); and the 2022 Biological Viability Assessment Update for Pacific Salmon and Steelhead Listed Under the ESA: Pacific Northwest (Ford 2022). These additional documents are incorporated by reference. The current condition of steelhead in the action area is described under **Section 4.6**.

3.6 Status of Critical Habitat: Middle Columbia River Steelhead

The NMFS issued a final rule designating critical habitat for 12 evolutionarily significant units (ESUs) of West Coast salmon (chum [*Oncorhynchus keta*], sockeye [*O. nerka*], and Chinook [*O. tshawytscha*]) and steelhead listed under the ESA. The specific areas designated in the rule include approximately 20,630 miles (33,201 kilometers) of lake, riverine, and estuarine habitat in Washington, Oregon, and Idaho, as well as approximately 2,312 miles (3,721 kilometers) of marine nearshore habitat in Puget Sound, Washington. Some of the areas designated are occupied by two or more ESUs.

For Middle Columbia River steelhead, 8,049 miles of critical habitat were designated within 114 watersheds within the range of this ESU. Designated critical habitat in the action area includes all areas of Kachess River in the action area between Kachess Reservoir and Lake Easton, and from Lake Easton upstream through the Keechelus reach of the Yakima River to Keechelus Dam (**Figure 2**; NMFS 2005).

Within designated critical habitat, six PBFs (formerly PCEs) were determined essential for the species' conservation. These were based on the unique life history of salmonoids and their biological needs. PBFs are described for the habitat types within the full range of habitat designated as critical for listed salmonid species. The Proposed Action, however, affects only freshwater habitats. The six PCEs are freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas (NMFS 2005).

[3] Personal communication with Patrick Monk, Reclamation, on November 2, 2020

This page intentionally left blank.

Chapter 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 impacts of state or private actions that 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).

4.1 Current Condition of the Species in the Action Area: Bull Trout

4.1.1 Yakima Core Area population

The action area for Bull Trout (**Figure 2**) is part of the Yakima Core Area, in the Middle Columbia River Recovery Unit (Mid-C RU). The Mid-C RU comprises 24 Bull Trout core areas, as well as two historically occupied core areas and a research needs area. Core areas are functionally similar to Bull Trout meta-populations in that Bull Trout within a core area are much more likely to interact, both spatially and temporally, than are Bull Trout from separate core areas. Major drainages in the Mid-C RU include the Methow River, Wenatchee River, and Yakima River, among others (USFWS 2015a, 2015b).

Bull Trout are distributed throughout the Yakima River Basin. Critical habitat has been designated throughout much of the basin, as described in the USFWS 2010 Final Critical Habitat Rule (75 *Federal Register* 63898) and in **Section 3.1.3**. The number of recognized local populations in the Yakima Basin has shifted over time, and questions about the status of several local populations remain. However, the newest information indicates there are 15 populations in this area (Reiss et al. 2012; USFWS 2015a, 2021a). These include four fluvial populations (mainstem Yakima River, American River, Crow Creek, and Rattlesnake Creek), two resident populations (North Fork Teanaway River and Ahtanum Creek), and nine adfluvial populations (Gold Creek, Box Canyon Creek, Kachess River, Cle Elum River, Indian Creek, South Fork Tieton River, North Fork Tieton River, Bumping River [includes Deep Creek], and Waptus Lake). More recently, Bull Trout have been captured at various locations in the mainstem Yakima River, and redds have been observed in the Upper Yakima River between Keechelus Dam and Lake Easton (Reclamation 2019a; USFWS 2021a).

Bull Trout abundance in the Yakima Core Area has been tracked primarily through redd surveys conducted on index reaches in spawning areas. Comparable data from redd surveys in the Yakima Core Area are available from 1984 through 2017 (Table 6 in Reclamation 2019a, pg. 40). The populations in the Yakima Core Area have spawning areas in headwaters streams. They also use lower reaches of the stream and larger rivers and connected lakes as FMO areas (Reiss et al. 2012).

Upper Yakima River Basin Local Populations

Based on information from the 2015 USFWS Final Recovery Plan (USFWS 2015c), the Upper Yakima River Basin consists of several local populations, including the Yakima River, Kachess Reservoir (Box Canyon Creek and Kachess River), Keechelus Reservoir (Gold Creek), Teanaway River, and Cle Elum Reservoir (Cle Elum and Waptus River) local populations. Bull Trout within the action area are likely part of the Gold Creek, Box Canyon Creek, Kachess River, and Upper Yakima River local populations. The status of these populations is described in more detail below.

Figure 13 in the Final Bull Trout Rescue and Rearing BA shows the current Bull Trout distribution and confirmed spawning areas in the Upper Yakima River Basin. This map provides the most up-to-date information on Bull Trout usage of the Upper Yakima River system, but it does not include the most recent data that have been collected on Bull Trout distribution in this area from eDNA testing (Reclamation 2019a, pg. 42).

Keechelus Reservoir

<u>Gold Creek Population</u>

Keechelus Reservoir has one adfluvial Bull Trout population that spawns and rears in Gold Creek. Gold Creek is one of several tributaries of Keechelus Reservoir, but it has the only known spawning habitat for Bull Trout in the Upper Yakima River. Available redd survey data show wide variation, with a range from two in 1984, 1985, and 2017 to 51 in 1996. The recent average from 1999 to 2017 has been 16 redds.

The USFWS (1998) considered the Gold Creek local population to be depressed, decreasing, and at risk of stochastic extirpation. These findings have been reaffirmed in subsequent analyses by the USFWS, including in Yakima Basin conservation assessments, in status reviews (USFWS 2008), and in the Final Bull Trout Recovery Plan (USFWS 2015a). WDFW has rated the status of this stock as being critical since 1998 (WDFW 2004). No information is available about the status of resident Bull Trout. The widespread presence of brook trout raises the possibility of ecological competition and introgressive hybridization. MacDonald et al. (1996) concluded that isolation and low numbers threaten the Keechelus Lake Bull Trout population.

Spawning occurs from early September to mid-October. It is suspected that migrating Bull Trout spawners may enter the creek in July or earlier; however, migration timing is likely affected by channel dewatering patterns and water temperature during this time. The lake provides FMO habitat for subadult and adult fish. Access to habitat areas occupied by other local Bull Trout populations in the core area has been cut off by the presence of Keechelus Dam, which is an impassible barrier to upstream migration. Some fish are potentially entrained and lost below the dam and cannot make it back to Gold Creek. However, entrained fish may survive and develop into fluvial fish in the Yakima River reach downstream of the dam. This population is close in distance to the Kachess and Box Canyon populations.

Kachess Reservoir

Kachess Reservoir was a natural lake comprised of two basins separated by an eastward-dipping reverse fault (Foster 1960). At the time of listing, the USFWS identified only one isolated local population in Kachess Reservoir (Reiss et al. 2012). This subpopulation included only the Box Canyon Creek local population, as Bull Trout spawning had not been observed in the Upper

Kachess River. The 2002 draft recovery plan for the Yakima Core Area (USFWS 2002) recognized both the Box Canyon Creek and Kachess River populations that utilize Kachess Reservoir.

Subsequent genetic analyses (Small et al. 2009) confirmed that the Upper Kachess and Box Canyon populations are distinct. The USFWS (2015) indicates that the Kachess local populations of Bull Trout have "extremely low abundances (that is, less than 20 redds)." Genetic samples collected from the Kachess River subpopulation clustered well with the main stem Upper Yakima group. This indicates that these fish have genetics that tend to be unique to the Yakima Core Area (Small et al. 2009, 2011, 2013).

Bull Trout enter their spawning streams from July to early October and spawn from mid-September through mid-October and sometimes into mid-November, depending on fall rains and access in this local population (WDFW 1998; USFS 2004). The timing of adult migration into this stream system is approximately 2 months later than average for the basin. The timing of spawning is a full month later than average dates (Meyer 2002). The Kachess Lake population is listed as critical by the WDFW (WDFW 1998, Table 1). Only limited spawning habitat is available to adult Bull Trout in the two major tributaries (Kachess River/Mineral Creek and Box Canyon Creek) due to impassible barriers and the predominance of large substrate material.

Both of these populations are relatively small; each has a limited amount of spawning and rearing habitat available below waterfalls that block farther upstream access. Both spawning streams enter Little Kachess Lake above the Narrows. Several other smaller tributaries also flow into Kachess Reservoir, but they are not known to support Bull Trout (Reiss et al. 2012). Kachess Reservoir provides FMO habitat for subadult and adult Bull Trout. Because Kachess Reservoir provides FMO habitat for subadult and adult Bull Trout from both local populations (Reiss et al. 2012), Bull Trout are likely to be present in the primary area of analysis in Kachess Reservoir throughout the year.

To date, the effects of reservoir depletion during summer and early fall have been less concerning in Kachess Reservoir than in other Yakima Basin impoundments. This is because the reservoir has a conservation pool (inactive storage) that has not been accessed for irrigation withdrawal. Both spawning streams enter the upper reservoir (Little Kachess Lake) above the Narrows; therefore, any Bull Trout residing in the lower reservoir would need to pass through the Narrows to reach spawning areas. Adult passage through the Narrows has not been observed to be a problem in the past, but observations during the lowest pool drawdowns are limited and not sufficient to quantify adult passage. It has been speculated that passage through the Narrows would be impeded at reservoir elevations of 2,204 feet and below. Currently, it is understood that the barriers between the Little Kachess Lake and main Kachess Lake can form and remain for over a year or more in drought conditions, when the reservoirs are drawn down and precipitation does not refill the reservoirs (Reclamation 2019a).

Box Canyon Creek Population

Box Canyon Creek originates in the Alpine Lakes Wilderness Area and flows into Kachess Reservoir from the northwest near its northern end. The reach accessible to migratory fish is relatively short, with an impassable waterfall (Peekaboo Falls) located at its upstream end approximately 1.6 miles above the lake.

Juvenile rearing occurs in the entire 1.6-mile accessible reach. Adult Bull Trout move into Box Canyon Creek in mid-July to mid-August, prior to spawning, and numerous fish migrate to and hold in the large pool directly below Peekaboo Falls. The spawning period for the Box Canyon Creek population begins in early September and can extend through mid-October. It is possible that a resident component exists as well, although this has not been confirmed.

Complete Bull Trout redd surveys have been conducted since 1984. Redd counts have been highly variable with the first 10 years having very low to zero counts. This was probably due in large part to limited adult access to the creek, as several years from the late 1980s through the mid-1990s were drought years in the Yakima River Basin. Chronic passage problems that occur at the mouth were not yet fully recognized or monitored at that time (Reiss et al. 2012). From 1999 to 2017, the average number of Bull Trout redds in Box Canyon Creek was 12. The count ranged from 2 to 31 (Table 6 in Reclamation 2019a, pg. 40) during that time period.

<u>Kachess River Population</u>

The Upper Kachess River is the smaller of two streams in what is locally known as the Kachess/Mineral system. Mineral Creek joins the river approximately 1.2 miles above the reservoir (at full pool) and contributes an estimated 75 percent of the combined flow of the two streams (Meyer 2002). Even though Mineral Creek provides more flow, the stream is referred to as the Kachess River below this confluence. Reiss et al. (2012) refer to it as the Upper Kachess River to differentiate it from the short reach remaining below Kachess Dam before it flows into Lake Easton on the Yakima River. The Lower Kachess River provides forage migration habitat for Bull Trout residing below the dams in the Upper Yakima. In the Mizell and Anderson Radio Telemetry Study, one fish was tagged below Kachess Dam. It was a female tagged in December and identified through genetics to be a Gold Creek Bull Trout (Mizell and Anderson 2015).

The Upper Kachess River adfluvial population spawns primarily in the Upper Kachess River above the Mineral Creek confluence, although a few redds are sometimes found below this point. Mineral Creek contains some suitable spawning habitat, and three redds were found in Mineral Creek during the 2017 redd surveys. In addition, Bull Trout were observed in Mineral Creek in prior years, which indicates that at least minimal spawning occurred during those years.[4] In addition, juvenile Bull Trout use both Mineral Creek and the Upper Kachess River for rearing with their distribution extending to the lake. Kachess Reservoir provides FMO habitat for subadult and adult fish. It is possible that a resident component also exists, although this has not been confirmed.

Adults have been observed to migrate into the Upper Kachess River in October, after fall rains have re-watered the reach above the lake (Meyer 2002). Spawning typically extends from mid-October through mid-November, which is about a month later than other Bull Trout populations in the Yakima River Basin. Fall rains render redd surveys difficult, but the highest redd count on record is 33 in 2011 (Table 6 in Reclamation 2019a, pg. 40).

The USFWS (1998) considered the Kachess River population to be depressed, decreasing, and at risk of stochastic extirpation. At the time, this local population did not include the Upper Kachess River local population, as Bull Trout spawning had not been observed in the Upper Kachess River,

[4] Scott Kline, WDFW, personal communication, 2019

and a local population was not recognized. The findings have been reaffirmed in subsequent analyses by the USFWS, including in Yakima Basin conservation assessments, in status reviews (USFWS 2008), and in the Final Bull Trout Recovery Plan (USFWS 2015a). WDFW rates the status of the Kachess Lake stock (which included the Upper Kachess River population) as critical; the WDFW further states that the Kachess Lake stock was very near extirpation (WDFW 2004).

Yakima River Population (Including Main Stem: Easton–Keechelus Reach and Kachess–Easton Reach)

The Yakima River begins at Keechelus Lake and flows southeasterly for about 214 miles to its confluence with the Columbia River. The Kachess River is one of the Yakima River's many smaller tributaries; it meets the Yakima River at Lake Easton, a 237-acre impoundment (at full pool) that is located slightly less than a mile upstream of the lake. The Easton Diversion Dam is equipped with upstream and downstream fish passage facilities; other diversion dams in the Yakima River Basin also are equipped with these facilities.

At the time of listing, the USFWS found no evidence that a subpopulation of Bull Trout remained in the mainstem Yakima River (USFWS 1998). The WDFW, however, did recognize a mainstem Yakima stock (WDFW 1998). Old catch records and anecdotal accounts indicated the species was present in the main stem historically; however, Bull Trout had rarely been encountered in the recent past, and no spawning activity had been observed. Through 1998, after 8 years of intensive electrofishing surveys, only four Bull Trout were captured in the main stem Upper Yakima River. Three of these fish were caught near Cle Elum and one near Ellensburg. (These surveys were conducted as part of the Yakima Species Interaction Study, a cooperative effort between the WDFW and Yakama Nation under the umbrella of the Yakima-Klickitat Fisheries Project.) Other Bull Trout sightings included an adult Bull Trout illegally caught in 1996 by an angler in Lake Easton (a 238-acre impoundment formed above Easton Diversion Dam) about 11.5 miles below Keechelus Dam (Reclamation 2019a).

More recently, the USFWS has indicated that a local populations exists (USFWS 2004–2010 draft and final critical habitat rules; USFWS 2015). For example, during spring Chinook brood stock collection at the Roza Diversion Dam (RM 127.9) in 1999, Yakama Nation fisheries personnel captured and released several Bull Trout that had ascended the fish ladder into the collection facility. Bull Trout were also captured at the facility in the years since; two were captured in both 2000 and 2001, five were captured in 2002, and two were captured in 2003. One to three Bull Trout continue to be caught in the Roza Dam adult trapping facility on an annual basis, although exact numbers have not been recorded at this site every year. A large subadult Bull Trout was captured at Roza Dam and radio tagged by the WDFW in 2004.

Three genetic samples have found fish from the Naches local populations passing through Roza Dam. One fish radio tagged at Roza Dam (Mizell and Anderson 2015) was genetically identified to be an Indian Creek fish that was entrained through the Tieton Dam. In addition, a genetic sample was collected from this fish for analysis by the WDFW. A comparison of this fish's genetic composition was compared with all other Bull Trout samples collected basin-wide to determine the genetic relationship between basin stocks. The Yakama Nation has reported that the last two Bull Trout reported at the Roza Dam facility occurred in January 2006 and in April of 2008. Thus, it seems Bull Trout are using the mainstem as a migration corridor outside of spawning migrations. All Bull Trout that have been captured at the Roza facility, other than the 2006 fish that was captured in

January, were observed in the spring (April–June), and all were in the 8- to 12-inch size range (Reclamation 2019a).

In 2004–2010 with the draft and final critical habitat rules and again in the 2015 final recovery plan, the USFWS has identified the mainstem Upper Yakima local population. Bull Trout redd surveys conducted along the 11-mile Upper Yakima reach between Keechelus Dam and Lake Easton have identified relatively few redds. When the first redd survey was conducted in 2000, two redds were found near Crystal Springs, less than a mile below Keechelus Dam. Surveys were conducted in 6 of the next 14 years, and six additional redds were found (Table 6 in Reclamation 2019a, pg. 40).

Bull Trout spawning activity has also been observed recently in the Upper Yakima River (Table 6 in Reclamation 2019a, pg. 40). In mid-September 2000, during a redd survey of the reach between Keechelus Dam and the Easton Diversion Dam, USFWS and WDFW biologists found two Bull Trout redds and four live adults (20 to 24 inches). In the following year, another redd was found, as well as an extremely large adult (greater than 30 inches) that was dead. Intensive monitoring efforts in the fall 2002 and 2003 did not locate any redds in this area. Incomplete surveys in 2004, 2005, and 2007 also failed to document any Bull Trout spawning activity in the main stem Upper Yakima River.

In 2006, the USFWS observed several large adfluvial Bull Trout in the Upper Yakima River in the areas above Cabin Creek. Occasionally, Bull Trout redds continue to be located in the upper mainstem in the Easton to Keechelus reach between the Cabin Creek wetlands and the outlet of Keechelus Dam. Finally, a large gravid female was captured and radio tagged at the base of Kachess Dam in 2005. Some of the fish that have been observed in the Upper Yakima River may be fish that have been entrained over dams and cannot return to upstream spawning areas and now spawn, or attempt to spawn, in the Upper Yakima main stem (Reclamation 2019a).

Because spring Chinook salmon and brook trout are present in the Keechelus reach and spawn at about the same time as Bull Trout, it can be hard to identify early redds. USFWS and WDFW personnel have surveyed after Chinook spawning and observed new bright redds between the Cabin Creek wetlands and the base of Keechelus Dam that exhibit the classifications of Bull Trout redds. In mid-September 2007, about five or so adult migratory Bull Trout were observed holding under a very large historic log jam in the lower portion of this reach. Only a few of the Bull Trout redds observed over the period of record have had fish associated with them. The two Bull Trout redds observed in 2000 had four Bull Trout within the immediate vicinity (Reiss et al. 2012). A Bull Trout was also observed holding on a redd (located at the mouth of Cabin Creek) in 2001 (Reclamation 2019a).

During surveys conducted in 2006, three adult Bull Trout (one believed to be a brook/bull hybrid) and one subadult were observed during snorkel surveys conducted in the upper mile of the reach (Reiss et al. 2012). Other Bull Trout observations upstream of Easton Dam include a juvenile Bull Trout located within the lake in 2001, a Bull Trout captured by an angler in Lake Easton, three adult Bull Trout observed near Keechelus Dam, and one adult Bull Trout located near Kachess Dam. Genetic analyses done on a limited number of Bull Trout observed in the Yakima River have assigned these fish to other local populations (Reiss et al. 2012).

Given these limited observations, it is difficult to ascertain the demographics and life history of the potential Bull Trout population in the mainstem Yakima River (Reiss et al. 2012). The Bull Trout that have been observed could belong to a single population group that spawns above Lake Easton but will migrate long distances when conditions (such as water temperatures) are favorable. It is also possible that some are fluvial fish belonging to an undocumented spawning population. Additionally, Bull Trout observed in the Upper Yakima River may have originated from populations upstream of upper Yakima storage dams and cannot spawn in their original spawning areas (Reclamation 2019a).

Although it is not clear what life history forms are present in the mainstem Yakima River, it is reasonable to assume that fluvial Bull Trout are present; this is because they exist in the Naches subbasin and local movement between the Naches River and Yakima River are known to occur. During a telemetry study conducted by the WDFW, a few Bull Trout that were tagged in the Naches River were tracked into the mainstem Yakima River. These fish used the main stem Yakima River between Ahtanum Creek and Wenas Creek for brief periods before migrating back to the Naches River. It is also reasonable to assume that the adfluvial life history form is present in Lake Easton, although this is speculative since no current data exist to confirm this. In all the other core areas in this Upper Mid-Columbia Geographic Area of the Middle Columbia Recovery Unit, Bull Trout use mainstems for travel and or spawning, depending on habitat conditions, including water flow and temperature. It is likely they key in on hyporheic areas and cool water for their spawning (Reclamation 2019a).

There is also evidence of an Upper Columbia Bull Trout in the Yakima River near Prosser and staying somewhere in the basin for 9 months. It was PIT tagged in the Entiat as a juvenile/subadult near spawning grounds and picked up at antennas during travel back and forth. It made it back to the Entiat core area after 3 years. Also, a genetic analysis shows that the Yakima fish has unique genes and historical genes from populations in both the Snake and Upper Columbia into Montana (Spruell and Maxwell 2002; Bohling et al. 2021).

<u>Kachess–Easton Reach</u>

The reach between Lake Easton and Kachess Dam (that is, a short segment of the Kachess River or Lower Kachess River) is the area most immediately downstream from the outlet works of the Kachess Dam. This reach would potentially experience reduced flow during phase 2 of the Proposed Action. The Lower Kachess River is classified as FMO and known presence habitat (Reiss et al. 2012).

Very few genetic samples have been collected from Bull Trout in the Upper Yakima River. In 2005, an adult Bull Trout was caught directly below Kachess Dam, and a subsequent genetic analysis linked this fish to the Gold Creek population in Keechelus Lake. Whatever their origin, there now appears to be a group of Bull Trout, apparently small, that spawns in the Upper Yakima River and displays a fluvial life history type (Reiss et al. 2012).

4.2 Current Conditions of Habitat in the Action Area: Bull Trout

The current condition of habitat in the action area is summarized generally; then it is evaluated in terms of the USFWS's Matrix of Pathways and Indicators (MPI; Table 1 in USFWS 1998). The objective of the MPI is to integrate the biological and habitat conditions to arrive at a determination of the potential effect of land management activities on a proposed or listed species. Indicators are assessed according to the condition levels in the matrix: "functioning appropriately," "functioning at risk," and "functioning at unacceptable risk." The definitions of these condition levels vary by the indicator being assessed, and are available in Table 1 in USFWS 1998.

4.2.1 General Habitat Description

There are approximately 11.4 miles of instream (aquatic) habitat in the action area, which extends from Kachess Reservoir to its confluence with the Yakima River at Lake Easton, and from there to the Keechelus Reservoir (**Figure 2**). The Yakima River is a tributary to the Columbia River, which flows to the Pacific Ocean. The portion of the Kachess River within the action area (below the dam) begins at the terminus of the outlet works and flows to the south, leaving the project area.

Bull Trout habitat in the action area is largely classified as FMO habitat/presence (Reiss et al. 2012). FMO habitat is defined as relatively large streams and mainstem rivers, including lakes or reservoirs, estuaries, and nearshore environments, where subadult and adult migratory Bull Trout forage, migrate, mature, or overwinter (USFWS 2015a). This habitat is typically downstream from spawning and rearing habitat; it contains all the physical elements to meet critical overwintering, spawning, migration, and subadult and adult rearing needs. While year-round occupancy by Bull Trout in FMO habitat segments in the Mid-C RU is possible, stream temperatures are often prohibitive during the warmest times of the year; thus, occupancy is more common from late fall through late spring.

Bull Trout spawning and rearing (SR) habitat exists in the action area for local Bull Trout populations located upstream of both Kachess and Keechelus Reservoirs. For these populations, SR habitat is upstream of the project reservoirs. Access to SR habitat is influenced by varial zone habitat conditions within each project reservoir's drawdown area as well as by natural stream dewatering that occurs in areas upstream of the reservoir operations' influence. The varial zone is the migration corridor where a tributary flows into a reservoir, which is periodically inundated or dewatered with fluctuating reservoir water surface levels (such as full pool levels or various drawdown levels). The Upper Yakima River above Easton Dam may also provide SR habitat for Bull Trout entrained out of project reservoirs; some Bull Trout redds have been observed in this reach during periodically conducted spawning surveys in the action area (Reclamation 2019a; USFWS 2021a).

4.2.2 Baseline Conditions: Pathways and Indicators

The MPI for Bull Trout is used to evaluate and document baseline conditions and to aid in determining whether a project is likely to adversely affect or result in the incidental take of Bull Trout. The MPI analysis incorporates four biological indicators and 19 physical habitat indicators. The condition of these indicators in the action area is described below.

Water Quality (Temperature, Sediment and Turbidity, Chemical Contamination, and Nutrients)

Reclamation collected water quality data in Kachess River approximately 984 feet downstream from Kachess Dam (station YKA001) during June, July, and August. Based on the Environmental Protection Agency database results, 11 samples were collected between 1999 and 2019 (EPA 2021). Sampling results indicate that water quality in the river is moderate to good. During sampling, the river exhibited low turbidity, low total suspended solids concentrations, and low fecal coliform counts.

However, dissolved oxygen and the water temperature exceeded state surface water quality criteria for individual samples. Water temperatures exceeded the state surface water quality criterion of 16 degrees Celsius (°C) (60.8 degrees Fahrenheit [°F]) on three occasions with a highest temperature reading of 18.5°C (65°F) in July 2015. During sampling, the average water temperature was 13.5°C (56.3°F), which is below the water quality criterion of 16°C (60.8°F). Dissolved oxygen measurements below the state surface water quality criterion were measured on five occasions (standard set to ensure dissolved oxygen criterion greater than 9.5 milligrams per liter [mg/L]); the lowest reading was 8.8 mg/L in July 1999. The average dissolved oxygen level during sampling was 9.8 mg/L, which exceeds the state water quality criterion (EPA 2021). Therefore, the Kachess River is listed on the Clean Water Act's 303(d) water quality list as category 2 (waters of concern) for dissolved oxygen (Ecology 2021).

The Washington Department of Ecology monitors the Upper Yakima River Basin and its major tributaries, measuring parameters that are important to aquatic species, including water temperature, dissolved oxygen, and pH. In 2020, monitoring was conducted throughout the upper basin but ended at Lake Easton, outside the action area. Data for the years of study can be found online (Ecology 2022).

A study published in 2000 on the water quality in the Yakima River Basin indicated multiple forms of pollutants in the basin. Although the use of dichloro-diphenyl-trichloroethane and insecticides has decreased, samples collected exceeded the EPA's chronic water quality criteria for the protection of aquatic life. Other chemicals and pollutants identified in the basin included azinphos-methyl, arsenic, fecal coliform bacteria, nitrogen, and phosphorus. Increases in concentrations of fecal coliform were found to coincide with specific river conditions, including high levels of suspended sediment, turbidity, nutrients, and specific conductivity (Fuher et al. 2004).

The Yakima River is listed on the Clean Water Act's 303(d) water quality list for the following parameters: toxin-related category 5 impairments, at least one toxic total maximum daily load, aldrin and/or dieldrin impairment, chlorpyrifos impairment, and category 5 dichloro-diphenyl-trichloroethane impairment (Gruen 2020).

Kachess Lake has a maximum depth of approximately 430 feet. Kachess Lake has been shown to be well oxygenated at all depths and during all times of year. Dissolved oxygen was shown to increase with water depth until around 65 feet, where it then began to drop. An average of the measurement at 3 feet was 8.9 mg/L; an average of the measurement at 62 feet was 12.1 mg/L. The peak water temperature of 21.3°C (70.3°F) was recorded in August 2012 at depths of 3 and 10 feet in Kachess Lake. Water temperatures have been shown to decrease with depth. This indicates the presence of a summer thermocline (Reclamation 2019c).

Keechelus Lake has a maximum depth of approximately 310 feet and an average depth of 98 feet. Keechelus Lake has been shown to be well oxygenated at all depths and during all times of year. Dissolved oxygen was shown to increase with water depth until around 49 to 65 feet, where it then began to drop. An average of five measurements of dissolved oxygen at 3 feet was 9.0 mg/L and 11.2 mg/L at 68 feet. Temperature data collected by Reclamation in 2016 showed the water temperature at 42.7 feet was 12.5°C (54.5°F). A peak water temperature of 21.6°C (70.9°F) was recorded in August 1998 at the surface. Water temperatures decreased with depth, indicating the presence of a summer thermocline (Reclamation 2019c).

Habitat Access (Physical Barriers)

Three major dams present physical barriers to aquatic species in the action area: the Kachess Dam, Lake Easton Dam, and Keechelus Lake Dam. Kachess Lake and Keechelus Lake are two of five major storage reservoirs in the Yakima River Basin. Fish passage facilities were not constructed at any of them. Native sockeye salmon, which depend on the natural lakes and spawn in the streams above them, were extirpated; other non-anadromous and anadromous salmonids and other fish species were excluded from the streams above these dams. Populations of resident fish species, such as Bull Trout, were isolated above the dams, including in Kachess Reservoir (Reiss et al. 2012).

The disruption of natural migration routes has negative effects on Yakima Basin Bull Trout populations by (1) creating small, isolated populations at risk of inbreeding and loss of genetic diversity; (2) reducing the likelihood that stray fish will recolonize areas after isolated catastrophic events; and (3) reducing the productivity of Bull Trout by limiting access to foraging habitat and eliminating marine-derived nutrients (BTWG 2017). Providing connectivity at Kachess Dam is identified as a recovery action in the Yakima Bull Trout Action Plan 2017 Action Plan Update (BTWG 2017). Specific population delineations for Bull Trout due to these physical barriers can be found in **Section 4.1**.

Habitat Elements (Substrate Embeddedness, Large Woody Debris, Pool Frequency and Quality, Large Pools, Off-channel Habitat, and Refugia)

Aquatic habitat can be divided into two main categories within the action area, lentic and lotic. Lentic areas refer to slow-moving or standing water; these include Keechelus Lake, Kachess Lake, and Lake Easton. These areas provide Bull Trout thermal refugia during the summer when deeper water is cooler than surface water. The Keechelus Reservoir shows inverse stratification in the winter when warmer water is beneath the colder water (Reclamation 2019c).

Lentic areas refer to moving water and include the Yakima and Kachess Rivers. These areas also provide important spawning and rearing habitat for Bull Trout. The substate for both rivers varies widely and ranges from cobble to gravel to sand. A lack of habitat complexity, including the lack of woody debris, primary pools, and functioning floodplains, has been identified as a primary threat to the Yakima Core Area Bull Trout population. The lack of woody debris in the Yakima River suggests there is also a lack of high flow refugia (USFWS 2015b). However, as previously described, no fish passages were constructed to allow aquatic species to move between lentic habitats and lotic habitats.

Channel Condition and Dynamics (Width-Depth Ratio, Streambank Condition, and Floodplain Connectivity)

An aquatic resource survey was conducted in the project area in summer 2020 (Reclamation 2021). The surveyors observed multiple ordinary high-water mark (OHWM) indicators in association with the Kachess River. These indicators were the presence of a streambed and banks, a change in vegetation cover and type, changes in sediment size and texture, wrack deposited on streambanks and in streamside vegetation, water staining on rocks, and algal mats.

Flows in the Kachess River at the time of the survey (August 8 and 9, 2020) were relatively low; this was indicated by the water level in the river being several feet in elevation below the OHWM extent in most places. The banks of the Kachess River are steep and relatively high. In most places in the action area, the left bank (as seen by a viewer looking downstream) extends steeply upward, limiting the active floodplain above the left bank to a few feet in width. The action area also includes the downstream portion of the excavated spillway channel where it joins the Kachess River. OHWM indicators observed in this area were generally the same as those described for the Kachess River.

The shoreline of Keechelus Reservoir, the Yakima River downstream of the reservoir, the Kachess Reservoir, and the Kachess River both upstream and downstream from the reservoir are within the mapped 100-year floodplain (Reclamation 2019c). The floodplain supports limited cover of herbaceous species, including common horsetail, water sedge, colt's-foot, and fowl manna grass. It also supports riparian shrubs and trees, such as mountain alder and black cottonwood, which are commonly rooted at the OHWM, in a narrow band following the river. Above the floodplain, conifer species typical of vegetation in the area and a thick duff layer indicated elevations above the active floodplain.

Similarly, there is little active floodplain on the right bank, which transitions steeply from the OHWM to upland conifer forest. In the project area's far downstream portion on the right bank, the floodplain extends farther from the river as the steep banks are not present; a mapped wetland exists in this area. Additional wetland complexes along the Kachess and Yakima Rivers are primarily riparian forested and shrub wetlands; they occur in the river floodplains and along tributaries (USFWS NWI 2018).

Banks on the Yakima River are similar to the Kachess River. They contain steep, rocky slopes through most of the stretch between Keechelus Reservoir and Lake Easton. The banks are typically non-vegetated but farther upland, the predominant vegetation includes coniferous forests of Douglas-fir and hemlock. Both the Yakima and the Kachess Rivers consist of a primary channel with little to no braiding and no backwater channels or oxbows.

Degradation of riparian habitat and reduced floodplain habitat function have been shown to reduce populations of anadromous and resident fish populations (Reclamation 2019c). Impacted floodplains in the Yakima River Basin are largely a result of irrigation and agricultural developments. These activities, along with other impacts, have channelized the Yakima River throughout much of the basin, reduced riparian vegetation, and altered floodplains, which has reduced habitat suitability in portions of the river (USFWS 2015b).

Flow/Hydrology (Change in Peak and Base Flows)

Both the Yakima River and the Kachess River have dams that impact flows within the river. In some areas, flows are higher, and in other areas flows are lower than compared with pre-dam construction. In general, the Yakima River from the Keechelus Dam to Easton Lake and the Kachess River from Kachess Dam to Easton Lake are heavily influenced by releases from respective dams that reduce the water quality and quantity and thereby impact habitat for aquatic species (Reclamation 2019c).

A previous monitoring study for a flow shutoff several years ago can provide information on Bull Trout presence and habitat and the response of fish during reduced flow. In 2019, the flow to the

Lower Kachess River was shut off entirely during a repair of the hydraulic hose on the Kachess Dam fish bypass gate. The Kachess River flow was reduced from about 17 to about 2 cfs for 3 hours. During this time, the river was monitored from the stilling basin downstream to the confluence with Lake Easton; the river channel was surveyed for about 3,400 linear feet, including a side channel. The stream channel is primarily trapezoidal, with mostly riffle and run type habitat; therefore, when it dewaters, flow becomes concentrated in a narrower band.

Only a few isolated pools were found, and one side channel became disconnected during the event; however, it was not entirely dewatered. No Bull Trout were found in dewatered riffles or isolated pools, but other fish (approximately 15 speckled dace and 10 sculpin) were observed. Fish were not measured, but most appeared to be 0.3 feet or less. The fish were moved to flowing water when feasible. Mortalities were not observed; however, visual observations witnessed fish compromised by the high turbidity. Some larger fish were observed swimming in pools, but they could not be identified (Reclamation 2019b).

Watershed Conditions (Road Density and Location, Disturbance History, Riparian Conservation Areas, Disturbance Regime, and Integration of Species and Habitat Conditions)

The primary road that intersects the action area is Interstate 90, which crosses the Kachess River between Lake Easton and the Kachess Dam. Roads around Kachess Lake are limited and are primarily Forest Service roads that lead to trailheads, boat launches, campgrounds, and private residences. The west side of Keechelus Lake has similar Forest Service roads providing access to campgrounds and trails, while Interstate 90 borders the east side. Lake Easton is bordered on the east by Interstate 90 and Old US Highway 10 and on the west by train tracks and the Iron Horse pedestrian trail.

The Yakima River between Keechelus Lake and Lake Easton closely parallels Interstate 90 with few other roads. The large Crystal Springs Sno-Park parking area is located west of the Yakima River in this stretch. The short stretch of the Kachess River between Lake Easton and the Kachess Dam crosses under Interstate 90 and Old US Highway 10. A small subdivision is located on the river's west side, and an access road leads from Forest Service Road 4818 to the Kachess Dam.

Watershed conditions in the Yakama River Basin have changed drastically since the pre-industrial era. Reclamation's Yakima Project has constructed six dams in the basin that store water for the ever-increasing agricultural industry. Although an important aspect of the local economy, these water diversions generally decrease the overall watershed conditions and aquatic habitat for many species. Other disturbances, such as livestock grazing, have degraded riparian areas along portions of the Yakima River that serve as important spawning areas for Bull Trout (USFWS 2015b).

The Yakima Basin Integrated Plan, which was authorized in 2013, was designed to improve water resource management and ecosystem restoration in the Yakima River Basin. The plan includes seven elements to achieve this approach: constructing fish passages at all reservoirs, modernizing infrastructure, increasing the surface water storage, increasing the aquifer water storage, enhancing fish and wildlife habitat, increasing water conservation, and increasing market reallocation of water. Multiple projects that incorporate these elements have been completed throughout the basin (Yakim Basin Integrated Plan 2022).

4.3 Current Condition of Critical Habitat in the Action Area: Bull Trout

In the action area, Bull Trout critical habitat occurs from Kachess Reservoir, downstream Kachess River to Lake Eason, and from Lake Easton, upstream the Yakima River to Keechelus Reservoir (**Figure 2**). The final rule identifies 9 PCEs of critical habitat essential to the species' conservation. For the purpose of this assessment, Reclamation recognizes that each PCE works in concert with others to support a designated use. Often, there is overlap between relevant factors for several PCEs. For example, PCEs 5 and 8 each consider water temperature, but in different ways. This section defines the individual Bull Trout PCEs and the presence/condition of each in the action area.

As described above, the action area for this consultation contains both SR and FMO areas for local Bull Trout populations located upstream of both Kachess and Keechelus Reservoirs. For these local populations, SR habitat is primarily upstream of the action area reservoirs. Access to SR habitat is influenced by varial zone habitat conditions within each reservoir's drawdown area as well as by natural stream dewatering that occurs in areas upstream of the reservoir operations' influence. The varial zone is the migration corridor where a tributary flows into a reservoir, which is periodically inundated or dewatered with fluctuating reservoir water surface levels (for example, full pool levels or various drawdown levels).

Areas downstream of the dams, including the Keechelus reach of the Upper Yakima River and Lower Kachess River to Lake Easton, may serve as SR habitat for Bull Trout entrained out of project storage reservoirs. Some Bull Trout redds have been observed in the Upper Yakima River between the Easton and Keechelus Dams during periodically conducted spawning surveys in the action area (Table 6 in Reclamation 2019a, pg. 40). FMO habitat is located in each population's respective reservoir, as well as in the Kachess River and Upper Yakima River downstream of the dams.

4.3.1 PCE 1

PCE 1 requires "springs, seeps, groundwater sources and subsurface connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia." PCE 1 plays different roles depending on the habitat type. In spawning and rearing habitats, groundwater influence can provide an important cue for spawning behaviors (75 *Federal Register* 63898, page 63930, citing Baxter and Hauer 2000). In FMO habitat, groundwater can provide a source of thermal refugia and water quality. The importance of this contribution to FMO habitat is relative to other sources of thermal refugia and water quality. Wetland complexes occur in the river floodplains and along tributaries in the action area, indicating the presence of this PCE (Reclamation 2019c).

4.3.2 PCE 2

PCE 2 requires "migration habitats with minimal physical, biological, or water quality impairments between spawning, rearing, over-wintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers." Generally, PCE 2 was considered as present in waterbodies where Bull Trout are able to migrate between different habitats, even if some impediments exist. Where impediments exceed the minimal threshold described in the PCE and Bull Trout migration behaviors are significantly affected by an impediment, the PCE is described as not fully functioning. There are areas where impediments exist in the action area. For this PCE to be considered as not present, impediments would have to be so severe that little meaningful migration can take place.

The construction of dams and irrigation storage reservoirs in the Upper Yakima River Basin has precluded anadromous fish access to some areas. Kachess Dam is a passage barrier for returning anadromous fish, and no anadromous fish species are present in the reservoir or in tributaries upstream of the dam (Reclamation 2019b). Downstream from the dam, the Yakima River watershed supports anadromous runs of salmonids, as well as resident species. Access to the Yakima River upstream of Easton Dam is likely compromised by passage conditions at Easton Dam. The dam appears to inhibit salmonid passage to at least some extent.

A recurrent effect on PCE 2 in reservoirs is associated with the exposure of the varial zone. A varial zone is seasonally present when the reservoir is drawn down below the point where the habitat changes from lentic conditions representative of the action area. Degradation of the varial zone occurs when high amounts of sediment from upstream tributaries deposit within a reservoir, forming delta-like zones at the mouths of tributaries. Reservoir drawdowns can expose greater amounts of the varial zone. Varial zones can present impediments to Bull Trout migration in different ways. In most instances, a lack of habitat complexity and cover in varial zones may expose migrating Bull Trout to an increased risk of predation. In other cases, varial zones also can expose physical barriers (including low flows).

4.3.3 PCE 3

PCE 3 requires "[a]n abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish." This PCE was considered as present and contributing to FMO habitat where a sufficiently abundant and diverse prey base allows for growth of both individual and populations of Bull Trout. Where the prey base is present to support individual growth, but may limit the growth of a population, PCE 3 was considered present, but providing a limited contribution to FMO habitat. If the prey base was not sufficient to influence Bull Trout use of a particular area, PCE 3 was considered not present. In the action area, FMO habitat is located in each population's respective reservoir as well as in the Kachess River and Upper Yakima River downstream of the dams.

4.3.4 PCE 4

PCE 4 requires "complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes, that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks, and unembedded substrates to provide a variety of depths, gradients, velocities, and structure." PCE 4 was considered present when a habitat exhibited some complex features. Some limiting factors may reduce the contribution of the FMO habitat's complexity. Reclamation's analysis focused on the influence of hydrologic conditions on the interface with riparian zones and in-channel structural features. In human-made environments such as reservoirs, the complex features and the processes that maintain them differ from those in natural environments.

The total habitat complexity may be less in a reservoir environment when not at full storage; however, functional complexity refers to the availability of habitats within the entire action area in addition to an open migration corridor (PCE 2) allowing fish to use a variety of river and reservoir environments. A lack of habitat complexity, including a lack of woody debris, primary pools, and functioning floodplains, has been identified as a primary threat to the Yakima Core Area Bull Trout population. The lack of woody debris in the Yakima River suggests there may be a lack of habitat complexity, and this PCE may not be fully functioning (USFWS 2015b).

4.3.5 PCE 5

PCE 5 requires "water temperatures ranging from 2° to 15° C with adequate thermal refugia for temperatures that exceed the upper end of this range." Cold-water temperatures are an important characteristic of Bull Trout SR habitat and FMO habitat. To evaluate this PCE, baseline seasonal temperatures were evaluated to determine whether they influenced the Bull Trout's use of the habitat. PCE 5 was considered present when water temperatures were within 2° to 15°C for those times Bull Trout were likely to use the habitat area. The PCE was considered present, but limited, where temperatures exceeded 15°C and during those times that portions of the stream channels where mostly dewatered during the summer months, but thermal refugia persist. The effects of water temperature on the Bull Trout's use of habitat complexity, migration, and prey base are discussed within those respective PCEs.

4.3.6 PCE 6

PCE 6 requires "in spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure the success of egg and embryo over-winter survival, fry emergence, and young of the year and juvenile survival." In the action area, SR habitat is primarily upstream of the action area reservoirs, including in Upper Kachess River, Box Canyon Creek, and Gold Creek (Reiss et al. 2012). Areas downstream of the dams, including the Keechelus reach of the Upper Yakima River and Lower Kachess River to Lake Easton, may serve as SR habitat for Bull Trout entrained out of project storage reservoirs. The substrate in the action area varies widely and ranges from cobble to gravel to sand.

4.3.7 PCE 7

PCE 7 requires "a natural hydrograph including peak, high, low, and base flows, or if flows are controlled, minimal flow departure from a natural hydrograph." PCE 7 addresses the amount and timing of streamflow and the normal range of changes to the reservoir's elevation fluctuations. Where critical habitat was designated as a reservoir, the BA notes that PCE 7 is functioning when the reservoir's elevation range falls within predictable and historical ranges; this includes all reservoirs in the action area. In the streams and rivers affected by the Proposed Action, reservoir management operations regulate and control flow conditions.

4.3.8 PCE 8

PCE 8 requires "sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited" (75 *Federal Register* 63897). To evaluate this PCE, Reclamation looked to the direct effects of water quality and total water quantity on Bull Trout behaviors. This PCE was considered present when water quality and quantity conditions were suitable for Bull Trout at a time when they are likely to inhabit the stream channels of reservoir tributaries. PCE 8 was considered present, but limited, if some impairment occurs while Bull Trout may be present. Sampling results from the Kachess River indicate that water quality in the river is moderate to good.

4.3.9 PCE 9

PCE 9 requires “low levels of nonnative predation, interbreeding, and competition.” Reclamation described this PCE as present where no self-sustaining populations of nonnative species exist within a waterbody. The PCE was described as fully functioning where no nonnative species are present or self-sustaining populations exist in such low densities as to not compete or prey on Bull Trout. PCE 9 was considered not present where high levels of hybridization with brook trout occur, where competition or predation prevent Bull Trout use of the waterbody, or where nonnative species are actively stocked within a waterbody. In some cases, nonnative species can simultaneously constitute predators, competitors, and prey to Bull Trout.

The relationship between habitat indicators (USFWS 1998) and the PCEs of critical habitat for the Bull Trout are “crosswalked” using the matrix developed by the USFWS (Krupka et al. 2011; **Table 2**).

Table 2
Relationship of the MPI to the PCEs of Bull Trout Critical Habitat

Pathways (bold) and Indicators	PCE 1	PCE 2	PCE 3	PCE 4	PCE 5	PCE 6	PCE 7	PCE 8	PCE 9
Water Quality									
Temperature	X	X			X			X	X
Sediment and turbidity	X	X	X	X		X		X	
Chemical contamination and nutrients	X	X	X					X	
Habitat Access									
Physical barriers		X							
Habitat Elements									
Substrate embeddedness	X	X	X	X		X			
Large, woody debris			X	X					
Pool frequency and quality			X	X					
Large pools				X	X				
Off-channel habitat	X		X	X	X				
Refugia	X	X	X	X	X	X	X	X	X
Channel Condition and Dynamics									
Width-depth ratio		X		X	X			X	
Streambank condition	X		X	X	X	X	X	X	
Floodplain connectivity	X		X	X	X	X	X	X	
Flow/Hydrology									
Change in peak and base flows	X	X			X		X	X	
Increase in drainage network	X				X	X	X	X	
Watershed Conditions									
Road density and location	X			X	X	X	X	X	

Pathways (bold) and Indicators	PCE 1	PCE 2	PCE 3	PCE 4	PCE 5	PCE 6	PCE 7	PCE 8	PCE 9
Disturbance history	X				X		X		
Riparian conservation areas	X		X	X	X	X	X	X	
Disturbance regime				X		X		X	

Sources: USFWS 1998; Krupka et al. 2011
Notes:
Abbreviated descriptions of the critical habitat PCEs are as follows:
PCE 1—Springs, seeps, groundwater
PCE 2—Migratory corridors
PCE 3—Abundant food base
PCE 4—Complex habitats
PCE 5—Temperature
PCE 6—Substrate
PCE 7—Hydrograph
PCE 8—Water quality and quantity
PCE 9 —Nonnative species

Table 3 summarizes the baseline condition of Bull Trout critical habitat PCEs in the action area in terms of the USFWS's MPI (USFWS 1998). This assesses conditions as functioning, not functioning, not fully functioning, or not present. The table is divided into three main areas: (1) Kachess Reservoir, including its main tributaries, the Kachess River, and Box Canyon Creeks; (2) Keechelus Reservoir, including its main tributary, and Gold Creek; and 3) Lake Easton and the Yakmia River up to Keechelus Reservoir.

Table 3
Condition of Bull Trout Critical Habitat PCEs in the Action Area in Terms of the USFWS's MPI (USFWS 1998)

PCE	Kachess Reservoir, Kachess River, and Box Canyon Creek	Keechelus Reservoir and Gold Creek	Lake Easton and Yakima River
PCE 1: Hyporheic flow	Functioning	Functioning	Functioning
PCE 2: Migration habits with minimal barriers	Not fully functioning	Not fully functioning	Not fully functioning
PCE 3: Food base	Functioning	Functioning	Functioning
PCE 4: Habitat complexity	Not fully functioning	Not fully functioning	Not fully functioning
PCE 5: Water and temperature	Functioning in reservoirs Not fully functioning in Kachess River	Functioning in reservoirs Not fully functioning in Gold Creek	Functioning in reservoirs Not fully functioning in Yakima River

PCE	Kachess Reservoir, Kachess River, and Box Canyon Creek	Keechelus Reservoir and Gold Creek	Lake Easton and Yakima River
PCE 6: Substrate	Not present in reservoirs Not fully functioning in Kachess River	Not present in reservoirs Not fully functioning in Gold Creek	Not present in reservoirs Not fully functioning in Yakima River
PCE 7: Natural hydrograph	Functioning in reservoirs Not fully functioning in Kachess River	Functioning in reservoirs Not fully functioning in Gold Creek	Functioning in reservoirs Not fully functioning in Yakima River
PCE 8: Water quality	Functioning in reservoirs Not fully functioning in Kachess River	Functioning in reservoirs Not fully functioning in Gold Creek	Functioning in reservoirs Not fully functioning in Yakima River
PCE 9: Low levels of nonnative predation and competition	Functioning	Functioning	Functioning

Source: Reclamation 2019a

4.4 Current Condition of the Species in the Action Area: Northern Spotted Owl

The action area is located within the East Cascades North Recovery Unit. This region consists of the eastern slopes of the Cascade Range, extending from the Canadian border south to the Deschutes National Forest near Bend, Oregon. A summary of trends in demographic parameters for NSOs from study areas in the East Cascades of Washington from 1985 to 2003 showed that populations and survival are declining (USFWS 2004). In particular, one of the biggest threats to the NSO in this region is ongoing habitat loss as a result of wildfire and the effects of fire exclusion on vegetation change (USFWS 2011).

Baseline surveys in the action area were conducted during the 2021 breeding season (Harris Environmental Group 2021). No NSO was detected. Individual barred owls were detected on the April 14, 2021, and May 26, 2021, survey visits. However, these detections and the lack of subsequent detections at the same survey points would indicate barred owls were not nesting in the area; these owls were likely dispersing through the area. A primary threat to the NSO is competition for habitat with barred owls. The presence of larger and more aggressive barred owls in potential habitat reduces the likelihood of NSO breeding occupancy (USFWS 2011).

4.5 Current Condition of Habitat in the Action Area: Northern Spotted Owl

In general, the NSO inhabits older forested habitats because these habitats contain the structures and characteristics required for NRF, and dispersal. They require mid- to late-serial stages of conifer forest habitat types. The term "suitable habitat" is used to categorize, analyze effects on, and track trends in NSO habitat across its range. Suitable habitat is typically characterized by average tree diameters that are usually above 20 inches dbh, the presence of at least a few large trees exceeding 30 inches dbh, canopy cover that is usually greater than 60 percent, and multiple canopy layers (Davis et al. 2016). Suitable habitat for the NSO is considered nesting/roosting habitat and foraging habitat. Dispersal habitat provides for movement but typically does not have suitable habitat characteristics that support nesting/roosting or foraging.

The NSO nests and roosts in forests that are structurally diverse and that offer protection from weather and cover to reduce predation. Both types of habitats must contain sufficient foraging habitat to meet the home range needs of territorial NSO pairs throughout the year. Nesting and roosting habitats must have moderate to high canopy cover (from 60 to over 80 percent); multilayered, multispecies canopies with large (20–30 inches or greater dbh) overstory trees; a high incidence of large, live trees with various deformities (such as large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags and large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for flight (USFWS 2012a).

Foraging habitat for the NSO varies greatly across the species' range, but it generally includes habitats with conifer species and hardwoods. Stands for foraging in the East Cascades generally include stands of nesting and roosting habitat and stands composed of Douglas-fir (*Pseudotsuga menziesii*) and white fir (grand fir)/Douglas-fir mix. Foraging habitat is also characterized as having a mean tree size greater than 16.5 inches quadratic mean diameter, large accumulations of fallen trees and other woody debris on the ground, and sufficient open space below the canopy for the NSO to fly. An increasing density of large trees (greater than 26 inches) and increasing basal area (the total area covered by trees measured at breast height) increases foraging habitat quality (Irwin et al. 2012; USFWS 2012a).

Research on NSO foraging habitat is lacking for the East Cascades. The model used for characterizing NSO habitat in the recovery plan and critical habitat designation found the best fit for foraging habitat was forest stands with a canopy cover of 52 percent or higher (USFWS 2011).

Dispersal habitat supports the transience and colonization phases of NSO dispersal; the NSO can fly through this habitat. It includes NRF habitat but also is composed of other forest types that occur between larger blocks of suitable habitat. Dispersal habitat contains trees large enough to provide protection from avian predators and some opportunity to forage. Dispersal habitat also includes younger and less diverse forest stands than required for foraging habitat—such as even-aged, pole-sized stands with roosting structures and foraging habitat. It is typically defined as stands that provide at least 40 percent canopy cover and 11-inch dbh trees (USFWS 2012a). This habitat is available to dispersing NSO, but is largely of inferior quality for NRF. Typically, dispersal habitat is considered at the landscape scale (for example, one-fourth township) intended to provide connectivity between NSO populations.

Based on prior surveys and a reconnaissance NSO habitat assessment, the action area is characterized primarily as foraging, dispersal, and unsuitable habitat. Unsuitable habitat is where existing development (such as structures, roads, and the dam), barren habitat along the shoreline, and open water occur. These areas do not have trees, forest structure, or canopy cover to support NSO habitat.

On November 12, 2021, a WDFW fish and wildlife biologist conducted a NSO habitat assessment (WDFW 2021 unpublished). The assessment focused on classifying NSO habitat types in the tree clearing areas (**Figure 8**). Area A (0.76 acres) was assessed to be dispersal habitat based on a lack of suitable nesting trees or snags (one tree greater than 30 inches dbh and one snag without nesting platform structures) and a lack of multilayered forest and low woody debris percentage (approximately 3 to 5 percent). Area B (1.72 acres) was dispersal habitat based on no snags, only three trees greater than 30 inches dbh, 2 to 3 percent downed woody debris, and a lack of multilayered forest structure and dense canopy. Area F was similar to Area B but with no large trees greater than 30 inches dbh; it is dispersal habitat (**Appendix D**).

Area C (4.58 acres) was typed as foraging habitat with nine trees greater than 30 inches dbh and approximately 20 trees greater than 25 inches dbh. This area does not quite have multilayered forest but is approaching that quality. Also, downed woody debris is approximately 8 to 10 percent. Areas D and E (2.54 acres) were also foraging habitat with similar characteristics to Area C; they had 10 trees greater than 30 inches and approximately 20 trees greater than 20 inches with 10 to 12 percent cover of downed woody debris in each area. The biologist did not identify any nesting or roosting habitat in the areas proposed for tree clearing (**Appendix D**).

Small patches (approximately 200 feet in diameter) of large tress (greater than 30 inches dbh) with some multilayered forest structure and canopy cover approaching 60 percent do occur, but these are outside the proposed project activities' footprint. These small patches could approach the metrics for meeting nesting and roosting habitat, but the potential for breeding NSO occupancy is considered low. This is because NSO breeding has never been documented in the vicinity, and the small, potentially suitable stands are close to a residential development and Highway 90 vehicle noise.

In addition to the November habitat assessment, baseline surveys (Harris Environmental Group 2021) were conducted; they revealed that the action area lacked old-growth forest with the multistoried canopy structure ideal for NSO habitat. The highest-quality habitat at the survey stations was at Station 2.0 and Station 5.0 (see Figure 5 in **Appendix B**). For example, in the immediate vicinity of Station 2.0 there appeared to be higher-quality NSO habitat, compared with the rest of the survey area, with multiple canopy layers and trees approaching 36 inches dbh. However, it is a small, isolated patch (164 feet in diameter) and is within 360 feet of a residential development.

At Station 5.0 in the lower portion of the project area east of the Kachess River, some larger Douglas-fir and western white pine (*Pinus monticola*) trees were present, with the largest trees having a dbh of approximately 36 inches (Figure 6 in **Appendix B**). However, the canopy's structure was such that lower and mid-canopy coverage is limited, and the overall canopy coverage is less than 60 percent (Figure 7 in **Appendix B**; see cover page of **Appendix B** for a view looking up at a 45-degree angle through mid- and upper canopy layers). Surveyors agreed with prior habitat characterizations in the area that determined that the area lacks NSO nesting and roosting habitat. The surveys revealed the area is better characterized as dispersal habitat, with only small patches of potentially suitable (foraging) habitat found in isolated clusters within the area.

4.6 Current Condition of Critical Habitat in the Action Area: Northern Spotted Owl

There are 177.9 acres of NSO critical habitat in the action area (**Figure 4–Figure 5**). The following paragraphs describe the four PBFs of NSO critical habitat, which are critical to the species' conservation, and their presence and current condition in the action area (77 *Federal Register* 71876, December 4, 2012; pp. 72051–72052).

1. **PBF 1: The forest types that may be in early-, mid-, or late-seral stages** and that support the NSO across its geographical range are primarily:
    - Sitka spruce
    - Western hemlock
    - Mixed conifer and mixed evergreen
    - Grand fir
    - Pacific silver fir
    - Douglas-fir
    - White fir
    - Shasta red fir
    - Redwood/Douglas-fir (in coastal California and southwestern Oregon)
2. **PBF 2: Habitat that provides for nesting and roosting** in many cases is the same habitat that also provides for foraging (PBF 3). Nesting and roosting habitat provides structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risks for adults and young. This PBF is found throughout the geographical range of the NSO, because stand structures at nest sites tend to vary little across the NSO's range. These habitats must provide:
    - Sufficient foraging habitat to meet the home range needs of territorial pairs of NSOs throughout the year
    - Stands for nesting and roosting that are generally characterized by:
        - Moderate to high canopy cover (60 to over 80 percent)
        - Multilayered, multispecies canopies with large (20–30 inches [51–76 centimeters] or greater dbh) overstory trees
        - High basal area (greater than 240 square feet per acre [55 square meters per hectare])
        - High diversity of different diameters of trees
        - High incidence of large, live trees with various deformities (such as large cavities, broken tops, mistletoe infections, and other evidence of decadence)
        - Large snags and large accumulations of fallen trees and other woody debris on the ground
        - Sufficient open space below the canopy for NSOs to fly

3. **PBF 3: Habitat that provides for foraging** varies widely across the NSO's range, in accordance with ecological conditions and disturbance regimes that influence vegetation structure and prey species distributions. Across most of the NSO's range, nesting and roosting habitat is also foraging habitat; however, in some regions the NSO may additionally use other habitat types for foraging. Foraging habitat PBFs are described for the four ecological zones within the geographical range of the NSO:
   - West Cascades/Coast Ranges of Oregon and Washington
   - East Cascades
   - Klamath and Northern California Interior Coast Ranges
   - Redwood Coast

   The action area is in the East Cascades ecological zone; the foraging habitat PBFs for this zone are as follows:

   East Cascades:
   - Stands of nesting and roosting habitat
   - Stands composed of Douglas-fir and white fir (grand fir)/Douglas-fir mix
   - A mean tree size greater than 16.5 inches quadratic mean diameter
   - Increasing density of large trees (greater than 26 inches) and increasing basal area (the total area covered by trees measured at breast height) increases the foraging habitat quality
   - Large accumulations of fallen trees and other woody debris on the ground
   - Sufficient open space below the canopy for NSOs to fly
4. **PBF 4: In all cases, habitat to support the transience and colonization phases of dispersal** would optimally be composed of NRF habitat (PBFs 2 or 3), but it may also be composed of other forest types that occur between larger blocks of NRF habitat. In cases where NRF habitats are insufficient to provide for dispersing or nonbreeding NSOs, the specific dispersal habitat PBFs for the NSO may be provided by the following:
   - Habitat supporting the transience phase of dispersal, which includes:
     - Stands with adequate tree size and canopy cover to provide protection from avian predators and minimal foraging opportunities; in general, this may include, but is not limited to, trees with at least 11 inches (28 centimeters) dbh and a minimum 40 percent canopy cover; and
     - Younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, if such stands contain some roosting structures and foraging habitat to allow for temporary resting and feeding during the transience phase
   - Habitat supporting the colonization phase of dispersal, which is generally equivalent to nesting, roosting, and foraging (NRF) habitat as described in PBFs 2 and 3, but may be smaller in area than that needed to support nesting pairs (USFWS 2012a).

In areas occupied at the time of listing, not all of the designated critical habitat contains all the PBFs. This is because not all life history functions require all the PBFs. Some subunits contain all PBFs and support multiple life processes, while some subunits may contain only PBFs necessary to support the species' particular use of those subunits as habitat. However, all the areas occupied at the time of listing and designated as critical habitat support at least PBF 1, in conjunction with at least one other PBF. Thus, PBF 1 must always occur in concert with at least one additional PBF (that is, PBFs 2, 3, or 4) (77 *Federal Register* 71876, December 4, 2012; p. 71908).

4.7 Current Condition of the Species in the Action Area: Middle Columbia River Steelhead

The action area for MCR steelhead (**Figure 2**) is within the Upper Yakima River Basin, which is occupied by steelhead from the Yakima River Upper Mainstem population of the Yakima Major Population Group (MPG). The Yakima River Upper Mainstem population consists of all steelhead trout that spawn in the Yakima River and its tributaries upstream of the Naches confluence.

For steelhead, the 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. 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 (that is, the progeny of naturally spawning parents) in the natural environment (for example, on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle (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.

For species with multiple populations, once the biological status of a species' populations has been determined, the 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 the 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 meta-populations (McElhany et al. 2000).

The summary that follows describes the status of MCR steelhead, with a focus on the Yakima River Upper Mainstem population of the Yakima MPG. The summary is based on the most recent available information, the 2022 Biological Viability Assessment Update (Ford 2022).

Abundance. Abundance estimates for the Yakima MPG population are based on steelhead counts at Prosser Dam, on the mainstem Yakima River. The 2022 Biological Viability Assessment Update reports that the Yakima River Upper Mainstem population has decreased sharply relative to the prior review (15 percent decrease in the 5-year geometric mean of raw natural spawner counts). This population has exhibited increases since the early 1990s, with similar peak return years as other DPS populations; however, given recent declines, the 15-year trend for the population was essentially zero (Ford 2022).

Productivity. Freshwater productivity, computed as a ratio of recruits per spawner and smolt-to-adult return survival estimates, indicates the overall population productivity in the freshwater environment. Brood year return rates reflect the combined impacts of year-to-year patterns in marine life history stages, upstream and downstream passage survivals, and density-dependent effects resulting from capacity or survival limitations on tributary spawning or juvenile rearing habitats. Freshwater productivity for the Middle Columbia River steelhead populations for which this indicator can be constructed is relatively moderate, with most of the populations below 100 (a conservative estimate of 100 smolts per spawner). Nonetheless, long-term productivity metrics, where produced, indicate the potential for needed improvements to reduce demographic risk factors (Ford 2022).

Spatial structure and diversity. Based on results from recent radio-tag and PIT-tag studies, the distribution across spawning areas within the Yakima River Upper Mainstem population continues to be substantially reduced from inferred historical levels. The population is rated at “moderate” risk for spatial structure impacts and at “high” risk for diversity impacts. These risks are due to the loss of life history and phenotypic diversity inferred from habitat degradation, including passage impacts within the Yakima River Basin. 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. There are no within-basin hatchery steelhead releases in the Yakima River, and outside-source strays remain at low levels (Ford 2022).

Flow regulation by Reclamation has resulted in non-normative flow regimes that do not benefit MCR steelhead; rather, this regulation adversely affects normal steelhead migration, spawning, and rearing behavior. Changes in the flow regime have 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. The risk to the Yakima River Upper Mainstem 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 (NMFS 2016).

Limiting factors. The most significant factors limiting productivity of the MCR steelhead in the Yakima River Basin are as follows:

- Alteration of streamflows due to development of irrigation systems, including both the dewatering of lower reaches in many tributaries and the high and low flows in the mainstem

Yakima and Naches Rivers associated with water storage and delivery from upstream reservoirs
- Creation of passage barriers associated with both small and large diversion dams, road crossings, and Reclamation storage dams
- Reductions in floodplain function due to diking, channel simplification, and floodplain development for agricultural and urban uses
- Impacts on riparian areas and upland hydrology due to past and, to a lesser extent, current grazing and forestry practices
- Changed ecological dynamics, including the reduction in beaver populations, reductions in the delivery of oceanic nutrients to headwaters by salmon, the introduction of exotic species, and increased predation by native species (NMFS 2009)

Recovery plan. In 2009, the 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, which is part of the larger recovery plan. This plan outlined specific recovery actions intended to reduce threats associated with land and water management activities in the Yakima River Basin. The 2022 Biological Viability Assessment Update (Ford 2022) provides updated information and analyses on the biological viability of the listed species, focusing primarily on trends and status in abundance, productivity, spatial structure, and diversity. This updated information will be incorporated into the next 5-year review, which will include a determination about whether changes in listing status are warranted.

Summary. The Middle Columbia River steelhead DPS is not currently meeting the viability criteria described in the Middle Columbia River steelhead recovery plan. The Yakima River Upper Mainstem population is considered at high risk of extinction within 100 years (Ford 2022). For the Yakima MPG to achieve "viable" status, two populations should be rated as "viable," including at least one of the two classified as large—the Naches River and the Yakima River Upper Mainstem. The remaining two populations should, at a minimum, meet the "maintained" criteria. The management unit plan also calls for at least one population to be "highly viable," consistent with the Interior Columbia Technical Recovery Team's recommendations.

4.8 Current Condition of Habitat in the Action Area: Middle Columbia River Steelhead

The historical lakes and tributaries of the Upper Yakima River Basin formerly supported anadromous fish species, including steelhead. However, the construction of dams and irrigation storage reservoirs has precluded anadromous fish access to some areas. Kachess Dam is a passage barrier for returning anadromous fish, and no anadromous fish species are present in the reservoir or in tributaries upstream of the dam (Reclamation 2019b). Downstream from the dam, the Yakima River watershed supports anadromous runs of salmon and steelhead, as well as resident species.

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) have documented a small percentage of Upper Yakima steelhead trout approaching Easton Dam, and none passing 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 at least partially passable to adult salmonids. Therefore, for the purposes of this analysis, it is assumed that some, but not all, steelhead trout that approach the dam are able to pass; therefore, relatively few steelhead trout may be present in the action area.[5]

Adequate flows are necessary for migrating adult steelhead to pass upstream to spawning areas, provide rearing habitat, and facilitate smolt emigration to marine environments. Flows also affect other habitat parameters, such as temperature, riparian vegetation, and food supply. In an unregulated condition, the flows in the Yakima River Basin would be dominated by snowmelt-driven discharge peaks in May or June that then 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 trout are adapted to these natural seasonal flow patterns, which maintained a variety of habitats and facilitated migratory behavior.

Management of water storage and delivery systems in the Yakima River Basin has significantly altered this flow pattern. Now winter and spring runoff from the Upper Yakima, Kachess, Cle Elum, Tieton, and Bumping Rivers are captured in storage reservoirs and used to meet summer irrigation needs in accordance with yearly entitlements. These operations result in streamflows across the basin that are often out of phase with the life history requirements of native salmonids and riparian species, such as cottonwoods. The most significant changes in flow regimes 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 (NMFS 2009).

See **Section 4.2** for a general description of the current habitat conditions in the action area.

4.9 Current Condition of Critical Habitat in the Action Area: Middle Columbia River Steelhead

In the action area, steelhead critical habitat occurs from Kachess Dam, downstream Kachess River to Lake Eason, and from Lake Easton, upstream the Yakima River to Keechelus Dam (**Figure 2**). The following paragraphs describe the six PBFs of steelhead designated critical habitat, which are critical to the species' conservation, and their presence and current condition in the action area.

4.9.1 PBF 1

PBF 1 requires **f**reshwater spawning sites with water quantity and quality conditions and gravel substrate supporting spawning, incubation, and larval development. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.

Although spawning has not been documented in the Kachess River below Kachess Dam, it is feasible for steelhead to spawn there. This is because the area is accessible to them, the water quality and quantity are sufficient, and there are juveniles present in the area.

[5] Sean Gross, NOAA Fisheries Biologist, personal communication on November 18, 2021

The Yakima River from Keechelus Dam to Lake Easton is known to support anadromous runs of salmon and steelhead. Microhabitats that contain water quality and quantity conditions and gravel substate supporting spawning, incubation, and larval development are likely present in this stretch of the Yakima River. Although spawning habitat may be present above Kachess and Keechelus Dams, the dams present a physical barrier for returning anadromous fish, and currently no steelhead occur upstream of either dam (Reclamation 2019b).

Because steelhead typically spawn in lotic habitats, it is unlikely that Lake Easton provides suitable spawning habitat. Because steelhead spawning habitat is defined by various water characteristics, such as water depth, velocity, and temperature, and these variables depend to some degree on the volume of water released by the Kachess and Keechelus Dams, suitable spawning habitat may vary and be absent in some years. Therefore, this PBF is present in the action area.

4.9.2 PBF 2

PBF 2 requires freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. These features are essential to conservation because without them juveniles cannot access and use the areas needed to forage, grow, and develop behaviors (such as predator avoidance and competition) that help ensure their survival.

Steelhead rearing habitat in the Kachess River of the action area is likely limited; this is because the steep, high banks of the Kachess River limit the active floodplain on both banks. However, the presence of limited cover of herbaceous species and riparian shrubs and trees, and a mapped wetland in the far downstream portion, indicate the presence of some features needed for rearing. Additionally, juveniles have been observed in Kachess River below the dam.

The Yakima River from Keechelus Dam to Lake Easton is known to support anadromous runs of salmon and steelhead. Microhabitats that contain cool, clear, and faster currents supporting steelhead rearing are likely present in this stretch of the Yakima River. Although rearing habitat may be present above Kachess and Keechelus Dams, the dams present a physical barrier for returning anadromous fish, and currently no steelhead occur upstream of either dam (Reclamation 2019b). Portions of Lake Easton may provide suitable rearing habitat for steelhead. Because steelhead rearing habitat is defined by various water characteristics, such as water depth, velocity, and temperature, and these variables depend to some degree on the volume of water released by the Kachess and Keechelus Dams, suitable rearing habitat may vary and be absent in some years. Therefore, this PBF is present in the action area.

4.9.3 PBF 3

PBF 3 requires freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival. These features are essential to conservation because without them juveniles cannot use the variety of habitats that allow them to avoid high flows, avoid predators, successfully compete, begin the behavioral and physiological changes needed for life in the ocean, and reach the ocean in a timely manner. Similarly, these features are essential for adults because they allow fish in a nonfeeding condition to successfully swim upstream, avoid predators, and reach spawning areas on limited energy stores.

Although flow regulation by Reclamation has resulted in non-normative flow regimes that adversely affect normal steelhead migration, Easton Dam is at least partially passable to adult salmonids. Few steelhead trout may migrate into Lake Easton and then into the Kachess and Yakima Rivers in the action area, but they do not migrate upstream of Kachess or Keechelus Dams. This area may also support local movements of rearing juveniles. Therefore, this PBF is present in the action area.

4.9.4 PBF 4

PBF 4 requires estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between freshwater and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential to conservation because without them juveniles cannot reach the ocean in a timely manner and use the variety of habitats that allow them to avoid predators, compete successfully, and complete the behavioral and physiological changes needed for life in the ocean. Similarly, these features are essential to the conservation of adults because they provide a final source of abundant forage that will provide the energy stores needed to make the physiological transition to freshwater, migrate upstream, avoid predators, and develop to maturity upon reaching spawning areas. This PBF does not exist in the action area, which only includes freshwater rivers and reservoirs.

4.9.5 PBF 5

PBF 5 requires nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation, and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels. As in the case with freshwater migration corridors and estuarine areas, nearshore marine features are essential to conservation because without them juveniles cannot successfully transition from natal streams to offshore marine areas. The NMFS has focused its designation on nearshore areas in Puget Sound because of its unique and relatively sheltered fjord-like setting (as opposed to the more open coastlines of Washington and Oregon). This PBF does not exist in the action area, which only includes freshwater rivers and reservoirs.

4.9.6 PBF 6

PBF 6 requires offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation. These features are essential for conservation because without them juveniles cannot forage and grow to adulthood. However, for the reasons stated previously in the NMFS 2005 document, it is difficult to identify specific areas containing this PCE as well as human activities that may affect the PCE condition in those areas. Therefore, the NMFS has not designated any specific areas based on this PCE; instead, it has identified this PBF because it is essential to the species' conservation and specific offshore areas may be identified in the future (in which case any designation would be subject to separate rulemaking). This PBF does not exist in the action area, which only includes freshwater rivers and reservoirs.

Critical habitat throughout much of the Interior Columbia Recovery Domain has been degraded by intense agriculture, alteration of stream morphology (that is, channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer streamflows, an impaired water quality, and a 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. Reduced tributary streamflow has been identified as a major limiting factor for Middle Columbia River steelhead in this area (NMFS 2016).

Despite these degraded habitat conditions, the Hydrologic Unit Codes 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.

This page intentionally left blank.

Chapter 5. Effects on Listed Species and Critical Habitat

5.1 Bull Trout

The 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 occur as a result of 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. The action's effects could occur later in time and could include consequences occurring outside the immediate area involved in the action.

The action's effects are classified into the eleven distinct elements, which are described in **Chapter 2**. These include:

- Preparing the site, including tree clearing and grubbing (phase 1)
- Constructing an access road (phase 1)
- Developing staging areas to support construction and long-term maintenance (phase 1)
- Site electrical upgrades (phase 1)
- Fabrication and delivery of pipes (phase 1)
- Extending and lining the conduit (phase 2)
- Low-flow bypass connection (phase 2)
- Installing a diaphragm filter around the conduit (phase 2)
- Installing a stability berm on top of the filter (phase 2)
- Installing an auxiliary drain below the outlet channel (phase 2)
- Revegetation after construction activities (post-project; **Appendix F**)

In consultation with the USFWS, NMFS, and WDFW, Reclamation developed project conservation measures to minimize adverse impacts on Bull Trout and its critical habitat. These include preparing and implementing a temporary erosion and sediment control plan and a spill prevention control and containment plan, adhering to the WSDOT Fish Exclusion Protocols and Standards (WSDOT 2016) for fish salvage and relocation, using NMFS-approved pump screens, and others (see **Section 2.1.6, Conservation Measures**). Additionally, Reclamation would adhere to a dewatering plan during proposed conduit outages. A draft plan is provided in **Appendix C**; Reclamation will finalize the plan in coordination with the USFWS, NMFS, and WDFW.

As noted in **Section 2.1.4**, Reclamation is currently consulting with the USFWS on the operation and maintenance of Reclamation facilities in the Yakima River Basin. Reclamation will not be analyzing operation and management of the larger Yakima River Basin Integrated Water Resource Management Plan in the current BA due to concerns with changing the Proposed Action of the consultation already in progress.

5.1.1 Preparing the site, including tree clearing and grubbing (phase 1)

This project element would involve tree clearing, chipping, grubbing, and hauling to prepare sites that would serve as the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). Reclamation plans to work on tree clearing, chipping, and shredding between May and June 2023, while tree hauling to the US Forest Service lot would occur between June and July 2023. These activities would occur outside the spawning period for Bull Trout.

The tree clearing and grubbing areas are shown in **Figure 8**. As shown in the figure, clearing of trees for two permanent operation and maintenance areas would occur adjacent to the outlet works, which is isolated from the Kachess River (except in the case of backwatering, by which fish may be carried into the outlet works if water elevation in the stilling basin rises). Therefore, Reclamation expects fish abundance in the outlet works to be extremely low during this phase of the Proposed Action. Where these areas extend south past the outlet works, they would not be directly adjacent to the Kachess River—the edge of the closest area would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel. An additional area would be cleared to the east of the outlet works, over 500 feet from the main channel. Another area also would be cleared adjacent to the dam. The latter area would be over 50 feet from Kachess Reservoir and separated by the concrete dam.

The use of various construction equipment for tree clearing and grubbing could affect Bull Trout by generating noise and vibrations that travel into water. High levels of underwater sound can have negative physiological effects on fish (Hastings and Popper 2005). The severity of the effect depends on physical, environmental, and biological factors, including the sound-generating activity, the sound intensity, the sound duration, the distance of fish from the point of origin, the depth of water and the location of the fish in the water column, the size of fish, the fish species, and ambient noise levels. While sound generated by tree clearing, chipping, and grubbing is not expected to reach intensities associated with blasting or impact pile driving, limited duration behavioral effects (disturbance) resulting from a fish species' startle response could occur. The startle response is observed as an involuntary reaction to an introduced noise disruption that results in a change in an individual's behavior. Bull trout are likely to avoid habitat closest to the construction area and displace into nearby habitat (that is, downstream in the Kachess River and into Lake Easton; Lake Easton Reservoir levels would not be affected by the Proposed Action) while noise- and vibration-generating activities occur.

Because it is not possible to define sound exposure criteria for every possible sound source, type of response, or fish species, recent guidelines for fish on interim sound exposure criteria are based on research that shows a general correlation between the extent of effects and the cumulative level of sound energy to which fish are exposed (WSDOT 2020; Popper et al. 2014; Andersson et al. 2017; Popper and Hawkins 2019; Popper et al. 2019). For Bull Trout, cumulative sound exposure levels of 187 dB (decibel) cSEL[6] (cumulative sound exposure level) for fish greater than 2 grams and 183 dB cSEL for fish less than 2 grams (or 206 dB_{peak}[7] for all sizes) may result in injury, while cumulative sound exposure levels of 150 dB_{RMS}[8] may result in behavioral effects (WSDOT 2020).

[6] Cumulative sound exposure level; a metric for acoustic events, often used as an indication of the energy dose
[7] Peak sound pressure, i.e., the instantaneous maximum overpressure, or underpressure, observed during each pulse
[8] The mean square pressure level of the pulse

The following equipment could be used for tree clearing, chipping, and grubbing: dozers, forklifts, chainsaws, log chippers, trucks and trailers, cranes, front-end loaders, motor graders, and compactors. At the closest distance of 50 feet from the Kachess River and Reservoir, noise from the use of various construction equipment for tree clearing and grubbing would range from 71 to 101 dB (**Table 4**). Therefore, project noise would likely not be of an intensity that would cause physiological damage or temporary threshold shifts (Popper and Hawkins 2019; Popper et al. 2019). Because levels of noise generated by project construction would fall within the thresholds for behavioral effects, they would likely cause limited duration disturbance resulting from a fish species' startle response. Fish closest the noise source (within tens of meters) may be at moderate risk of sound masking and high risk of behavioral responses (Popper and Hawkins 2019; Popper et al. 2019).

Table 4
Average Maximum Noise Levels at 50 Feet from Construction Equipment Anticipated to Be Used for the Proposed Action

Equipment[a]	Impact Device	Actual Measured Average Lmax[b] at 50 feet
dozers	No	86
forklifts	No	88
chainsaws	No	83
concrete mixer truck	No	82
concrete pump truck	No	89
excavator	No	87
power tools—chipping gun	No	101
flatbed truck	No	74
cranes	No	79
front-end loaders (cyclical)	No	81
front-end loaders (passby)	No	71
graders	No	79
water trucks	No	72
compactors	No	75
pumps	No	74

Source: WSDOT 2020

[a] The values presented in the table represent the average maximum noise levels (Lmax) at 50 feet from the source due to use of heavy equipment associated with the Proposed Action. For all equipment that could be used in the Proposed Action, the Lmax ranges from about 71 to 101 dB for non-impact equipment.

[b] Lmax is the maximum value of a noise level that occurs during a single event.

All noise associated with tree clearing and grubbing (and the entire Proposed Action) would be generated out of water, and the sounds levels estimated in **Table 4** are for airborne sound attenuation. These values do not account for reductions in sound attenuation that would occur with travel through the bedrock, dam, concrete-lined outlet works, and water; all of these factors would contribute to reducing the noise before reaching Bull Trout in the river or reservoir. Other natural factors, such as the topography, vegetation, and temperature, can further reduce noise over distance. The action area's proximity to a residential development's construction sites and Highway 90 indicates ambient noise or elevated background sound exist near the project-generated noise sources, which could somewhat hide or mask construction noise (WSDOT 2020). Therefore, the noise levels reaching Bull Trout would be less than those reported in the table.

In addition to noise, tree clearing and grubbing could affect Bull Trout by causing habitat alterations. In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Of this total area, tree clearing and grubbing would occur in six areas over 9.6 acres that would serve as the access road and contractor use areas (**Figure 6–Figure 8**; **Appendix D**). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where Bull Trout may be present during the time these activities occur (tree clearing, chipping, and grubbing from May through June 2023; tree hauling from June through July 2023). As described above, all tree clearing and grubbing areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Most disturbance areas would be farther away, in the uplands (**Figure 8**). The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**), which would reduce sedimentation into the channel. The dam itself would reduce sedimentation into Kachess Reservoir.

Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river or reservoir. After implementing erosion-control conservation measures, minor amounts of erosion and sedimentation into Kachess River or Reservoir could occur and cause effects on Bull Trout, as described in the following paragraphs.

In general, tree clearing and grubbing near a stream could alter habitat for Bull Trout by causing excess runoff containing nutrients or sediment to enter the aquatic ecosystem, which could alter water quality parameters (Elliot et al. 2010; Bixby et al. 2015). Additionally, clearing trees and other vegetation could reduce bank stability and increase erosion. This would increase sedimentation into streams, which could reduce habitat conditions for Bull Trout, which requires low turbidity (Bash 2001). This is because an increase in fine sediment can result in reduced food availability and plant biomass, reduced visibility of prey, reduced availability of benthic[9] food due to smothering, and clogging of gill filaments (Bruton 1985).

Sedimentation could also affect Bull Trout through effects on prey. Fine sediment can affect macroinvertebrates by causing physical damage, clogging organs, smothering or burial, and habitat alteration (Jones et al. 2012). Larger particle-sized sediment could alter habitat conditions for Bull Trout by settling over habitat and causing effects on and changes in use of the substrate, pools, and other habitat features. Because tree clearing areas would not be directly along the river bank, a reduction in shading and subsequent changes in stream temperatures (Bixby et al. 2015; Neary et al. 2003) are not expected. There could be a slight decrease in large wood, which could cause alterations to the stream structure and complexity (Bixby et al. 2015). As described above, implementing a temporary erosion and sediment control plan (**Section 2.1.6**) would reduce the potential for these effects. Additionally, as described above, the distance of the tree clearing and grubbing areas from the river would reduce the likelihood of sediment entering the water.

[9] Occurring at the bottom of a body of water

The effects from minor amounts of sediment entering the water would be minimized by monitoring turbidity, as described under **Conservation Measures** (**Section 2.1.6**). The construction contractor would monitor and collect water samples to measure potential increases in turbidity to ensure compliance with Water Quality Standards for Surface Waters (WAC 173-201A) during replacement of the outlet works. In accordance with the WAC's aquatic life turbidity criteria for the salmonid rearing and migration category, maximum allowable turbidity levels shall not exceed a 10-NTU increase over background when the background is 50 NTUs or less, or a 20 percent increase in turbidity when the background turbidity is more than 50 NTUs. Should observed turbidity exceed allowable levels at the point of compliance specified in the conservation measure, in-water construction would temporarily stop until turbidity has cleared. In-water construction could then recommence at a slower rate to minimize generated turbidity. Monitoring and additional temporary work stoppages would occur, as needed, in accordance with the conservation measure.

The use of heavy machinery for tree clearing and grubbing could increase the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water, where they could injure or kill aquatic food organisms or directly expose Bull Trout to hazardous materials. Adherence to conservation measures to protect the water quality (**Section 2.1.6, Conservation Measures**) and the spill prevention control and containment plan would minimize the risk of spills entering the water and affecting Bull Trout. Such measures would include conducting fueling and maintenance away from the Kachess River, regularly checking equipment for leaks, having proper concrete washing sites, and maintaining spill prevention and cleanup kits on-site. It is unlikely that any machinery or equipment fluids or accidental concrete would be spilled in volumes or concentrations large enough to harm Bull Trout in or downstream of the action area.

5.1.2 Access road construction (phase 1)

Access road construction would occur from July to early October 2023 and would involve using the following equipment: dozers, forklifts, trucks and trailers, cranes, front-end loaders, screens, motor graders, water trucks, and compactors. As shown in **Figure 6–Figure 7**, the location of the access road would be over 100 feet from the Kachess River and Reservoir.

As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River and Reservoir, noise from the use of various construction equipment for access road construction (for example, dozers, forklifts, and cranes) would range from 71 to 101 dB (**Table 4**). This range falls within the thresholds for behavioral effects. Noise levels resulting from the access road construction would likely be less; this is because the access road would be over 100 feet from the river and reservoir. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

Because access road construction would occur from July to early October 2023, it could overlap with the Bull Trout spawning period (early September to mid-October). Noise from equipment use could interfere with spawning, if spawning adults are present. There is a low likelihood of this effect because Bull Trout spawning has not been documented in the reach of the Kachess River near where this project element would occur. There has been very low effort to survey the area for spawning, and since Bull Trout spawn up the Yakima River, which also empties into Lake Easton, it is possible that adults could be moving into the action area looking for suitable spawning habitat. If spawning individuals were present, the noise could disturb them, as described above. This could displace fish and impede them from spawning in the Kachess River. Most of the higher-level noise-generating activities would be from tree clearing, chipping, and shredding, which would occur in early summer, outside the spawning season (see ***Preparing the site, including tree clearing and grubbing***).

Constructing the access road would cause up to 3.6 acres of surface disturbance (**Figure 6–Figure 7**). Surface disturbance for the access road would occur a minimum of 100 feet from the Kachess River, where Bull Trout could be present during the time these activities occur (July to early October 2023). Due to the distance of the access road construction from the river and the implementation of erosion-control methods described under **Conservation Measures** (**Section 2.1.6**), constructing the access road is unlikely to cause increased sedimentation into the river or associated effects on Bull Trout. If minor levels of sedimentation occur, effects would be as described under ***Preparing the site, including tree clearing and grubbing.***

The use of heavy machinery for access road construction increases the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. As described under ***Preparing the site, including tree clearing and grubbing***, adherence to water quality conservation measures (**Section 2.1.6, Conservation Measures**) and the spill prevention control and containment plan would minimize the risk of spills entering the water and affecting Bull Trout.

5.1.3 Staging areas development (phase 1)

Staging areas would be developed from May to July 2023. This project element would involve construction using the following equipment: dozers, forklifts, trucks and trailers, cranes, front-end loaders, screens, motor graders, water trucks, and compactors. The staging areas are shown in **Figure 6–Figure 7**. As seen in those figures, clearing of trees for two permanent operation and maintenance areas would occur adjacent to the outlet works, which is isolated from the Kachess River and does not contain any fish, except in the case of backwatering. Where these areas extend south past the outlet works, they would not be directly adjacent to the Kachess River; the edge of the closest area would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel. An additional area would be cleared to the east of the outlet works, over 500 feet from the main channel, and another area would be cleared adjacent to the dam. The latter area would be over 50 feet from Kachess Reservoir and separated by the concrete dam.

As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River and Reservoir, noise from the use of various construction equipment for developing staging areas (for example, dozers, forklifts, and cranes) would range from 71 to 101 dB (**Table 4**). This range falls within the thresholds for behavioral effects. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

Developing the staging areas would cause up to 4.8 acres of surface disturbance (**Figure 6–Figure 7**). Surface disturbance for the staging areas would be on either side of the concrete-lined outlet works, a minimum of 50 feet from the stilling basin and farther than 100 feet from the main channel, where Bull Trout may be present during the time these activities occur (May to July 2023). The distance of the staging areas from the river and implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would minimize the amount of sediment entering the Kachess River. Minor levels of sedimentation could occur, and Bull Trout could be affected, as described under ***Preparing the site, including tree clearing and grubbing.***

The use of heavy machinery for developing the staging areas increases the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. As described under ***Preparing the site, including tree clearing and grubbing***, adherence to water quality conservation measures (**Section 2.1.6, Conservation Measures**) and the spill prevention control and containment plan would minimize the risk of spills entering the water and affecting Bull Trout.

5.1.4 Site electrical upgrade (phase 1)

Site electrical upgrades would entail replacing the current generators, erecting an electrical building along the access road, and burying existing overhead electrical lines beneath the existing approach road. These activities would occur during the same time as access road construction, from July to early October 2023. These activities would involve using the following equipment: dozers, forklifts, trucks and trailers, cranes, front-end loaders, screens, motor graders, water trucks, and compactors. As shown in **Figure 6–Figure 7**, the location of the electrical upgrades would be over 100 feet from the Kachess River and Reservoir.

As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River and Reservoir, noise from the use of various construction equipment for electrical upgrades (for example, dozers, forklifts, and cranes) would range from 71 to 101 dB (**Table 4**). This range falls within the thresholds for behavioral effects. Noise levels resulting from electrical upgrades would likely be less than this range; this is because the sites for electrical upgrades would be over 100 feet from the river and reservoir. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

As described for ***Assess road construction***, because site electrical upgrades would occur from July to early October 2023, activities could overlap with the Bull Trout spawning period (early September to mid-October). Noise from equipment use could interfere with spawning, if spawning adults are present. There is a low likelihood of this effect because Bull Trout spawning has not been documented in the reach of the Kachess River near where this project element would occur, and activities would be over 100 feet from the river and reservoir.

Site electrical upgrades would cause up to 1.0 acres of surface disturbance (**Figure 6–Figure 7**). Surface disturbance for electrical upgrades would occur a minimum of 100 feet from the Kachess River, where Bull Trout may be present during the time these activities occur (July to early October 2023). Due to the distance of the electrical upgrades from the river and the implementation of the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**), activities associated with electrical upgrades would be unlikely to cause increased sedimentation into the river or associated effects on Bull Trout. If minor levels of sedimentation occur, effects would be as described under ***Preparing the site, including tree clearing and grubbing***.

The use of heavy machinery for electrical upgrades increases the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. As described under ***Preparing the site, including tree clearing and grubbing***, adherence to water quality conservation measures (**Section 2.1.6, Conservation Measures**) and the spill prevention control and containment plan would minimize the risk of spills entering the water and affecting Bull Trout.

5.1.5 Fabrication and delivery of pipes (phase 1)

Fabrication and delivery of pipes to the project area would take place from January to February 2024 and would rely on equipment such as trucks and cranes to delivery and fabricate 10-foot-diameter pipe. Work during this phase would occur in the contractor use areas and access road, as indicated in **Figure 6–Figure 7**. There would be no in-water work during this phase.

Although these project activities would be spatially displaced from the Kachess River and Reservoir, Bull Trout in the immediate vicinity of the access road and contractor use areas could still be disturbed by noise transferred through the bedrock and dam. The types of equipment used for fabrication and delivery of pipes (trucks and cranes) would likely generate lower levels of noise than equipment used for site preparation and road and staging area construction. As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River and Reservoir, noise from the use of various construction equipment for pipe fabrication and delivery (for example, trucks and cranes) would range from 71 to 101 dB (**Table 4**). This range falls within the thresholds for behavioral effects. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

5.1.6 Conduit extension and liner (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025). Prior to placing the diaphragm filter and stability berm, the conduit would be extended downstream by about 100 feet from its current position to accommodate those additions. Extending the conduit would involve excavating a 100-foot-long trench. The width of the excavation would range from approximately 34 feet at its narrowest point to approximately 250 feet at its widest point. It would also involve placing a new concrete encasement around a 10-foot-diameter liner pipe and constructing a new transition section at the relocated outlet works portal structure.

Excavating the foundation for the conduit extension would occur between January and February 2024. Lining the conduit would occur soon after this time, but this schedule could be revised closer to the actual construction. Activities and construction associated with the project element would take place within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish (except in the case of backwatering). The construction area in the outlet works would be isolated from water via a cofferdam to prevent any backwatering of the work area and effectively exclude fish from the work area (**Figure 9**).

The following equipment could be used to extend and line the conduit: front-end loaders, cranes, dozers, excavators, and trucks. Most of the noise from using this equipment would be generated within the outlet works, where fish are not present; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. As described under ***Preparing the site, including tree clearing and grubbing***, noise and vibrations could travel from the source into the river or reservoir where Bull Trout are present. The equipment used for conduit extension and lining would range from approximately 71 to 101 dB at a distance of 50 feet from the source (**Table 4**). These values are likely overestimates, as all noise generated for conduit extension and lining would be generated out of water, and reductions in sound attenuation would occur with travel through the bedrock, dam, concrete-lined outlet works, water, etc. These levels of noise would fall within the thresholds for behavioral effects, and therefore, would likely cause limited duration disturbance resulting from a fish species' startle response. General effects of noise are described further under ***Preparing the site, including tree clearing and grubbing***.

Work for this project element would be contained within the outlet works, which is a concrete/stoned-lined channel (**Figure 6–Figure 7**). The nature of the outlet works channel itself means that minimal sedimentation would occur because the channel is made of concrete and rock; however, excavation could produce dust and other fine sediments. To reduce the amount of sediment-laden water being generated during work, Reclamation would employ a cofferdam below the excavation area composed of a temporary earth fill with a geomembrane liner to prevent water in the river channel from flowing back into the excavation (**Figure 9**). Reclamation would control flows through the dam to avoid overtopping the cofferdam and construction areas during the project. Excavation for the conduit extension would also employ erosion-control measures, including trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment.

After construction, the excavation would be recovered with concrete or stone, or both. The outlet works is lined with concrete and stone, a cofferdam would prevent river backflow into the excavation, and Reclamation would control flows through the dam. Therefore, there would be minimal sediment generated that would run into the river or reservoir during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal sediment that would enter the river when the cofferdam is removed and flow is reintroduced to the construction/excavation area.

There would also be a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the excavation area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Excavating the foundation for the conduit extension would occur between January and February 2024. Constructing the formwork and installing rebar would occur for about 3 months from March 18 to June 9. Therefore, associated activities would occur before spawning, so this project element would not cause impacts on spawning.

5.1.7 Low-flow bypass pipe connection (phase 2)

Repairing the bypass (replacing the existing valve, connecting the permanent bypass piping, connecting the temporary bypass piping extension, and removing the temporary bypass) would occur during phase 2 (January 2024 to July 2025) of the Proposed Action. The exact dates of the schedule would be determined closer to the actual construction date. This work would occur within the outlet works, and equipment such as front-end loaders, cranes, dozers, trucks, and pumps could be used.

Use of the above equipment could potentially cause effects on Bull Trout due to noise and vibrations, as described under ***Conduit extension and liner***; the pumps used to deliver water to the channel over the spillway during the conduit outages would add an additional noise source. The pumps would be placed in the intake of the spillway or on the dam crest. With redundancy, there would be an estimated four pumps (two primary and two backup pumps). The pumps would produce noise on the level of approximately 74 dB for one pump at a distance of 50 feet from the source and 148 dB for two pumps, which is the maximum that would be used at a time (**Table 4**; WSDOT 2020). This level of noise would fall within the thresholds for behavioral effects; therefore, this level of noise would likely cause limited duration disturbance of fish in Kachess Reservoir, where the pumps would be deployed. Noise from pumps would likely not affect Bull Trout in Kachess River because the main channel is separated from the pumps' location by the outlet works, a distance of several hundred feet. For the Kachess Reservoir population of Bull Trout, fish closest the noise source (within tens of meters) may be at moderate risk of sound masking and high risk of behavioral responses (Popper and Hawkins 2019; Popper et al. 2019). However, they would likely relocate to other areas of the reservoir during pumping.

As described under the Proposed Action, currently to maintain or operate the conduit, the bypass cannot be flowing. Extending the bypass piping would help to limit issues related to maintaining flows during operation and maintenance activities; however, flow could not be passed through the conduit during work on the bypass. Therefore, as described under **Section 2.1.3**, Reclamation is prepared to have a maximum of four, up to 12-hour conduit outages, which is when the low-flow bypass and the gates of the Kachess Dam will need to be closed, and the outlet works would need to be shut off. This does not preclude passing water over the spillway or pumping water when needed. During these outages, Reclamation plans to maintain at least 10 cfs of minimum flows in the Kachess River either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. All pumps would be screened with NMFS-compliant fish screens (**Section 2.1.6, Conservation Measures**) to minimize the risk of entrainment.

If Reclamation is not able to either pass water over the spillway or pump during one of the four possible conduit outages, dewatering of the Kachess River below the project area could occur, in which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The need for this to occur will depend on reservoir storage and water year, but it would only occur when the reservoir is less than 2,245 feet and during the March–December work window. This dewatering event would coincide with when Easton Lake gates are raised, when it is not dewatered in the winter, to lessen the distance of the impact. This would most likely occur in the fall, but based on water year, there is a chance this might need to take place in the spring or summer. It is anticipated that one dewatering event would be needed and would take place for a time period not to exceed 12 hours. If it is necessary to dewater the Kachess River, at least 30 calendar day advance notice of the event will be given to USFWS, NMFS, WDFW, and other interested parties.

The dewatering plan is provided in **Appendix C**, which provides information regarding fish handling and removal. The final details of the salvage will be agreed upon in coordination with the USFWS, NMFS, and WDFW and considering site conditions, temperatures, and equipment needs based on the time of year.

Reclamation will adhere to fish rescue protocols (WSDOT 2016, 2021; USFWS 2012; **Appendix A**) during dewatering operations to ensure fish protection measures are employed and to decrease the likelihood of injury or mortality to any fish present. Biologists will be on site during dewatering to monitor site conditions and conduct fish recovery. All fish within the Kachess River between Kachess Reservoir and Lake Easton will be targeted for removal from areas that become dewatered using a variety of fish capture methods. Initially, biologists will use dip nets, beach seines, or snorkel surveys to “herd” fish in to capture nets. Locations and numbers of adult salmonids including salmon, steelhead, or Bull Trout will be identified by snorkel surveys during the night of day 1 of dewatering.

Efforts will be made to capture and remove adult fish prior to full dewatering by conducting fish recovery during the ramp down described below. Any Bull Trout encountered will be netted and captured and removed for subsequent holding and handling. USFWS has an ongoing study of Bull Trout in the Yakima Basin and may sample Bull Trout for genetics and PIT tag those fish under an existing Section 10 permit (FWS/IR09/IR12/AES/Recovery/PER0019854-1). Reclamation intends to incorporate fish capture and handling protocols described in the Section 10 permit for the Kachess SOD project including recommendations for fish capturing, handling, sampling gear, monitoring, and release.

During dewatering, Reclamation will slowly reduce flow dam releases using the standard ramp down rates that are consistent with current operational practices, i.e., 2 inches/hour (**Appendix C**). The goal is to reduce flow about 50% on Day 1 and conduct fish recovery. Once flow is reduced to about 15 cfs, a barrier net will be placed at the downstream end of the reach to prevent fish from moving into the area. Additional fish recovery efforts (primarily snorkel surveys) will be done overnight because Bull Trout juveniles in particular tend to hide under cover during daylight hours. On the second day, flows will be reduced from about 15 cfs to zero cfs gradually, with fish recovery occurring throughout that time period (**Appendix C**).

Due to the length of the reach (approximately 0.8 miles when Lake Easton is at full pool), Reclamation anticipates that fish rescue efforts may require 4-6 hours to conduct using an adequate number of fish biologists and fish rescue crews. This is currently described as at least three groups of three, with qualified biologists on each team and a fisheries biologist with the experience and training necessary to handle ESA species to oversee the effort (**Appendix C; Section 2.1.6**). Fish recovery would be conducted in accordance with fish exclusion protocols developed by WSDOT (2016, 2021) and USFWS (2012) as requested by NMFS (Sean Gross personal communication). Electroshocking would occur in accordance with NMFS (2000) electrofishing guidelines. Electroshocking would not be used until all areas to be e-fished are isolated and all adult or subadult-sized fish are removed by other methods from the area.

Prior to dewatering, biologists will conduct snorkel surveys to determine the approximate numbers and species of fish present and the extent of the equipment needs. Any Bull Trout encountered will be removed and relocated to a temporary refuge, such as the stilling basin, deep pools, or Lake Easton, if desired based on input from NMFS, USFWS, and WDFW. Small numbers of fish would be held in containers such as coolers or buckets for short time periods, while being transported to more suitable holding areas. Large numbers of fish would be held in larger containers, such as 330-500 gal stock tanks and provided with oxygen for aeration. If adult or subadult Bull Trout are captured, they may be isolated from other fish and separated by size class to avoid predation during holding (**Appendix C**).

Handling activities, even when accomplished carefully and efficiently, are likely to result in sublethal adverse effects (abrasions and stress) to all Bull Trout handled (USFWS 2011). Adherence to fish exclusion protocols and standards (USFWS 2012; WSDOT 2016, 2021) would minimize, but not avoid, the effects of handling. These effects could include physiological stress and risk of injury, such as minor abrasion. Because the timing of dewatering would be chosen to fall within a temperature threshold that would minimize effects from extreme temperatures, likely when air temperatures are above 40 ˚F and below 80˚F, the risk of heat or cold stress would be minimized. Aerating water in holding containers would avoid effects associated with dissolved oxygen depletion. If the potential dewatering event overlaps spawning, emergence, or rearing periods for Bull Trout (there is potential for this because dewatering would coincide with when Easton Lake gates are raised, which is most likely in the fall), it could interfere with these life stages. For example, dewatering could preclude spawning, dry out redds, and interfere with fry emergence or juvenile rearing.

Reduced flows could indirectly affect Bull Trout through effects on their habitat. Habitat effects could occur during the three outages for which supplemental water is provided at a rate of 10 cfs as well as during the fourth potential outage for which no supplemental water would be provided. Effects on habitat include changes in the water temperature and depth, fragmentation of pools, reduced habitat for refugia and cover, and restricted movement, as described in more detail below.

During the three outages for which supplemental water would be provided at a rate of 10 cfs, reduced flows in the Kachess River would lower water levels in the river for up to 12 hours. This could subsequently elevate water temperatures, change flow characteristics from primarily riffle/run to resembling a narrow channel, and reduce availability of habitat features such as pools, refugia, and prey. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage. Water levels are not expected to be reduced by an amount that would fragment habitat or restrict movement (for example, by causing isolated pools or side channels); this is because a flow of 10 cfs would be provided via the spillway or pumping.

During the potential conduit outage for which no supplemental water would be provided, reduced flows in the Kachess River would lower water levels in the river for up to 12 hours to a greater extent than the outages with supplemental water. Reduced water levels could change flow characteristics from primarily riffle/run to resembling a narrow channel or isolated pools and side channels with areas of dry bed exposed. This would reduce the availability of habitat features such as pools, refugia, and prey. It also could elevate stream temperatures. Water levels could be reduced by a degree that could fragment habitat (for example, by causing isolated pools or side channels and exposed areas of streambed), which in turn may impede Bull Trout movement. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

Certain areas may not become dewatered at all (Reclamation 2019b). As observed during previous dewatering event, the stream channel is primarily trapezoidal, with mostly riffle and run type habitat; therefore, when it dewaters, flow becomes concentrated in a narrower band (Reclamation 2019b). This type of stream channel could reduce the likelihood of the streambed becoming completely dry, and minimal flows could remain that would sustain aquatic life. It is expected that isolated pools, such as the stilling basin, would remain at least 8 feet deep[10] and would provide a temporary refuge for fish during the shutoff periods. Similarly, pools and riffles could also retain water and provide refuge until fish can be relocated.

During all conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There could be a short-term positive benefit to Bull Trout in this reach resulting from elevated water levels, which could potentially reduce water temperatures and increase availability of habitat features, such as riffles, pools, and refugia. As described in **Section 2.1.3, Operation and Maintenance During Construction**, reducing flow from Kachess Reservoir and compensating with flow from Keechelus Reservoir could cause a temporary increase in the Kachess Reservoir's elevation and a temporary decrease in the Keechelus Reservoir's elevation; however, the estimated changes in water levels are outside the accuracy of water surface elevation instruments, and any potential effects would be so small as to be discountable.

Reduced flows could indirectly affect Bull Trout through effects on prey. Reducing flow and potentially drying out the streambed could reduce habitat for macroinvertebrates and cause changes in community variability, species abundance, and distribution (Muehlbauer et al. 2011; Vadher et al. 2018). Survivorship may decrease with longer drying times (Fritz and Dodds 2004; Vadher et al. 2018). Such effects on macroinvertebrates could temporarily alter and potentially reduce prey availability for Bull Trout.

Retention of water in sediment interstices has been shown to support the persistence of some macroinvertebrate species, up to 7 days in moist interstices and longer in fully saturated interstices (Stubbington et al. 2009). Conduit outages associated with the Proposed Action would be 12 hours or less. Providing supplemental water during three conduit outages would reduce the potential for alterations or reductions of the prey base. During the dewatering event, the streambed would likely remain wet from minimal flows from the spillway and groundwater seepage, and some isolated pools would likely remain. This could reduce the potential for alterations or reductions of the prey base if temperatures do not cause the prey to freeze. Based on input from the NMFS, USFWS, and WDFD, Reclamation would choose the timing of dewatering to fall within a temperature threshold

[10] Craig Haskell, personal communication

that would minimize effects on Bull Trout and their prey from extreme temperatures. This would reduce the potential for this effect.

5.1.8 Diaphragm filter (phase 2)

During this project element, the current outlet works structure would be demolished and removed via excavation, while a four-sided diaphragm filter would be placed just downstream of the original outlet location. Additionally, a 12-inch-diameter drainpipe would be attached. Because the existing outlet works structure would be removed, no significant excavation into the embankment would be necessary to install the new filter. It would extend 10 feet below the base of the extended conduit and part way up the embankment. Work on this project element would take place during phase 2 (January 2024 to July 2025). It would occur after the conduit lining and extension; more precise timing will be known closer to the actual construction.

Activities and construction associated with installing the diaphragm filter would occur within the outlet works, which is a concrete/stone-lined channel that is separated from Kachess River and inaccessible to fish except in the case of backwatering. A cofferdam will be placed in the lower end of the outlet channel to prevent any backwatering of the work area if water elevation in the stilling basin rises (**Figure 9**).

The following equipment could be used to install the diaphragm: front-end loaders, cranes, dozers, excavators, and trucks. Most noise from using this equipment would be generated within the outlet works, where fish are not present; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. Impacts from noise could affect Bull Trout. The magnitude and type of impacts (temporary, behavioral impacts) would be similar to those described under ***Conduit extension and liner***.

The nature of the outlet works channel, which is made of concrete and rock and where work for this project element would occur (**Figure 6–Figure 7**), indicates that minimal sedimentation would occur. Still, demolishing and removing the existing structure via excavation could produce dust and other fine sediments. As described under ***Conduit extension and liner,*** measures would be taken to reduce sedimentation. These include employing a cofferdam below the excavation area to prevent water in the river channel from flowing back into the excavation; controlling flows through the dam to avoid overtopping the cofferdam and construction areas during the project; and employing erosion-control measures, such as trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment (**Section 2.1.6, Conservation Measures**). As a result of these measures, as well as the outlet works' concrete lining, there would be minimal sediment generated that would run into the river or reservoir during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal sediment that would enter the river when the cofferdam is removed.

There would also be a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the construction area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to water quality design conservation measures (**Section 2.1.6, Conservation Measures**).

Because the precise timing of the diaphragm installation is unknown at this point, there is the potential for effects on Bull Trout spawning. If spawning adults are present, noise from the equipment used to remove the existing structure and install the diaphragm filter could cause behavioral effects that interfere with spawning, such as by displacing fish and impeding them from spawning in the Kachess River. There is a low likelihood of this effect because Bull Trout spawning has not been documented in the reach of the Kachess River near where this project element would occur. However, there has been very low effort to survey the area for spawning.

5.1.9 Stability berm (phase 2)

This project element involves constructing a stability berm from compacted fill material sourced from the excavation (consisting of a mixture of clay, sand, gravel, and cobbles) that would overlay the filter zone. Per Reclamation design standards (Reclamation 2011), the berm height could be up to one-half of the reservoir height. Work on this project element would take place during phase 2 (January 2024 to July 2025), and more precise timing will be known closer to the actual construction.

Activities associated with constructing a stability berm would occur within the outlet works, which is a concrete/stone-lined channel that is separated from Kachess River and inaccessible to fish except in the case of backwatering. A cofferdam will be placed in the lower end of the outlet channel to prevent any backwatering of the work area if water elevation in the stilling basin rises (**Figure 9**).

The following equipment could be used to construct the stability berm: front-end loaders, cranes, dozers, and trucks. Most noise from using this equipment would be generated within the outlet works, where fish are not present; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. Impacts from noise could affect Bull Trout. The magnitude and type of impacts (temporary, behavioral impacts) would be similar to those described under ***Conduit extension and liner***.

Constructing the stability berm is expected to produce minimal sedimentation because the work area would already be excavated. Effects from the excavation are described under ***Conduit extension and liner.*** Measures to reduce sedimentation would apply under all phases of construction and project elements. These include employing a cofferdam below the excavation area to prevent water in the river channel from flowing back into the excavation; controlling flows through the dam to avoid overtopping the cofferdam and construction areas during the project; and employing erosion-control measures, such as trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment (**Section 2.1.6, Conservation Measures**).

There would also be a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the construction area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Because the precise timing of the stability berm construction is unknown at this point, there is the potential for effects on Bull Trout spawning. If spawning adults are present, the noise from the equipment used during construction could cause behavioral effects that interfere with spawning, such as by displacing fish and impeding them from spawning in the Kachess River. There is a low likelihood of this effect because Bull Trout spawning has not been documented in the reach of the Kachess River near where this project element would occur. However, there has been very low effort to survey the area for spawning.

5.1.10 Auxiliary drain (phase 2)

This project element would involve installing a filter drain below the outlet channel. The filter drain would span from the upstream left end of the conduit and extend along the farthest downstream extent to the inspection well. The auxiliary drain would be 12 inches in width with a depth of approximately 10 feet below the outlet channel. The drainpipe would be installed near the left side of the outlet channel using trenching to expand the area to approximately 35 feet at its widest and approximately 3 feet at its narrowest. At its upstream end, the drain would terminate at an auxiliary inspection well that is being included as part of an effort to improve monitoring in this area. At its downstream end, the drain would discharge into the stilling basin just to the left of the end of the concrete liner. Reclamation would install a pair of pumps at the bottom of the well, about 20–30 feet below the surface, to ensure any collecting seepage drains properly.

Work on this project element would take place during phase 2 (January 2024 to July 2025); more precise timing will be known closer to the actual construction. Activities and construction associated with this element would occur within the outlet works, which is a concrete/stone-lined channel that is separated from Kachess River and inaccessible to fish except in the case of backwatering. A cofferdam will be placed in the lower end of the outlet channel to prevent any backwatering of the work area if water elevation in the stilling basin rises (**Figure 9**).

Project elements would involve using equipment such as front-end loaders, cranes, dozers, excavators, and trucks. Most noise from using this equipment would be generated within the outlet works, where fish are not present; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. Impacts from noise could affect Bull Trout. The magnitude and type of impacts (temporary, behavioral impacts) would be similar to those described under ***Conduit extension and liner***.

The nature of the outlet works channel, which is made of concrete and rock and where work for this project element would occur (**Figure 6–Figure 7**), indicates that minimal sedimentation would occur. Still, using trenching to install the drainpipe could produce dust and other fine sediments. As described under ***Conduit extension and liner,*** Reclamation would take measures to reduce sedimentation. These include employing a cofferdam below the excavation area to prevent water in the river channel from flowing back into the excavation; controlling flows through the dam to avoid overtopping the cofferdam and construction areas during the project; and employing erosion-control measures, such as trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment (**Section 2.1.6, Conservation Measures**). As a result of these measures, as well as the concrete lining of the outlet works, there would be minimal sediment generated that would run into the river or reservoir during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal sediment that would enter the river when the cofferdam is removed.

There would be a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the construction area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Because the precise timing of the stability berm construction is unknown at this point, there is the potential for effects on Bull Trout spawning. If spawning adults are present, noise from the equipment used during construction could cause behavioral effects that interfere with spawning, such as by displacing fish and impeding them from spawning in the Kachess River. There is a low likelihood of this effect because Bull Trout spawning has not been documented in the reach of the Kachess River near where this project element would occur. However, there has been very low effort to survey the area for spawning.

5.1.11 Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service.

Surface disturbance and using equipment for grading, planting, and seeding could temporarily affect Bull Trout habitat through a short-term effect on water quality within the Kachess River. This would be due to a slight increase in the potential for erosion and subsequent increase in sedimentation and turbidity from planting and seeding in areas near Bull Trout habitat. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Most disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

Because revegetation would restore habitat to baseline conditions, Reclamation would not anticipate long-term impacts on Bull Trout or Bull Trout habitat from restoration activities.

5.1.12 Cumulative effects

Cumulative effects include the effects of future activities that are reasonably certain to occur in the action area. 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.

For this description of cumulative effects, Reclamation assumes that future activities in the action area will continue into the immediate future at present or increased intensities. As the human population continues to grow, demand for dispersed and developed recreation is likely to occur. This demand could correlate with an increase in developments in and around Kachess Reservoir and Lake Easton to accommodate an increase in visitor use. Developments could include trail building and maintenance and the addition or expansion of existing facilities, such as boat launches, buildings, and campgrounds. Additionally, Reclamation would anticipate developments on private land in or near the action area. These activities have the potential to remove riparian vegetation, deplete streamflow, disrupt fish migration, disconnect rivers from their floodplains, interrupt groundwater-surface water interactions, reduce stream shade (which increases the stream temperature), reduce off-channel rearing habitat, and reduce the accumulation of large woody debris (LWD). Activities associated with visitor use, such as swimming, fishing, and boating, would also be expected to increase with regional population growth. However, Reclamation would only expect these activities to cause minor disturbance to Bull Trout. Specifically, fishing in the action area has likely resulted in the incidental catch of Bull Trout.

Other environmental factors, such as climate change and wildfire, may impact Bull Trout. An increase in water temperature as a result of climate change could restrict current habitat. Wildfires in the action area's vicinity could increase erosion, cause an increase in water turbidity, and decrease the overall water quality. Each subsequent action by itself may have only a small incremental effect; however, taken together, they may have a substantive effect that would further degrade the watershed's condition and resiliency and impact habitat suitability for Bull Trout.

Watershed assessments and other education programs may reduce these adverse effects by continuing to raise public awareness about the potentially detrimental effect of residential development and recreation in sensitive habitats and by presenting ways in which a growing human population and healthy fish populations can coexist. Additionally, future restoration projects within the action area could positively impact Bull Trout by improving the water quality and stream habitats.

Effects from implementing the Proposed Action would incrementally contribute to cumulative effects on Bull Trout. Noise from construction activities would contribute to disturbance, while sedimentation produced during construction for some of the project elements could contribute to temporary habitat alterations. Changes in the flow during conduit outages for the low-flow bypass connection would also temporarily contribute to temporary habitat alterations, such as reduced water levels; changes in the flow characteristics; reductions in the availability of habitat features, such as pools and riffles, refugia, and prey; and habitat fragmentation. These effects would be temporary; habitat would return to pre-project conditions after construction.

The Proposed Action would contribute to beneficial effects on Bull Trout and habitat by improving seepage and internal erosion issues through the dam embankment along the outlet works conduit. Reducing erosion would improve habitat conditions for Bull Trout by decreasing turbidity and, thus, improving opportunities for foraging and movement. Improvements to the dam would also reduce the risk of a potential complete dam failure. A complete dam failure could cause catastrophic effects downstream, such as flooding downstream of the dam, which could kill fish and destroy habitat.

5.2 Bull Trout Critical Habitat

Surface disturbance associated with the Proposed Action would occur in areas next to, but not within, Bull Trout critical habitat along the Kachess River and in Kachess Reservoir. Disturbance would occur as a result of activities associated with clearing and grubbing to construct the access road and contractor use areas as well as from construction associated with replacing the outlet works. None of this critical habitat area would be permanently altered or lost; this is because the extended conduit and associated features are not accessible to Bull Trout (**Figure 6–Figure 7**). However, temporary modifications to the PCEs would occur downstream of this area, as described below.

Conduit outages would also cause temporary effects on critical habitat PCEs in the larger action area, namely the Yakima River. This is because flows from Keechelus Reservoir would increase to account for reduced flows from Kachess Reservoir during the outages. As described in **Section 2.1.3, Operation and Maintenance during Construction**, reducing the flow from Kachess Reservoir and compensating with flow from Keechelus Reservoir could result in a temporary increase in the Kachess Reservoir's elevation and a temporary decrease in the Keechelus Reservoir's elevation. However, the estimated changes in water levels are outside the accuracy of water surface elevation instruments, and any potential effects on critical habitat PCEs in the reservoirs would be so small as to be discountable.

5.2.1 PCE 1

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur out of water within the areas shown in **Figure 6–Figure 8**. PCE 1 requires "springs, seeps, groundwater sources and subsurface connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia." Because the project elements listed above would not occur within Bull Trout critical habitat or within water at all, they would not alter springs, seeps, groundwater sources, and subsurface connectivity. Effects on PCE 1 would be unlikely.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025). It would include the following elements: extending the conduit via excavation; lining the conduit with a new concrete encasement; constructing a new transition section at the relocated outlet works portal structure; repairing the bypass by replacing the existing valve, connecting the permanent bypass piping, connecting the temporary bypass piping extension, and removing the temporary bypass; demolishing and removing the current outlet works structure and installing a diaphragm filter; constructing a stability berm; and installing a filter drain below the outlet channel. All activities and construction associated with these project elements would occur within the outlet works, which is a concrete/stone-lined channel that is separated from Kachess River and inaccessible to fish except in the case of backwatering, or in the upland staging areas and access road. The construction area in the outlet works would be isolated from water via a cofferdam to prevent river backflow from entering the project area (**Figure 9**).

Because the construction area would be isolated from water, most construction activities associated with the above project elements would not affect PCE 1, which requires "springs, seeps, groundwater sources and subsurface connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia."

The exception is repairing the bypass (replacing the existing valve, connecting the permanent bypass piping, connecting the temporary bypass piping extension, and removing the temporary bypass), which would require a maximum of four, up to 12-hour conduit outages, which does not preclude passing water over the spillway or pumping water when needed. During these outages, Reclamation plans to maintain at least 10 cfs of minimum flows in the Kachess River either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years.

If Reclamation is not able to either pass water over the spillway or pump during one of the four possible conduit outages, dewatering of the Kachess River below the project area could occur, in which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The need for this to occur will depend on reservoir storage and water year, but it would only occur when the reservoir is less than 2,245 feet and during the March–December work window. This dewatering event would coincide with when Easton Lake gates are raised, when it is not dewatered in the winter, to lessen the distance of the impact. This would most likely occur in the fall, but based on water year, there is a chance this might need to take place in the spring or summer. It is anticipated that one dewatering event would be needed and would take place for a time period not to exceed 12 hours. If it is necessary to dewater the Kachess River, at least 30 calendar day advance notice of the event will be given to USFWS, NMFS, WDFW, and other interested parties.

The conduit outages would affect PCE 1 due to the reduced flow, which would reduce water levels in the Kachess River downstream of Kachess Reservoir. Reduced water levels could change the flow characteristics and expose areas of dry bed. This, in turn, could affect groundwater and subsurface water connectivity, such as hyporheic flows; this is because the water table would be lowered if the streambed is dry in areas, and subsurface water connectivity would be reduced. This could temporarily reduce the critical habitat's ability to provide thermal refugia and contribute to water quality and quantity. The potential for these effects would be greatest during the potential outage in which no supplemental water would be provided. However, the effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outages.

During all conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There may be a short-term positive benefit to PCE 1 in this reach resulting from the elevated flow and water levels, which may potentially elevate the water table and increase subsurface water connectivity.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. Because revegetation would not occur within Bull Trout critical habitat or within water at all, it would not alter springs, seeps, groundwater sources, and subsurface connectivity, and effects on PCE 1 would be unlikely.

5.2.2 PCE 2

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). Tree clearing, chipping, and shredding would occur between May and June 2023; tree hauling to the US Forest Service lot would occur between June and July 2023; access road construction and electrical upgrades would occur from July to early October 2023; staging areas would be developed from May to July 2023; and fabrication and delivery of pipes would take place from January to February 2024.

All these activities would occur within the areas shown in **Figure 6–Figure 8**. As shown in the figures, clearing of trees for two permanent operation and maintenance areas would occur adjacent to the outlet works. The outlet works is isolated from the Kachess River, except in the case of backwatering, in which fish may be carried into the outlet works. Where these areas extend south past the outlet works, they would not be directly adjacent to the Kachess River; the edge of the closest area would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel. An additional area would be cleared to the east of the outlet works, over 500 feet from the main channel, and another area would be cleared adjacent to the dam. The latter area would be over 50 feet from Kachess Reservoir and separated by the concrete dam. The location of the access road and buried electrical line would be over 100 feet from the Kachess River and Reservoir.

In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists. PCE 2 requires "migration habitats with minimal physical, biological, or water quality impairments between spawning, rearing, over-wintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers." The project elements listed above could temporarily affect this PCE through a short-term effect on water quality within the Kachess River, which serves as FMO habitat for Bull Trout. This would be due to a slight increase in the potential for erosion and the subsequent increase in sedimentation and turbidity from tree clearing and construction in areas near Bull Trout critical habitat. The potential for this effect would be reduced because, as described above, all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**). This would reduce sedimentation into the channel. The dam itself would reduce sedimentation into Kachess Reservoir. Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river or reservoir. After implementation of erosion-control conservation measures, minor amounts of erosion and sedimentation into Kachess River or Reservoir could occur and temporarily affect PCE 1 due to the reduced water quality and increased turbidity.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam. Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PCE 2, through a short-term effect on water quality (increased sedimentation and turbidity) within the Kachess River. However, the construction area would be isolated from water, and Reclamation would implement conservation measures to reduce sedimentation, including implementing a sediment and erosion-control plan (**Section 2.1.6, Conservation Measures**). As a result, there would be minimal sediment generated that would run into the river or reservoir during construction.

Because the excavation area would be recovered with concrete after construction, there would also be minimal effects from reintroducing water into the construction area when the cofferdam is removed. There would also be a minimal risk of effects on PCE 2 due to contamination, such as from accidental spills. This is because of the isolated construction area and water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Repairing the bypass would require a maximum of four up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would affect PCE 2 due to the reduced flow, which would reduce water levels in the Kachess River downstream of Kachess Reservoir. Reduced water levels could affect the flow characteristics from primarily riffle/run to resembling a narrow channel or isolated pools and side channels with areas of dry bed exposed. This could potentially fragment habitat (for example, by causing isolated pools or side channels and exposed areas of streambed) and temporarily reduce the critical habitat's ability to provide migration habitats with minimal physical, biological, or water quality impairments. The reduced flow and water levels could also impact the water quality by elevating stream temperatures and altering water chemistry parameters, such as dissolved oxygen. The potential for these effects would be greatest during the potential outage in which no supplemental water would be provided. However, the effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

The effect on PCE 2 would occur from the end of the outlet works to Lake Easton; the exact distance would depend on the water year and subsequent level of Lake Easton. Lake Easton water levels would be in the normal operational range through the coordinated use of Keechelus Reservoir. The Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There could be a short-term positive benefit to PCE 2 in this reach resulting from the elevated flow, which could increase migration habitats by temporarily deepening pools and widening the channel.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. These areas would be adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands.

Surface disturbance and use of equipment for grading, planting, and seeding could temporarily affect PCE 2 through a short-term effect on the water quality within the Kachess River, which serves as FMO habitat for Bull Trout. This would be due to a slight increase in the potential for erosion and subsequent increase in sedimentation and turbidity from grading, planting, and seeding in areas near Bull Trout critical habitat. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). Implementing erosion-control methods during revegetation (**Appendix F, Revegetation Plan**) would further minimize the chance of sediment entering the river or reservoir.

Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on PCE 2 from restoration activities.

5.2.3 PCE 3

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur within the areas shown in **Figure 6–Figure 8**. Further details of these project elements are discussed under **Section 2.1.2**.

In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists or in the surrounding uplands. PCE 3 requires "[a]n abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish."

The project elements listed above could temporarily affect this PCE by reducing inputs of terrestrial material that may either serve as direct prey for Bull Trout (for example, terrestrial insects) or as food for aquatic Bull Trout prey (for example, detritus). This is because terrestrial vegetation would be removed in areas adjacent to Bull Trout critical habitat. The potential for this effect would be reduced; this is because all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). Therefore, the contribution of these areas to terrestrial food sources is likely already low.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PCE 3, through a short-term increase in sedimentation and turbidity. These short-term increases could affect the availability of prey (for example, by covering benthic organisms or altering habitat for forage fish) within the Kachess River. However, the construction area would be isolated from water. Also, Reclamation would implement conservation measures to reduce sedimentation, including implementing a sediment and erosion-control plan (**Section 2.1.6, Conservation Measures**). As a result, there would be minimal sediment generated that would run into the river or reservoir during construction.

Because the excavation area would be recovered with concrete after construction, there would also be minimal effects from reintroducing water into the construction area when the cofferdam is removed. There would also be a minimal risk of effects on PCE 3 due to contamination, such as from accidental spills that could reduce habitat for prey. This is because of the isolated construction area and the water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Repairing the bypass would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would affect PCE 3 due to the reduced flow in the Kachess River downstream of Kachess Reservoir. Reducing flow may fragment habitat, which would inhibit Bull Trout access to prey. Reducing flow and potentially drying out areas of the streambed could reduce habitat for smaller fish and strand them, making this food source unavailable. It would also reduce macroinvertebrates and cause changes in community variability, species abundance, and distribution (Muehlbauer et al. 2011; Vadher et al. 2018). Survivorship could decrease with longer drying times (Fritz and Dodds 2004; Vadher et al. 2018). These effects on macroinvertebrates could temporarily reduce the food base, including aquatic macroinvertebrates and forage fish.

The potential for this effect would be greatest during the potential outage in which no supplemental water would be provided. The effects could also occur during the three outages with supplemental water provided at 10 cfs. This effect would be temporary, and prey availability would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. These areas would be adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands.

Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect PCE 3 through a short-term effect on terrestrial organisms that serve as prey. Revegetation would ultimately benefit PCE 3 by restoring vegetation that supports the Bull Trout food base. This includes terrestrial material that may either serve as direct prey for Bull Trout (for example, terrestrial insects) or as food for aquatic Bull Trout prey (for example, detritus).

5.2.4 PCE 4

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur within the areas shown in **Figure 6–Figure 8**. Further details of these project elements are discussed under **Section 2.1.2**.

In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands. PCE 4 requires "complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes, that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks, and unembedded substrates to provide a variety of depths, gradients, velocities, and structure."

The project elements listed above could temporarily affect this PCE through a decrease in LWD inputs within the Kachess River due to tree clearing and grubbing. These project elements would also affect PCE 4 due to a temporary increase in the potential for erosion and the subsequent increase in sedimentation from tree clearing and construction in areas near Bull Trout critical habitat. Fine sediments from runoff and erosion could affect substrate embeddedness by filling in sediment interstices and decreasing the average grain size. The potential for this effect would be reduced because all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Also, the majority of disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**). This would reduce sedimentation into the channel. The dam itself would reduce sedimentation into Kachess Reservoir. Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river or reservoir. After implementing the erosion-control conservation measures, minor amounts of erosion and sedimentation into Kachess River or Reservoir could occur and temporarily affect PCE 4 due to the reduced water quality and increased turbidity.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PCE 4, through a short-term increase in sedimentation and turbidity within the Kachess River. This could affect substrate embeddedness by filling in sediment interstices and decreasing the average grain size.

However, the construction area would be isolated from water. Also, Reclamation would implement conservation measures to reduce sedimentation, including implementing a sediment and erosion-control plan (**Section 2.1.6, Conservation Measures**). As a result, there would be minimal sediment generated that would run into the river or reservoir during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal effects from reintroducing water into the construction area when the cofferdam is removed.

Repairing the bypass would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would affect PCE 4 due to effects on the aquatic environment and the processes in Kachess River below the dam. Reducing or stopping flow would affect the flow characteristics and gradually reduce the water levels in the river. This would temporarily alter habitat complexity by lowering the depth of existing pools and creating isolated pools, reducing side channels, creating areas of exposed streambed that do not serve as habitat, and decreasing water depths and velocities throughout the reach until it meets Lake Easton. Changing the flow could also fragment habitat, which would inhibit fish from accessing refugia, pools, cover, prey, etc., for the periods in which the water flows are changed. The potential for these effects would be greatest during the potential outage in which no supplemental water would be provided. However, these effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

During all conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for 12 hours. There could be a short-term positive benefit to PCE 4 in this reach resulting from the elevated flow and water levels, which could temporarily increase side channels, pool depth, and water levels and velocities.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. These areas would be adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands.

Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect PCE 4. This is due to a temporary increase in the potential for erosion and subsequent increase in sedimentation. Erosion and sedimentation could affect substrate embeddedness by filling in sediment interstices and decreasing the average grain size. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). Implementing erosion-control methods during revegetation (**Appendix F, Revegetation Plan**) would further minimize the chance of sediment entering the river or reservoir. Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on PCE 4 from restoration activities.

5.2.5 PCE 5

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur within the areas shown in **Figure 6–Figure 8**. Further details of these project elements are discussed under **Section 2.1.2**.

In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists. Because tree clearing areas would not be directly along the river bank, a reduction in shading and subsequent changes in stream temperatures (Bixby et al. 2015; Neary et al. 2003) are not expected. Therefore, these project elements are not expected to affect PCE 5, which requires **"water temperatures ranging from 2° to 15° C with adequate thermal refugia for temperatures that exceed the upper end of this range."**

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Because the construction area would be isolated from water, most construction activities associated with the above project elements would not affect PCE 5, which requires "water temperatures ranging from 2° to 15° C with adequate thermal refugia for temperatures that exceed the upper end of this range."

The exception is repairing the bypass, which would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would affect PCE 5 due to reducing or stopping flow in the Kachess River downstream of Kachess Reservoir. Reduced water levels could temporarily alter stream temperatures and reduce thermal refugia, which are important characteristics of Bull Trout SR and FMO habitats. The greatest change in temperature would occur in pools or small channels that become isolated, and temperatures in these areas could potentially fall outside the ideal range of 2° to 15°C. If outages occur in winter, they could lead to colder temperatures and potential freezing of isolated pools after dewatering. Isolated areas could also lack thermal refugia.

Based on input from the NMFS, USFWS, and WDFD, Reclamation would choose the timing of conduit outages to be the most ideal time based on weather (that is, within a temperature threshold); this would help limit effects on PCE 5. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage. The effect on PCE 5 would occur from the end of the outlet works to Lake Easton; the exact distance would depend on the water year and subsequent level of Lake Easton.

Lake Easton water levels would be in the normal operational range through the coordinated use of Keechelus Reservoir. The Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There may be a short-term positive benefit to PCE 5 in this reach resulting from the elevated flow, which could elevate water levels and help maintain water temperatures and thermal refugia.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US

Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. These areas would be adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands. Because revegetation areas would not be directly along the riverbank, a reduction in shading and subsequent changes in stream temperatures (Bixby et al. 2015; Neary et al. 2003) are not expected. Therefore, post-project restoration is not expected to affect PCE 5, which requires "water temperatures ranging from 2° to 15° C with adequate thermal refugia for temperatures that exceed the upper end of this range."

5.2.6 PCE 6

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur within the areas shown in **Figure 6–Figure 8**. Further details of these project elements are discussed under **Section 2.1.2**.

In total, the project would require up 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands. PCE 6 requires "In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure the success of egg and embryo over-winter survival, fry emergence, and young of the year and juvenile survival." The project elements listed above could temporarily affect this PCE through a temporary increase in the potential for erosion and the subsequent increase in sedimentation from tree clearing and construction in areas near Bull Trout critical habitat. This would alter the substrate size and composition.

Bull Trout SR habitat generally contains abundant gravel and cobble substrates, but fine sediments from runoff and erosion could affect substrate embeddedness by filling in sediment interstices and decreasing the average grain size. The potential for this effect would be reduced because all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**); this would reduce sedimentation into the channel. The dam itself would reduce sedimentation into Kachess Reservoir. Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river or reservoir. After implementing the erosion-control conservation measures, minor amounts of erosion and sedimentation into Kachess River or Reservoir could occur and temporarily affect PCE 6 due to the reduced water quality and increased turbidity.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PCE 6, through a short-term increase in sedimentation and turbidity within the Kachess River. These could alter the substrate in SR areas by filling in sediment interstices and decreasing the average grain size.

However, the construction area would be isolated from water. Also, Reclamation would implement conservation measures to reduce sedimentation, including implementing a sediment and erosion-control plan (**Section 2.1.6, Conservation Measures**). As a result, there would be minimal sediment generated that would run into the river or reservoir during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal chance of sedimentation when the cofferdam is removed.

Repairing the bypass would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would affect PCE 6 due to the effects on the flow characteristics and substrate in Kachess River below the dam. Reducing or stopping the flow could alter the distribution of sediments over the channel because it would reduce transport of fine sediments and other material down the channel. This could temporarily alter the substrate amount, size, and composition in SR areas with finer sediments filling in sediment interstices and reducing the average grain size. Fine sediments could become more concentrated in isolated pools or channels where transport is temporarily halted.

The potential for these effects would be greatest during the potential outage in which no supplemental water would be provided; however, these effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage. The effect on PCE 6 would occur from the end of the outlet works to Lake Easton; the exact distance would depend on the water year and subsequent level of Lake Easton.

During all conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for 12 hours. There could be a short-term positive benefit to PCE 6 in this reach resulting from the elevated flow that could temporarily increase sediment transport; this would lead to a decrease in fine sediments and to a substrate amount, size, and composition that are more suitable for SR.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. These areas would be adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands.

Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect PCE 6 due to a temporary increase in the potential for erosion and the subsequent increase in sedimentation. Erosion and sedimentation could affect substrate characteristics by filling in sediment interstices and decreasing the average grain size, making them less functional as SR sites. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). Implementing erosion-control methods during revegetation (**Appendix F, Revegetation Plan**) would further minimize the chance of sediment entering the river or reservoir.

Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on PCE 6 from restoration activities.

5.2.7 PCE 7

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur out of water within the areas shown in **Figure 6–Figure 8**. PCE 7 requires "a natural hydrograph including peak, high, low, and base flows, or if flows are controlled, minimal flow departure from a natural hydrograph." Because the project elements listed above would not occur within Bull Trout critical habitat or within water at all, they would not alter the natural hydrograph or the amount and timing of streamflow. Effects on PCE 7 would be unlikely.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Because of this, most construction activities associated with the above project elements would not alter the natural hydrograph or the amount and timing of streamflow. Effects on PCE 7 would be unlikely.

The exception is repairing the bypass, which would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would affect PCE 7 due to the reduced flow, which would reduce water levels in the Kachess River downstream of Kachess Reservoir and could potentially cause departure from the natural hydrograph. This would result from changes in the amount and timing of streamflow. The potential for these effects would be greatest during the potential outage in which no supplemental water would be provided; however, these effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and flows would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

During all conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). There would not be a measurable effect on the reservoir levels during these events, as described under **Section 2.1.3**; however, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. This could potentially cause a departure from the natural hydrograph due to changes in the amount and timing of streamflow. These effects would be temporary, and flows would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. Because revegetation would not occur within Bull Trout critical habitat or within water at all, it would not alter the natural hydrograph or the amount and timing of streamflow. Thus, effects on PCE 7 would be unlikely.

5.2.8 PCE 8

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur within the areas shown in **Figure 6–Figure 8**. Further details of these project elements are discussed under **Section 2.1.2**.

In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands. PCE 8 requires "sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited." The project elements listed above could temporarily affect this PCE through a short-term effect on the water quality within the Kachess River. This would be due to a slight increase in the potential for erosion and the subsequent increase in sedimentation and turbidity from tree clearing and construction in areas near Bull Trout critical habitat. The potential for this effect would be reduced because all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river or reservoir. After implementing the erosion-control conservation measures, minor amounts of erosion and sedimentation into Kachess River or Reservoir could occur and temporarily affect PCE 8 due to the reduced water quality and increased turbidity. However, due to the reasons described above, water quality is unlikely to be altered to a degree that would inhibit normal reproduction, growth, and survival.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PCE 8, through a short-term increase in sedimentation and turbidity. These could affect the water quality within the Kachess River. However, because the construction area would be isolated from water and conservation measures would be implemented to reduce sedimentation (**Section 2.1.6, Conservation Measures**), there would be minimal sediment generated that would run into the river or reservoir during construction. The water quality is unlikely to be altered to a degree that would inhibit normal reproduction, growth, and survival.

Because the excavation area would be recovered with concrete after construction, there would also be minimal effects from reintroducing water into the construction area when the cofferdam is removed. There would also be a minimal risk of effects on PCE 8 due to contamination, such as from accidental spills that could reduce habitat for prey. This is because of the isolated construction area and water quality conservation measures (**Section 2.1.6, Conservation Measures).**

Repairing the bypass would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would affect PCE 8 due to the reduced flow, which would reduce water levels in the Kachess River downstream of Kachess Reservoir. Reduced water levels could potentially form isolated pools and side channels with areas of dry bed exposed. Reduced water levels could temporarily inhibit the critical habitat's ability to provide sufficient water quantity for normal reproduction, growth, and survival. The potential for these effects would be greatest during the potential outage in which no supplemental water would be provided; however, these effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage. The effect on PCE 8 would occur from the end of the outlet works to Lake Easton; the exact distance would depend on the water year and subsequent level of Lake Easton.

Lake Easton water levels will be in the normal operational range through the coordinated use of Keechelus Reservoir. The Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There could be a short-term positive benefit to PCE 8 in this reach resulting from the elevated flow, which could increase the critical habitat's ability to provide sufficient water quantity for normal reproduction, growth, and survival.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. These areas would be adjacent to, but not within, the Kachess River, where Bull Trout critical habitat exists, or in the surrounding uplands.

Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect PCE 8 through a short-term effect on the water quality within the Kachess River. This is due to a slight increase in the potential for erosion and subsequent increase in sedimentation and turbidity from grading, planting, and seeding in areas near Bull Trout critical habitat. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River and Reservoir, except those areas along the dam and outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

Implementing erosion-control methods during revegetation (**Appendix F, Revegetation Plan**) would further minimize the chance of sediment entering the river or reservoir. Water quality is unlikely to be altered to a degree that would inhibit normal reproduction, growth, and survival. Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on PCE 8 from restoration activities.

5.2.9 PCE 9

PCE 9 requires “low levels of nonnative predation, interbreeding, and competition.” Reclamation would not expect the Proposed Action to influence the occurrence of nonnative predators; therefore, the Proposed Action would be unlikely to affect this PCE.

To assess effects on critical habitat, the crosswalked relationship between habitat indicators (USFWS 1998) and the PCEs of critical habitat for the Bull Trout were considered (Krupka et al. 2011; **Table 2** in **Section 4.3**). **Table 5,** below, shows a matrix summarizing the effects of the Proposed Action on Bull Trout critical habitat PCEs.

Table 5
Effects of the Proposed Action on Matrix Indicators[1]

Pathways (bold) and Indicators	Restore[2]	Maintain[3]	Degrade[4]
Water Quality			
Temperature			X
Sediment and turbidity			X
Chemical contamination and nutrients		X	
Habitat Access			
Physical barriers			X
Habitat Elements			
Substrate embeddedness			X
Large, woody debris			X
Pool frequency and quality			X
Large pools			X
Off-channel habitat			X
Refugia			X
Channel Conditions and Dynamics			
Width-depth ratio			X
Streambank condition			X
Floodplain connectivity			X
Flow/Hydrology			
Change in peak and base flows			X
Increase in drainage network			X
Watershed Conditions			
Road density and location		X	
Disturbance history		X	
Riparian conservation areas		X	
Disturbance regime		X	

Sources: USFWS 1998; Krupka et al. 2011
[1] See table X for the crosswalk between matrix indicators and Bull Trout critical habitat PCEs
[2] For the purposes of this checklist, “restore” means to change the function of an “at risk” indicator to “properly Functioning,” or to change the function of a “not properly functioning” indicator to “at risk” or “properly functioning” (that is, it does not apply to “properly functioning” indicators).
[3] For the purposes of this checklist, “maintain” means that the function of an indicator does not change (that is, it applies to all indicators regardless of functional level).

[4] For the purposes of this checklist, “degrade” means to change the function of an indicator for the worse (that is, it applies to all indicators regardless of functional level). In some cases, a “not properly functioning” indicator may be further worsened, and this should be noted. This includes temporary degradation.

Cumulative effects

Cumulative effects from a variety of activities are likely to adversely affect the PCEs associated with Bull Trout critical habitat. These actions include, but are not limited to, industrial and residential development, road construction and maintenance, mining, forest activities, agriculture and grazing, and fire management. Depending on the type of action, the intensity, and the duration, impacts from these activities have the potential to degrade all PCEs within the action area.

5.3 Northern Spotted Owl

In consultation with the USFWS and WDFW, Reclamation developed project design features and conservation measures to minimize adverse impacts on the NSO and its critical habitat. These include NSO surveys prior to habitat removal and disturbance, implementing seasonal restrictions if resident NSOs are detected, replanting overstory trees in temporary use areas, and collaborating with the US Forest Service for placement of removed trees and vegetation for wildlife habitat improvement in the project area (see **Section 2.1.6, Conservation Measures**).

The Proposed Action would result in construction of the access road and contractor use areas during phase 1 of the project (between May and October 2023), pipe delivery and construction during phase 1 (January to February 2024), and replacement of the outlet works during phase 2 (January 2024 to July 2025). Reclamation anticipates that construction-related effects on NSO would occur from one or more effect pathways. These effects include noise and disturbance and habitat removal and modification, as described in the following sections.

5.3.1 Noise and disturbance

Development of the access road and contractor use areas would occur during the first phase of construction (May/June to October 2023); this would involve activities such as tree cutting and chipping, tree hauling, and access road and use area construction using the following equipment: dozers, forklifts, chainsaws, log chippers, trucks and trailers, cranes, front-end loaders, screens, motor graders, water trucks, and compactors. Fabrication and delivery of pipes to the project area would occur approximately January to June 2023 and would rely on equipment such as 10-foot diameter pipe, trucks, and cranes. Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025) and would involve use of equipment such as trucks; front-end loaders; off-road trucks, cranes, and dozers; and concrete trucks.

If NSOs are present, the above activities and the use of equipment could result in disturbance effects on the NSOs. Loud and continuous noise above ambient levels can result in a significant disruption of NSO breeding, feeding, or sheltering behavior such that it creates the potential for injury to individuals (that is, injury in the form of harassment). NSO reactions to excessive noise levels at or in the immediate vicinity could include the following: flushing from the nest site, which would leave eggs or young exposed to predation; causing a juvenile to prematurely fledge, which would increase its risk of predation; interrupting foraging activities, which would result in the reduced fitness or even mortality of an individual; or disrupting roosting activities, which would cause a NSO to relocate.

A NSO that may be disturbed at a roost site is presumably capable of moving away from disturbance without a significant disruption of its behavior, although there is some potential of increased predation if NSOs flush during daytime hours. NSOs forage primarily at night; therefore, projects that occur during the day are not likely to disrupt their foraging behavior.

For a significant disruption of behavior to occur as a result of disturbance caused by a Proposed Action, the disturbance and NSO must be close to one another. Light maintenance (such as road brushing and grading) and log hauling associated with project activities would have the potential to affect NSO, if these are used within 0.25 miles of an occupied NSO nest tree or suitable nest tree in unsurveyed NRF habitat during the early breeding season (March 1–July 31). The use of chainsaws and heavy equipment would have the potential to adversely affect NSOs, if they are used within 195 feet (65 yards) of an occupied NSO nest tree or suitable nest tree in unsurveyed NRF habitat during the critical breeding period (March 1–July 31). Because tree clearing (phase 1, May to October 2023) and the use of heavy equipment for outlet works replacement (phase 2, January 2024 to July 2025) would overlap the critical breeding period, these actions would cause adverse effects on the NSO, if present.

However, there is low potential that NSOs would be present during the project. This is because, as noted in **Section 4.4**, no NSO was detected during baseline surveys in 2021 or during prior surveys in the vicinity as well as, their significantly reduced population and the availability of higher quality habitat outside the project area. Reclamation would conduct USFWS approved modified surveys for NSO presence prior to and during project activities; results of surveys would determine use of seasonal restrictions during phase 1 (**Section 2.1.6, Conservation Measures** and **Appendix E, Modified NSO Survey Memorandums**).

5.3.2 Habitat removal and modification

The action area for NSO totals 7,258 acres with a 1.8-mile buffer around project activities, excluding major water bodies. A large portion of the action area consists of the town of Easton and associated developments, the I-90 Highway corridor, and utility rights-of-way corridors that would be considered unsuitable or dispersal NSO habitat (**Figure 4**).

Tree clearing, shredding, and grubbing during phase 1 of the project (between May and October 2023) would result in habitat modification and removal. Reclamation would remove a total of 1,436 trees from six areas over 9.6 acres that would serve as the access road and contractor use areas (see **Appendix D**). Removing large trees would reduce the availability of habitat features in the action area, such as roost sites, foraging areas, or shelter. On November 12, 2021, WDFW and Reclamation biologists conducted a reconnaissance NSO habitat assessment, focusing on areas of tree removal and potential NSO suitable habitat in the project area. Based on the recent habitat assessment, the Proposed Action could remove up to 7.12 acres of suitable (foraging) NSO habitat and 2.48 acres of dispersal habitat.

Where tree clearing and grubbing occurs within NSO suitable habitat, it could degrade, downgrade, or remove the foraging habitat. Dispersal habitat would either be degraded or removed. The terms used to describe the effects on habitat are:

- Degrade, which indicates that activities would have a negative influence on habitat quality from the removal or reduction of NSO habitat elements, but not to the degree where the existing habitat function is changed.
- Downgrade, which indicates that activities would reduce habitat elements to the degree where the habitat would not function as it did before the activity, but the activities would not remove the habitat entirely (that is, downgrade from NRF to dispersal habitat).
- Remove, which indicates that activities would reduce habitat elements to the degree where the habitat is no longer functioning for the NSO.

The area slated for tree clearing, shredding, and grubbing contains 7.12 acres of suitable NSO (foraging) habitat and 2.48 acres of dispersal habitat (**Figure 4–Figure 5**). For the purposes of this analysis, it is assumed that removing trees from this habitat would reduce the canopy cover to below 40 percent (that is, below the minimum canopy cover required to classify as dispersal habitat) and result in habitat removal. In NSO habitat with canopy cover greater than 40 percent prior to treatment, the removal of trees that results in canopy covers of less than 40 percent would classify as removal of 2.48 acres of dispersal habitat.

The removal of NRF habitat could impede the breeding, feeding, or sheltering of individual NSOs. Because this habitat is removed (and not downgraded), it could also reduce the NSO's ability to use these areas during dispersal across the landscape, and would, therefore, impede movement. It would also reduce the ability of these areas to provide protection from avian predators and foraging opportunities (USFWS 1992, 2011). This effect would be temporary in some areas because areas cleared for temporary use could be replanted with overstory trees in coordination with a local USFWS biologist and the US Forest Service replanting plan (**Section 2.1.6, Conservation Measures**); however, it would take decades or more for the area to reach the early-, mid-, or late-seral stages that support the NSO across its geographical range, and the areas cleared for permanent use cannot be replanted with overstory trees.

Reclamation will work with the contractor to see if trees over 30' dbh can be retained without inhibiting the construction of the project as well as with USFWS and WDFW biologists to determine the appropriate amount of woody debris to leave in areas that will not be operationally maintained (**Section 2.1.6, Conservation Measures**). This would help retain NSO habitat features to some extent.

There are no activity centers within 1.8 miles of the project area, so they would not be affected. However, removal of 9.6 acres of NSO habitat would reduce the NSO's ability to travel to and from activity centers (dispersal) and reduce the quality of habitat around them for foraging.

In addition to the tree clearing and grubbing areas, an additional 0.7 acres in the action area would experience temporary disturbance from activities such as vehicle use, equipment storage, etc. Temporary disturbance of these areas could reduce habitat quality through minor vegetation removal or damage. It also may reduce the suitability of NSO habitat by removing or reducing features such as snags, downed wood, and canopy closure. However, these areas would be reclaimed through seeding or revegetation.

Clearing and grubbing of trees, as well as minor vegetation disturbance, would also degrade foraging opportunities by reducing understory vegetation, downed wood, and mid-story stand complexity; all of these negatively affect NSO prey species habitat. Research suggests that thinning or associated practices could be detrimental to wood rats, a common prey species, if it reduces hardwoods, shrubs, or downed wood (Innes et al. 2007). The Proposed Action would also negatively affect flying squirrels, another common prey species, by reducing canopy closure, mid-canopy structure, and hiding cover. The Proposed Action may also reduce possible denning structures (trees) and foraging opportunities in cleared areas (Williams et al. 1992).

5.3.3 Cumulative effects

Cumulative effects include the effects of future activities that are reasonably certain to occur in the action area. 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.

For this description of cumulative effects, it is assumed that future activities in the action area will continue into the immediate future at present or increased intensities. As the human population continues to grow, demand for dispersed and developed recreation is likely to occur. This demand could correlate with an increase in developments in and around Kachess Reservoir and Lake Easton to accommodate an increase in visitor use. Developments could include trail building and maintenance and the addition or expansion of existing facilities such as boat launches, buildings, and campgrounds. Additionally, developments on private land in or near the action area would be anticipated. These activities have potential to degrade, downgrade, or remove suitable NSO habitat; disturb or cause avoidance of areas; and disturb or affect the distribution of prey species. Each subsequent action by itself may have only a small incremental effect but taken together they may have a substantive effect that would further degrade habitat suitability for NSO.

5.4 Northern Spotted Owl Critical Habitat

There are 177.9 acres of NSO critical habitat in the action area; of these, 9.6 acres would be in the tree clearing, shredding, and grubbing areas. These actions would essentially clear the canopy and remove NSO habitat elements in the mapped critical habitat. Although the entire project area is within mapped NSO critical habitat, existing disturbed and developed areas, barren areas, and open water would not have habitat elements or PBFs that would qualify as NSO critical habitat. This would include some areas of the 9.6 acres in the barren areas along the dam, along the concrete spillway, along Kachess Reservoir, and in the power line right-of-way. Therefore, effects on designated critical habitat are likely an overestimation. Potential effects specific to each PBF are described in the following paragraphs.

PBF 1: Because tree clearing and grubbing over 9.6 acres of critical habitat would reduce canopy cover, PBF 1 could be adversely affected in these areas, and critical habitat would be effectively removed. However, the Proposed Action's effects would be minimal when compared with the overall availability of critical habitat in the area. The Proposed Action could remove only 0.001 percent of the total East Cascades North critical habitat unit (882,017 acres) and only 0.004 percent of the critical habitat subunit (215,240 acres). Some of the 9.6 acres would also be revegetated in coordination with a local USFWS biologist and the US Forest Service replanting plan (Conservation Measures). However, it would take decades for the area to reach the early-, mid-, or late-seral stages that support the NSO across its geographical range, and the areas cleared for permanent use cannot be replanted with overstory trees.

PBF 2: Based on prior NSO surveys, habitat assessments, and forest cover type modeling, the action area is mostly comprised of NSO foraging and dispersal habitat. There are a few patches with large trees, some multilayered structure, and higher canopy cover that may meet USFWS metrics for nesting and roosting habitat, but these are not within the 9.6-acre tree clearing areas. Based on the November 12, 2021, NSO habitat assessment, PBF 2 habitat (nesting and roosting) would not be affected because it does not occur within the tree clearing areas.

PBF 3: Tree clearing, shredding, and grubbing in the action area would reduce features that provide for foraging, such as mean tree sizes greater than 16.5 inches quadratic mean diameter, a density of large trees (greater than 26 inches), large accumulations of fallen trees and other woody debris on the ground, and cover from predations when flying. Tree clearing Areas C and D/E were identified as forging habitat and total 7.12 acres. The removal of trees, LWD, and vegetation would adversely affect PBF 3 in these areas and effectively remove critical habitat. This is approximately 0.003 percent of the total critical habitat subunit (215,240 acres). Some of the areas would be replanted in coordination with a local USFWS biologist and the US Forest Service replanting plan (**Section 2.1.6, Conservation Measures**). However, it would take decades for the area to reach the early-, mid-, or late-seral stages that function as NSO foraging habitat, and the areas cleared for permanent use cannot be replanted with overstory trees.

Additional vegetation loss and removal could also occur in lower levels over the 0.7 acres of critical habitat outside the tree clearing and grubbing areas in the action area. This is due to minor disturbances from human presence, vehicle use, and other activities. This could alter habitat features such as woody debris for NSOs as well as for prey species. This would interfere with foraging and adversely affect PBF 3.

PBF 4: According to the November 12, 2021, NSO habitat assessment, of the 9.6 acres of critical habitat that would be affected by tree clearing and grubbing actions, approximately 1.7 acres were determined to be dispersal habitat (WDFW 2021). Dispersal habitat would be removed because removal of trees would decrease canopy cover below 40 percent. The area removed is less than 0.001 percent of the total critical habitat subunit (215,240 acres) within the East Cascades North critical habitat unit. Dispersal habitat is not a limiting factor for NSO survivorship and recovery. Also, dispersal habitat is abundant throughout the region. The Proposed Action's removal of dispersal habitat is expected to have discountable effects on NSO critical habitat.

5.4.1 Cumulative effects

Cumulative effects from a variety of activities could adversely affect NSO critical habitat. These actions include, but are not limited to, industrial and residential development, road construction and maintenance, mining, forest activities, agriculture and grazing, and fire management. Activities that involve the removal of mature trees that provide canopy cover may have the longest-term impacts since it would take decades for the area to reach the early-, mid-, or late-seral stages that support the NSO across its geographical range. These activities could include, but are not limited to, industrial and residential development, road construction and maintenance, mining, and forest management. Other activities such as agriculture and grazing, small developments, and fire management may impact smaller trees and understory vegetation that provide foraging and dispersal habitat for the NSO.

Additional factors such as climate change and wildfires could also impact habitat suitability for the NSO. Intense wildfires and change in wildfire regimes can affect Douglas-fir forests, the prominent forest type in the East Cascade ecological zone. These impacts can include killing mature trees, vegetation shifts, and declined recruitment (Davis et al. 2020). Depending on the type of action, the intensity, and the duration, impacts from these activities have the potential to degrade all PBFs within the action area.

5.5 Middle Columbia River Steelhead

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 occur as a result of 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. The action's effects could occur later in time and could include consequences occurring outside the immediate area involved in the action.

The action's effects are classified into the eleven distinct elements, which are described in **Chapter 2**. These include:

- Preparing the site, including tree clearing and grubbing (phase 1)
- Constructing an access road (phase 1)
- Developing staging areas to support construction and long-term maintenance (phase 1)
- Site electrical upgrades (phase 1)
- Fabrication and delivery of pipes (phase 1)
- Extending and lining the conduit (phase 2)
- Low-flow bypass connection (phase 2)
- Installing a diaphragm filter around the conduit (phase 2)
- Installing a stability berm on top of the filter (phase 2)
- Installing an auxiliary drain below the outlet channel (phase 2)
- Revegetation after construction activities (post-project; **Appendix F**)

In consultation with the USFWS, NMFS, and WDFW, Reclamation developed project conservation measures to minimize adverse impacts on steelhead and its critical habitat. These include preparing and implementing a temporary erosion and sediment control plan and a spill prevention control and containment plan, adhering to WSDOT fish exclusion protocols and standards (WSDOT 2016) for fish salvage and relocation, using NMFS-approved pump screens, and others (see **Section 2.1.6, Conservation Measures**). Additionally, Reclamation would adhere to a dewatering plan during proposed conduit outages. A draft plan is provided in **Appendix C**; Reclamation will finalize the plan in coordination with the USFWS, NMFS, and WDFW.

As noted in **Section 2.1.4**, Reclamation is currently consulting with the USFWS on the operation and maintenance of Reclamation facilities in the Yakima River Basin. Reclamation will not be analyzing operation and management of the larger Yakima River Basin Integrated Water Resource Management Plan in the current BA due to concerns with changing the Proposed Action of the consultation already in progress.

5.5.1 Preparing the site, including tree clearing and grubbing (phase 1)

This project element would involve tree clearing, chipping, grubbing, and hauling to prepare sites that will serve as the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). Reclamation plans to work on tree clearing, chipping, and shredding between May and June 2023, and tree hauling to the US Forest Service lot would occur between June and July 2023. Therefore, the timing of these activities would overlap with the spawning, emergence, and rearing periods for steelhead, as described in more detail below.

The tree clearing and grubbing areas are shown in **Figure 8**. As shown in the figure, clearing of trees for two permanent operation and maintenance areas would occur adjacent to the outlet works. The outlet works is isolated from the Kachess River (except in the case of backwatering, by which fish may be carried into the outlet works if water elevation in the stilling basin rises). Therefore, fish abundance in the outlet works is expected to be extremely low during this phase of the Proposed Action. Where clearing and grubbing areas extend south past the outlet works, they would not be directly adjacent to the Kachess River—the edge of the closest area would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel. Additional areas would be cleared to the east and west of the outlet works, over 500 feet from the main channel of the river.

The use of various construction equipment for tree clearing and grubbing could affect steelhead by generating noise and vibrations that travel into water. High levels of underwater sound can have negative physiological effects on fish (Hastings and Popper 2005). The severity of the effect depends on physical, environmental, and biological factors, including the sound-generating activity, sound intensity, sound duration, distance of fish from the point of origin, depth of water and the location of the fish in the water column, the size of fish, the fish species, and ambient noise levels. While sound generated by tree clearing, chipping, and grubbing is not expected to reach intensities associated with blasting or impact pile driving, limited duration behavioral effects (disturbance) resulting from a fish species' startle response could occur. The startle response is observed as an involuntary reaction to an introduced noise disruption that results in a change in an individual's behavior.

Steelhead are likely to avoid habitat closest to the construction area and displace into nearby habitat (likely, downstream in the Kachess River and into Lake Easton; Lake Easton Reservoir levels would not be affected by the Proposed Action) while noise and vibration activities occur.

Because it is not possible to define sound exposure criteria for every possible sound source, type of response, or fish species, recent guidelines for fish on interim sound exposure criteria are based on research that shows a general correlation between the extent of effects and the cumulative level of sound energy to which fish are exposed (WSDOT 2020; Popper et al. 2014; Andersson et al. 2017; Popper and Hawkins 2019; Popper et al. 2019). For salmon, cumulative sound exposure levels of 187 dB cSEL[11] for fish greater than 2 grams and 183 dB cSEL for fish less than 2 grams (or 206

[11] Cumulative sound exposure level; a metric for acoustic events, often used as an indication of the energy dose

dB_{peak}[12] for all sizes) may result in injury, while cumulative sound exposure levels of 150 dB_{RMS}[13] may result in behavioral effects (WSDOT 2020).

The following equipment could be used for tree clearing, chipping, grubbing, and hauling: dozers, forklifts, chainsaws, log chippers, trucks and trailers, cranes, front-end loaders, motor graders, and compactors. At the closest distance of 50 feet from the Kachess River, noise from the use of various construction equipment for tree clearing and grubbing would range from 71 to 101 dB (**Table 6**). Therefore, project noise would likely not be of an intensity that would cause physiological damage or temporary threshold shifts (Popper and Hawkins 2019; Popper et al. 2019). Because levels of noise generated by project construction (**Table 6**) would fall within the thresholds for behavioral effects, they would likely cause limited duration disturbance resulting from a fish species' startle response. Fish closest to the noise source (within tens of meters) could be at a moderate risk of sound masking and a high risk of behavioral responses (Popper and Hawkins 2019; Popper et al. 2019).

All noise associated with tree clearing and grubbing (and the entire Proposed Action) would be generated out of water, while the sounds levels estimated in **Table 6** are for airborne sound attenuation. These values do not account for reductions in sound attenuation that would occur with travel through the bedrock, dam, concrete-lined outlet works, and water. All of these would contribute to reducing noise before reaching steelhead in the river. Other natural factors, such as the topography, vegetation, and temperature, can further reduce noise over distance. The action area's proximity to a residential development and Highway 90 indicates ambient noise or elevated background sound exists near the project-generated noise sources. This could somewhat hide or mask construction noise (WSDOT 2020), suggesting that the noise levels reaching steelhead would be less than those reported in the table.

Table 6
Average Maximum Noise Levels at 50 Feet from Construction Equipment Anticipated to Be Used for the Proposed Action

Equipment[a]	Impact Device	Actual Measured Average Lmax[b] at 50 feet
dozers	No	86
forklifts	No	88
chainsaws	No	83
concrete mixer truck	No	82
concrete pump truck	No	89
excavator	No	87
power tools—chipping gun	No	101
flatbed truck	No	74
cranes	No	79
front-end loaders (cyclical)	No	81

[12] Peak sound pressure, i.e., the instantaneous maximum overpressure, or underpressure, observed during each pulse
[13] The mean square pressure level of the pulse

Equipment[a]	Impact Device	Actual Measured Average Lmax[b] at 50 feet
front-end loaders (passby)	No	71
graders	No	79
water trucks	No	72
compactors	No	75
pumps	No	74

Source: WSDOT 2020

[a] The values presented in the table represent the average maximum noise levels (Lmax) at 50 feet from the source due to the use of heavy equipment associated with the Proposed Action. For all equipment that could be used in the Proposed Action, Lmax ranges from about 71 to 101 dBA for non-impact equipment.

[b] Lmax is the maximum value of a noise level that occurs during a single event.

In addition to noise, tree clearing, chipping, and grubbing could affect steelhead by causing temporary habitat alterations. In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Of this total area, tree clearing, shredding, and grubbing would occur in six areas over 9.6 acres that would serve as the access road and contractor use areas (**Figure 6–Figure 8**). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where steelhead may be present during the time these activities occur (tree clearing, chipping, and shredding in May–June 2023; tree hauling in June–July 2023). As described above, all tree clearing and grubbing areas would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel of the Kachess River (except those areas along the dam and outlet works). The majority of the disturbance areas would be farther away, in the uplands (**Figure 8**).

The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**). This would reduce sedimentation into the channel. Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the channel. After implementing the erosion-control conservation measures, minor amounts of erosion and sedimentation into Kachess River could occur and cause effects on steelhead, as described in the following paragraph.

In general, tree clearing and grubbing near a stream could alter habitat for steelhead by causing excess runoff containing nutrients or by causing sediment to enter the aquatic ecosystem, which could alter the water quality parameters (Elliot et al. 2010; Bixby et al. 2015). Additionally, clearing trees and other vegetation could reduce bank stability and increase erosion. This would increase sedimentation into streams and subsequently could reduce habitat conditions for steelhead, which require low turbidity (Bash 2001). An increase in fine sediment can result in reduced food availability and plant biomass, reduced visibility of prey, reduced availability of benthic[14] food due to smothering, and clogging of gill filaments (Bruton 1985).

Sedimentation could also affect steelhead through effects on prey. Fine sediment can affect macroinvertebrates by causing physical damage, clogging organs, smothering or burial, and habitat

[14] Occurring at the bottom of a body of water

alteration (Jones et al. 2012). Larger particle-sized sediment could alter the habitat conditions for steelhead by settling over habitat and causing effects on and changes in use of the substrate, pools, and other habitat features. Because tree clearing areas would not be directly along the river bank, a reduction in shading and subsequent changes in stream temperatures (Bixby et al. 2015; Neary et al. 2003) are not expected. There could be a slight decrease in large wood, which could cause alterations to the stream structure and complexity (Bixby et al. 2015). As described above, implementing a temporary erosion and sediment control plan (**Section 2.1.6**) would reduce the potential for these effects. Additionally, as described above, the distance of the tree clearing and grubbing areas from the river would reduce the likelihood of sediment entering the water and effects on steelhead habitat.

Reclamation would minimize the effects from minor amounts of sediment entering the water by monitoring turbidity, as described under **Conservation Measures** (**Section 2.1.6**). The construction contractor would monitor and collect water samples to measure potential increases in turbidity to ensure compliance with Water Quality Standards for Surface Waters (WAC 173-201A) during replacement of the outlet works. In accordance with the WAC's aquatic life turbidity criteria for the salmonid rearing and migration category, maximum allowable turbidity levels shall not exceed a 10-NTU increase over background when the background is 50 NTUs or less, or a 20 percent increase in turbidity when the background turbidity is more than 50 NTUs. Should observed turbidity exceed allowable levels at the point of compliance specified in the conservation measure, in-water construction would temporarily stop until turbidity has cleared. In-water construction could then recommence at a slower rate to minimize generated turbidity. Monitoring and additional temporary work stoppages would occur, as needed, in accordance with the conservation measure.

The use of heavy machinery for tree clearing and grubbing increases the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water, where they could injure or kill aquatic food organisms, or directly expose steelhead to hazardous materials. Adherence to water quality conservation measures and the spill prevention control and containment plan (**Section 2.1.6, Conservation Measures**) would minimize the risk of contaminants entering the water and affecting steelhead. Such measures would include conducting fueling and maintenance away from the Kachess River, regularly checking equipment for leaks, having proper concrete washing sites, and maintaining spill prevention and cleanup kits on-site. It is unlikely that any machinery or equipment fluids or accidental concrete would be spilled in volumes or concentrations large enough to harm steelhead in or downstream of the action area.

As stated above, work on this project element would overlap with the spawning, emergence, and rearing periods for steelhead (the spawning period for steelhead in the area is typically April through May; fry emergence is typically May through June, followed by juvenile rearing). Although steelhead spawning has not been documented in the Kachess River below the Kachess Dam, where all tree clearing and grubbing would take place, it is possible that spawning adults, redds, fry, or juveniles could be present in low abundance. If so, noise associated with tree clearing and hauling could impact these life stages for steelhead. Impacts could include an avoidance of adults to spawn in areas of the river closest to where tree clearing and grubbing would occur (minimum of 100 feet from the main channel) due to disturbance from noise, movement, and vibrations. Work occurring near the water could induce erosion and sedimentation, which could make sediments unsuitable for spawning. Sedimentation could also reduce suitability of rearing sites by increasing turbidity and reducing the water quality. Newly emerged fry could leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat. Because Reclamation would implement erosion-control measures to reduce sedimentation (**Section 2.1.6, Conservation Measures**) and the closest tree clearing and grubbing sites would be a minimum of 100 feet from the main channel of the Kachess River (**Figure 8**), the potential for these effects to occur would be low.

5.5.2 Access road construction (phase 1)

Access road construction would occur from July to early October 2023 and could involve using the following equipment: dozers, forklifts, trucks and trailers, cranes, front-end loaders, motor graders, and compactors. As shown in **Figure 6–Figure 7**, the location of the access road would be over 100 feet from the Kachess River.

As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River, noise from the use of various construction equipment for access road construction (e.g., trucks, dozers, forklifts, and cranes) would range from 71 to 101 dB (**Table 6**). This range falls within the thresholds for behavioral effects on fish. Noise levels resulting from access road construction would likely be less, because the access road would be over 100 feet from the river. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

Because access road construction would occur from July to early October 2023, it would not overlap with the steelhead spawning period (April through May). However, access road construction could impact adults and rearing juveniles and fry (fry emergence is typically May–June, followed by rearing). Noise and the vibration from the equipment used for access road construction could cause juveniles and fry to leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat.

Constructing the access road would cause up to 3.6 acres of surface disturbance (**Figure 6–Figure 7**).

Surface disturbance for the access road would occur a minimum of 100 feet from the Kachess River, where steelhead could be present during the time these activities occur (July to early October 2023). Due to the distance of the access road construction from the river and the implementation of the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**), constructing the access road is unlikely to cause increased sedimentation into the river or associated effects on steelhead. If minor levels of sedimentation occur, effects would be as described under ***Preparing the site, including tree clearing and grubbing.***

The use of heavy machinery for access road construction increases the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. As described under ***Preparing the site, including tree clearing and grubbing***, adherence to the water quality conservation measures and the spill prevention control and containment plan (**Section 2.1.6, Conservation Measures**) would minimize the risk of spills entering the water and affecting steelhead.

5.5.3 Staging areas development (phase 1)

Staging areas would be developed from May to July 2023. This project element would involve construction using the following equipment: dozers, forklifts, trucks and trailers, cranes, front-end loaders, motor graders, and compactors. The locations of the staging areas, including temporary contractor use areas as well as permanent operation and management areas, are shown in **Figure 6–Figure 7** and areas that would be newly cleared and grubbed are shown in **Figure 8**. As seen in those figures, clearing of trees for two permanent operation and maintenance areas would occur adjacent to the outlet works, which is isolated from the Kachess River and is not assessable to fish, except in the case of backwatering. Where these areas extend south past the outlet works, they would not be directly adjacent to the Kachess River; the edge of the closest area would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel of the river. Additional area would be cleared to the east and west of the outlet works, over 500 feet from the main channel.

As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River, noise from the use of various construction equipment for developing staging areas (for example, dozers, forklifts, and cranes) would range from 71 to 101 dB (**Table 6**). This range falls within the thresholds for behavioral effects. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

Developing the staging areas would cause up to 4.8 acres of surface disturbance (**Figure 6–Figure 7**).

Surface disturbance for the staging areas would be on either side of the concrete-lined outlet works, a minimum of 50 feet from the stilling basin and farther than 100 feet from the main channel, where steelhead could be present during the time these activities occur (May to July 2023). The distance of the staging areas from the river and the implementation of the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would minimize the amount of sediment entering the Kachess River. Minor levels of sedimentation could occur, and steelhead could be affected, as described under ***Preparing the site, including tree clearing and grubbing.***

The use of heavy machinery for staging area development increases the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. As described under ***Preparing the site, including tree clearing and grubbing***, adherence to the water quality conservation measures (**Section 2.1.6, Conservation Measures**) and the spill prevention control and containment plan would minimize the risk of spills entering the water and affecting steelhead.

Because work on this project element would occur from May to July 2023, it could interfere with steelhead spawning (April through May) and fry emergence (typically May–June). Effects from noise and vibrations from the use of equipment could include adults avoiding areas near where construction activities occur for spawning. They could also cause fry to leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat. Work occurring near the water could cause erosion and sedimentation, resulting in adults avoiding these areas for spawning. Sedimentation could also reduce the suitability of rearing sites by reducing the water quality. Newly emerged fry could leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat. Because Reclamation would implement erosion-control measures to reduce sedimentation (**Section 2.1.6, Conservation Measures**) and the closest staging areas would be a minimum of 100 feet from the main channel of the Kachess River (**Figure 8**), the potential for these effects to occur would be low.

5.5.4 Site electrical upgrade (phase 1)

Site electrical upgrades would entail replacing the current generators, erecting an electrical building along the access road, and burying existing overhead electrical lines beneath the existing approach road. These activities would occur during the same time as access road construction (from July to early October 2023) and would involve using the following equipment: dozers, forklifts, trucks and trailers, cranes, front-end loaders, screens, motor graders, water trucks, and compactors. As shown in **Figure 6–Figure 7**, the location of the electrical upgrades would be over 100 feet from the Kachess River.

As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River, noise from the use of various construction equipment for electrical upgrades (for example, dozers, forklifts, and cranes) would range from 71 to 101 dB (**Table 6**). This range falls within the thresholds for behavioral effects. Noise levels resulting from electrical upgrades would likely be less, because the sites for electrical upgrades would be over 100 feet from the river. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

Because site electrical upgrades would occur from July to early October, the upgrades would not overlap with the steelhead spawning period (April through May). However, noise and vibrations associated with equipment used for site electrical upgrades could impact rearing juveniles and fry. They could cause juveniles and fry to leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat.

Site electrical upgrades would involve up to 1.0 acre of surface disturbance (**Figure 6–Figure 7**).

Surface disturbance for electrical upgrades would occur a minimum of 100 feet from the Kachess River, where steelhead could be present during the time these activities occur (July to early October 2023). Due to the distance of the electrical upgrades from the river and the implementation of the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**), activities associated with electrical upgrades are unlikely to cause increased sedimentation into the river or associated effects on steelhead. If minor levels of sedimentation occur, effects would be as described under ***Preparing the site, including tree clearing and grubbing***.

The use of heavy machinery for electrical upgrades increases the risk for accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. As described under ***Preparing the site, including tree clearing and grubbing***, adherence to the water quality conservation measures (**Section 2.1.6, Conservation Measures**) and the spill prevention control and containment plan would minimize the risk of spills entering the water and affecting steelhead.

5.5.5 Fabrication and delivery of pipes (phase 1)

Fabrication and delivery of pipes to the project area would take place from January to February 2024 and would rely on equipment such as trucks and cranes to delivery and fabricate 10-foot-diameter pipe. Work during this phase would occur in the contractor use areas and access road, as indicated in **Figure 6–Figure 7**. There would be no in-water work during this phase.

Although these project activities would be spatially displaced from the Kachess River, steelhead in the immediate vicinity of the access road and contractor use areas could still be disturbed by noise transferred through the bedrock and dam. The types of equipment used for fabrication and delivery of pipes (trucks and cranes) would likely generate lower levels of noise than equipment used for site preparation and road and staging area construction (**Table 6**). As described under ***Preparing the site, including tree clearing and grubbing***, at the closest distance of 50 feet from the Kachess River, noise from the use of various construction equipment for pipe fabrication and delivery (for example, trucks and cranes) would range from 71 to 101 dB (**Table 6**). This range falls within the thresholds for behavioral effects. This project element would likely cause limited duration disturbance resulting from a fish species' startle response, as described under ***Preparing the site, including tree clearing and grubbing***.

5.5.6 Conduit extension and liner (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025). Prior to placing the diaphragm filter and stability berm, the conduit would be extended downstream by about 100 feet from its current position to accommodate those additions. Extending the conduit would involve excavating a 100-foot-long trench. The width of the excavation would range from approximately 34 feet at its narrowest point to approximately 250 feet at its widest point. It would also involve placing a new concrete encasement around a 10-foot-diameter liner pipe and constructing a new transition section at the relocated outlet works portal structure.

Excavating the foundation for the conduit extension would occur between January and February 2024. Lining the conduit would occur soon after this time, but this schedule could be revised closer to the actual construction. Activities and construction associated with the project element would take place within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish (except in the case of backwatering). The construction area in the outlet works would be isolated from water via a cofferdam to prevent any backwatering and effectively exclude fish from the work area (**Figure 9**).

The following equipment may be used to extend and line the conduit: front-end loaders, cranes, dozers, and trucks. Most noise from using this equipment would be generated within the outlet works, where fish are excluded; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. As described under ***Preparing the site, including tree clearing and grubbing***, noise and vibrations could travel from the source into the river, where steelhead are present. The equipment used for conduit extension and lining would range from approximately 71 to 101 dB at a distance of 50 feet from the source (**Table 6**). These values are likely overestimates, as all noise generated for conduit extension and lining would be generated out of water. Reductions in sound attenuation would occur with travel through the bedrock, dam, concrete-lined outlet works, water, etc. These levels of noise would fall within the thresholds for behavioral effects and would likely cause limited duration disturbance resulting from a fish species' startle response. General effects of noise are further described under ***Preparing the site, including tree clearing and grubbing***.

Work for this project element would be contained within the outlet works, which is a concrete/stoned-lined channel (**Figure 6–Figure 7**). Because the channel is made of concrete and rock, work within it would cause minimal sedimentation, although excavation could produce dust and other fine sediments. To reduce the amount of sediment-laden water generated during work, Reclamation would employ a cofferdam below the excavation area (**Figure 9**). The cofferdam would be composed of a temporary earth fill with a geomembrane liner to prevent water in the river channel from flowing back into the excavation. Reclamation would control flows through the dam to avoid overtopping the cofferdam and construction areas during the project. Excavation for the conduit extension would also employ erosion-control measures, including trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment. For these reasons, there would be minimal sediment generated that would run into the river during construction. After construction, the excavation would be recovered with concrete or stone, or both; therefore, there would also be minimal sediment that would enter the river when the cofferdam is removed and water is reintroduced to the construction/excavation area.

Extending and lining the conduit would also cause a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the excavation area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to the water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Excavating the foundation for the conduit extension would occur between January and February 2024. Constructing formwork and installing rebar would occur for about 3 months from March 18 to June 9. The spawning period for steelhead is April, and fry emergence is typically May through June; therefore, constructing formwork and installing rebar could overlap with both these life stages. Noise associated with construction activities could impact spawning and the emergence of steelhead. Impacts could include adults avoiding areas for spawning where tree clearing is taking place due to noise, movement, and vibrations. Work occurring near the water could cause erosion and sedimentation, resulting in adults avoiding these areas. Newly emerged fry could leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat. However, as described above, the risk of these effects would be small because Reclamation would implement mitigation measures to reduce sedimentation.

5.5.7 Low-flow bypass pipe connection (phase 2)

Repairing the bypass would involve replacing the existing valve, connecting the permanent bypass piping, connecting the temporary bypass piping extension, and removing the temporary bypass. It would occur during phase 2 (January 2024 to July 2025) of the Proposed Action; the exact dates of the schedule would be refined closer to the actual construction date. This work would occur within the outlet works, and equipment such as front-end loaders, cranes, dozers, trucks, screens, and pumps could be used.

Use of the above equipment could potentially cause effects on steelhead due to noise and vibrations, as described under ***Conduit extension and liner***. The pumps used to deliver water to the channel over the spillway during the conduit outages (described below) would add an additional noise source. The pumps would be placed in the intake of the spillway or on the dam crest. With redundancy, there would be an estimated four pumps (two primary and two backup pumps). One pump would produce noise on the level of approximately 74 dB at a distance of 50 feet from the source, and two pumps would produce 148 for dB, which is the maximum number that would be used at a time (**Table 6**; WSDOT 2020). Noise from pumps would likely not affect steelhead in Kachess River because the main channel is separated from the pumps' location by the outlet works and the dam, a distance of several hundred feet.

As described under the Proposed Action, currently to maintain or operate the conduit, the bypass cannot be flowing. Extending the bypass piping would help to limit issues related to maintaining flows during operation and maintenance activities; however, flow could not be passed through the conduit during work on the bypass. Therefore, as described under **Section 2.1.3**, Reclamation is prepared to have a maximum of four, up to 12-hour conduit outages, which is when the low-flow bypass and the gates of the Kachess Dam will need to be closed, and the outlet works would need to be shut off. This does not preclude passing water over the spillway or pumping water when needed. To the extent possible, all conduit outages would be timed to coincide with times when water can be provided via the spillway. As a result, during these outages, Reclamation will maintain at least 10 cfs of minimum flows in the Kachess River. Reclamation would do this either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. All pumps would be screened with NMFS-compliant fish screens (**Section 2.1.6, Conservation Measures**) to minimize the risk of entrainment.

If Reclamation is not able to either pass water over the spillway or pump during one of the four possible conduit outages, dewatering of the Kachess River below the project area could occur, in which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The need for this to occur will depend on reservoir storage and water year, but it would only occur when the reservoir is less than 2,245 feet and during the March–December work window. This dewatering event would coincide with when Easton Lake gates are raised, when it is not dewatered in the winter, to lessen the distance of the impact. This would most likely occur in the fall, but based on water year, there is a chance this might need to take place in the spring or summer. It is anticipated that one dewatering event would be needed and would take place for a time period not to exceed 12 hours. If it is necessary to dewater the Kachess River, at least 30 calendar day advance notice of the event will be given to USFWS, NMFS, WDFW, and other interested parties.

The dewatering plan is provided in **Appendix C**, which provides information regarding fish handling and removal. The final details of the salvage will be agreed upon in coordination with the USFWS, NMFS, and WDFW and considering site conditions, temperatures, and equipment needs based on the time of year.

Reclamation will adhere to fish rescue protocols (WSDOT 2016, 2021; USFWS 2012; **Appendix A**) during dewatering operations to ensure fish protection measures are employed and to decrease the likelihood of injury or mortality to any fish present. Biologists will be on site during dewatering to monitor site conditions and conduct fish recovery. All fish within the Kachess River between Kachess Reservoir and Lake Easton will be targeted for removal from areas that become dewatered using a variety of fish capture methods. Initially, biologists will use dip nets, beach seines, or snorkel surveys to "herd" fish in to capture nets. Locations and numbers of adult salmonids including salmon, steelhead, or Bull Trout will be identified by snorkel surveys during the night of day 1 of dewatering.

Efforts will be made to capture and remove adult fish prior to full dewatering by conducting fish recovery during the ramp down described below. Any steelhead encountered will be netted and captured and removed for subsequent holding and handling. Reclamation intends to incorporate fish capture and handling protocols described in the Section 10 permit for the Kachess SOD project including recommendations for fish capturing, handling, sampling gear, monitoring, and release.

During dewatering, Reclamation will slowly reduce flow dam releases using the standard ramp down rates that are consistent with current operational practices, i.e., 2 inches/hour (**Appendix C**). The goal is to reduce flow about 50% on Day 1 and conduct fish recovery. Once flow is reduced to about 15 cfs, a barrier net will be placed at the downstream end of the reach to prevent fish from moving into the area. Additional fish recovery efforts (primarily snorkel surveys) will be done overnight to locate fish that tend to hide under cover during daylight hours. On the second day, flows will be reduced from about 15 cfs to 0 cfs gradually, with fish recovery occurring throughout that time period (**Appendix C**).

Due to the length of the reach (approximately 0.8 miles when Lake Easton is at full pool), Reclamation anticipates that fish rescue efforts may require 4-6 hours to conduct using an adequate number of fish biologists and fish rescue crews. This is currently described as at least three groups of three, with qualified biologists on each team and a fisheries biologist with the experience and training necessary to handle ESA species to oversee the effort (**Appendix C; Section 2.1.6**). Fish recovery would be conducted in accordance with fish exclusion protocols developed by WSDOT (2016, 2021) and USFWS (2012) as requested by NMFS (Sean Gross personal communication). Electroshocking would occur in accordance with NMFS (2000) electrofishing guidelines. Electroshocking would not be used until all areas to be e-fished are isolated and all adult or subadult-sized fish (for steelhead, fish larger than 22 inches) are removed by other methods from the area. Therefore, adult steelhead will not be shocked. Additionally, any adult steelhead would likely move into deep pools the ramp down procedure and would not require rescue. If the work occurs outside of April/May, the chance of encountering an adult steelhead should be extremely low.

Prior to dewatering, biologists will conduct snorkel surveys to determine the approximate numbers and species of fish present and the extent of the equipment needs. Any steelhead encountered will be removed and relocated to a temporary refuge, such as the stilling basin, deep pools, or Lake Easton, if desired based on input from NMFS, USFWS, and WDFW. Small numbers of fish would be held in containers such as coolers or buckets for short time periods, while being transported to more suitable holding areas. Large numbers of fish would be held in larger containers, such as 330-500 gal stock tanks and provided with oxygen for aeration (**Appendix C**).

Handling activities, even when accomplished carefully and efficiently, are likely to result in sublethal adverse effects (abrasions and stress) to all steelhead handled. Adherence to fish exclusion protocols and standards (USFWS 2012; WSDOT 2016, 2021) would minimize, but not avoid, the effects of handling. These effects could include physiological stress and risk of injury, such as minor abrasion. Because the timing of dewatering would be chosen to fall within a temperature threshold that would minimize effects from extreme temperatures, likely when air temperatures are above 40 ˚F and below 80˚F, the risk of heat or cold stress would be minimized. Aerating water in holding containers would avoid effects associated with dissolved oxygen depletion. If the potential dewatering event overlaps spawning, emergence, or rearing periods for steelhead, it could interfere with these life stages. For example, dewatering could preclude spawning, dry out redds, and interfere with fry emergence or juvenile rearing. This is unlikely because dewatering would coincide with when Easton Lake gates are raised, which is most likely in the fall.

Reduced flows and water levels in Kachess River during the conduit outages could indirectly affect steelhead through the effects on habitat. Effects on habitat include changes in the water temperature and depth, fragmentation of pools, reduced habitat for refugia and cover, and restricted movement, as described in more detail below. During the three outages for which supplemental water would be provided at a rate of 10 cfs, reduced flows in the Kachess River would lower water levels in the river for up to 12 hours. This could subsequently elevate water temperatures, change flow characteristics from primarily riffle/run to resembling a narrow channel, and reduce the availability of habitat features, such as pools, refugia, and prey. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage. Water levels are not expected to be reduced by an amount that would fragment habitat or restrict movement (for example, by causing isolated pools or side channels); this is because a flow of 10 cfs would be provided via the spillway or pumping.

During the potential outage for which no supplemental water would be provided (the potential dewatering event), reduced flows in the Kachess River would lower water levels in the river for up to 12 hours to a greater extent than the outages with supplemental water. Reduced water levels could change the flow characteristics from primarily riffle/run to resembling a narrow channel or isolated pools and side channels with areas of dry bed exposed. This would reduce the availability of habitat features, such as pools, refugia, and prey. It could also elevate stream temperatures. Water levels could be reduced by a degree that could fragment habitat (for example, by causing isolated pools or side channels and exposed areas of streambed), which in turn could impede steelhead movement. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

Certain areas may not become dewatered at all (Reclamation 2019b). As observed during previous dewatering event, the stream channel is primarily trapezoidal, with mostly riffle and run type habitat; therefore, when it dewaters, flow becomes concentrated in a narrower band (Reclamation 2019b). This type of stream channel could reduce the likelihood of the streambed becoming completely dry, and minimal flows could remain that would sustain aquatic life. It is expected that isolated pools, such as the stilling basin, would remain at least 8 feet deep[15] and would provide a temporary refuge for fish during the shutoff periods. Similarly, pools and riffles could also retain water and provide refuge until fish can be relocated.

During all conduit outages, fish passage and minimum flows will be maintained at all times below Easton Dam. If necessary, Keechelus Reservoir would be used to compensate for water deliveries by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. This could cause a short-term positive benefit to steelhead in this reach resulting from elevated water levels, which could potentially reduce water temperatures and increase the availability of habitat features such as riffles, pools, and refugia. As described in **Section 2.1.3**, reducing the flow from Kachess Reservoir and compensating with flow from Keechelus Reservoir could result in a temporary increase in the Kachess Reservoir's elevation and a temporary decrease in the Keechelus Reservoir's elevation. However, steelhead are not know to be present in either of these reservoirs because accessible habitat above both of these dams has been unavailable to steelhead since the early 20th century (YBFWRB 2009). Further, the estimated changes in water levels are outside the accuracy of water surface elevation instruments, and any potential effects to fish present in the reservoirs would be so small as to be discountable.

Reduced flows in Kachess River downstream of the dam could indirectly affect steelhead through effects on prey. Reducing the flow and potentially drying out the streambed could reduce habitat for macroinvertebrates and cause changes in community variability, species abundance, and distribution (Muehlbauer et al. 2011; Vadher et al. 2018). Survivorship could decrease with longer drying times (Fritz and Dodds 2004; Vadher et al. 2018). Such effects on macroinvertebrates could temporarily alter and potentially reduce prey availability for steelhead.

Retention of water in sediment interstices has been shown to support the persistence of some macroinvertebrate species, up to 7 days in moist interstices and longer in fully saturated interstices (Stubbington et al. 2009). Conduit outages associated with the Proposed Action would be 12 hours or less. Providing supplemental water during three conduit outages would reduce the potential for alterations or reductions of the prey base. During the dewatering event, the streambed would likely remain wet from minimal flows from the spillway and groundwater seepage, and some isolated pools would likely remain. This could reduce the potential for alterations or reductions of the prey base, if temperatures do not cause prey to freeze. Based on input from the NMFS, USFWS, and WDFD, Reclamation would choose the timing of dewatering to fall within a temperature threshold to minimize effects on steelhead and their prey from extreme temperatures, which would reduce the potential for this effect.

5.5.8 Diaphragm filter (phase 2)

During this project element, the current outlet works structure would be demolished and removed via excavation, while a four-sided diaphragm filter would be placed just downstream of the original outlet location. Additionally, a 12-inch-diameter drainpipe would be attached. Because of the removal of the existing outlet works structure, no significant excavation into the embankment would

[15] Craig Haskell, personal communication

be necessary to install the new filter. The new filter would extend 10 feet below the base of the extended conduit and part way up the embankment. Work on this project element would take place during phase 2 (January 2024 to July 2025). It would occur after the conduit lining and extension, and more precise timing will be known closer to the actual construction.

Activities and construction associated with installing the diaphragm filter would occur within the outlet works, which is a concrete/stone-lined channel that is isolated from Kachess River and inaccessible to fish except in the case of backwatering. A cofferdam will be placed in the lower end of the outlet channel to prevent any backwatering of the work area if water elevation in the stilling basin rises (**Figure 9**).

The following equipment could be used to install the diaphram: front-end loaders, cranes, dozers, excavators, and trucks. The majority of noise from using this equipment would be generated within the outlet works, where fish are not present; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. Impacts from noise could affect steelhead. The magnitude and type of impacts (temporary, behavioral impacts) would be similar to those described under ***Conduit extension and liner***.

The nature of the outlet works channel, which is made of concrete and rock and where work for this project element would occur (**Figure 6–Figure 7**), indicates that minimal sedimentation would occur. Still, demolishing and removing the existing structure via excavation could produce dust and other fine sediments. As described under ***Conduit extension and liner,*** Reclamation would take measures to reduce sedimentation. These include employing a cofferdam below the excavation area to prevent water in the river channel from flowing back into the excavation; controlling flows through the dam to avoid overtopping the cofferdam and construction areas during the project; and employing erosion-control measures, such as trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment (**Section 2.1.6, Conservation Measures**). As a result of these measures, as well as the concrete lining of the outlet works, there would be minimal sediment generated that would run into the river during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal sediment that would enter the river when the cofferdam is removed.

There would also be a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the construction area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to the water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Because the precise timing of the diaphragm installation is unknown at this point, there is the potential for effects on steelhead spawning, emergence, and rearing. If spawning adults are present. noise from the equipment used for removing the existing structure and installing the diaphragm filter could cause behavioral effects that interfere with spawning, such as by displacing fish and impeding them from spawning in the Kachess River. Newly emerged fry could leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat.

5.5.9 Stability berm (phase 2)

This project element involves constructing a stability berm from compacted fill material sourced from the excavation (consisting of a mixture of clay, sand, gravel, and cobbles) that would overlay the filter zone. Per Reclamation design standards (Reclamation 2011), the berm height could be up to one-half of the reservoir height. Work on this project element would take place during phase 2 (January 2024 to July 2025); more precise timing will be known closer to the actual construction.

Activities associated with constructing a stability berm would occur within the outlet works, which is a concrete/stone-lined channel that is separated from Kachess River and inaccessible to fish except in the case of backwatering. A cofferdam will be placed in the lower end of the outlet channel to prevent any backwatering of the work area if water elevation in the stilling basin rises (**Figure 9**).

The following equipment could be used to construct the stability berm: front-end loaders, cranes, dozers, and trucks. Moist noise from using this equipment would be generated within the outlet works, where fish are not present; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. Impacts from noise could affect steelhead. The magnitude and type of impacts (temporary, behavioral impacts) would be similar to those described under ***Conduit extension and liner***.

Constructing the stability berm is expected to produce minimal sedimentation because the work area would already be excavated. Effects from the excavation are described under ***Conduit extension and liner.*** Measures to reduce sedimentation would apply under all phases of construction and project elements. These include employing a cofferdam below the excavation area to prevent water in the river channel from flowing back into the excavation; controlling flows through the dam to avoid overtopping the cofferdam and construction areas during the project; and employing erosion-control measures, such as trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment (**Section 2.1.6, Conservation Measures**).

There would also be a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the construction area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to the water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Because the precise timing of the stability berm construction is unknown at this point, there is the potential for effects on steelhead spawning, emergence, and rearing. If spawning adults are present, noise from equipment used during construction could cause behavioral effects that interfere with spawning, such as by displacing fish and impeding them from spawning in the Kachess River. Newly emerged fry could leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat.

5.5.10 Auxiliary drain (phase 2)

This project element would involve installing a filter drain below the outlet channel. It would span from the upstream left end of the conduit and extend along the farthest downstream extent to the inspection well. The auxiliary drain would be 12 inches in width with a depth of approximately 10 feet below the outlet channel. The drainpipe would be installed near the left side of the outlet channel using trenching to expand the area to approximately 35 feet at its widest and approximately 3 feet at its narrowest. At its upstream end, the drain would terminate at an auxiliary inspection well that is being included as part of an effort to improve monitoring in this area. At its downstream end, the drain would discharge into the stilling basin just to the left of the end of the concrete liner. A pair of pumps would be installed at the bottom of the well, about 20–30 feet below the surface, to ensure any collecting seepage drains properly.

Work on this project element would take place during phase 2 (January 2024 to July 2025); more precise timing will be known closer to the actual construction. Activities and construction associated with this element would occur within the outlet works, which is a concrete/stone-lined channel that is separated from Kachess and inaccessible to fish except in the case of backwatering. A cofferdam will be placed in the lower end of the outlet channel to prevent any backwatering of the work area if water elevation in the stilling basin rises (**Figure 9**).

Project elements would involve using equipment such as front-end loaders, cranes, dozers, excavators, and trucks. Most noise from using this equipment would be generated within the outlet works, where fish are not present; some noise sources would also occur along the access road and staging areas, where crews would stage equipment and drive. Impacts from noise could affect steelhead. The magnitude and type of impacts (temporary, behavioral impacts) would be similar to those described under ***Conduit extension and liner***.

The nature of the outlet works channel, which is made of concrete and rock and where work for this project element would occur (**Figure 6–Figure 7**), indicates that minimal sedimentation would occur. Still, using trenching to install the drainpipe could produce dust and other fine sediments. As described under ***Conduit extension and liner,*** Reclamation would take measures to reduce sedimentation. These include employing a cofferdam below the excavation area to prevent water in the river channel from flowing back into the excavation; controlling flows through the dam to avoid overtopping the cofferdam and construction areas during the project; and employing erosion-control measures, such as trench wall support, as needed, and a filtered excavation dewatering pump to extract groundwater and precipitation without sediment (**Section 2.1.6, Conservation Measures**). As a result of these measures, as well as the concrete lining of the outlet works, there would be minimal sediment generated that would run into the river during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal sediment that would enter the river when the cofferdam is removed.

There would be a minimal risk of contamination, such as from accidental spills of concrete, fuel, lubricants, hydraulic fluid, or similar contaminants into the riparian zone or directly into the water. This is because the cofferdam would isolate the construction area, so no water from the channel or dam would flow into the work area or vice versa. Additionally, Reclamation would adhere to the water quality conservation measures (**Section 2.1.6, Conservation Measures**).

Because the precise timing of the auxiliary drain construction is unknown at this point, there is the potential for effects on steelhead spawning, emergence, and rearing. If spawning adults are present, noise from equipment used during construction could cause behavioral effects that interfere with spawning, such as by displacing fish and impeding them from spawning in the Kachess River. Newly emerged fry could leave the original emergence site and relocate to another area, thereby increasing the risk of predation or an inability to relocate to suitable rearing habitat.

5.5.11 Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service.

Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect steelhead habitat through a short-term effect on water quality within the Kachess River. This would be due to a slight increase in the potential for erosion and the subsequent increase in sedimentation and turbidity from seeding and planting in areas near steelhead habitat. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River, except those areas along the dam and outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

Because revegetation would restore habitat to baseline conditions, Reclamation would not anticipate long-term impacts on steelhead or steelhead habitat from restoration activities.

5.5.12 Cumulative effects

Cumulative effects include the effects of future activities that are reasonably certain to occur in the action area. 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.

For this description of cumulative effects, Reclamation assumes that future activities in the action area will continue into the immediate future at present or increased intensities. As the human population continues to grow, demand for dispersed and developed recreation is likely to occur. This demand could correlate with an increase in developments in and around Kachess Reservoir and Lake Easton to accommodate an increase in visitor use. Developments could include trail building and maintenance and the addition or expansion of existing facilities, such as boat launches, buildings, and campgrounds. Additionally, Reclamation anticipates developments on private land in or near the action area. These activities have the potential to remove riparian vegetation, deplete streamflow, disrupt fish migration, disconnect rivers from their floodplains, interrupt groundwater-surface water interactions, reduce stream shade (which increases stream temperature), reduce off-channel rearing habitat, and reduce the accumulation of LWD. Reclamation also expects activities associated with visitor use, such as swimming, fishing, and boating, to increase with regional population growth. However, these activities would only be expected to cause minor disturbance to Middle Columbia River steelhead. Specifically, fishing in the action area has likely resulted in the incidental catch of Middle Columbia River steelhead.

Other environmental factors, such as climate change and wildfire, may impact Middle Columbia River steelhead. An increase in water temperature as a result of climate change could restrict current habitat. Wildfires in the action area vicinity could increase erosion, cause an increase in water turbidity, and decrease the overall water quality. Each subsequent action by itself may have only a small incremental effect. However, taken together, they may have a substantive effect that would further degrade the watershed's condition and resiliency and impact habitat suitability for Middle Columbia River steelhead.

Watershed assessments and other education programs may reduce these adverse effects by continuing to raise public awareness about the potentially detrimental effect of residential development and recreation in sensitive habitats and by presenting ways in which a growing human population and healthy fish populations can coexist. Additionally, future restoration projects within the action area could positively impact Middle Columbia River steelhead by improving the water quality and stream habitats.

The effects from implementing the Proposed Action would incrementally contribute to the cumulative effects on steelhead. Noise from construction activities would contribute to disturbance, while sedimentation produced during construction for some of the project elements could contribute to temporary habitat alterations. Changes in the flow during conduit outages for the low-flow bypass connection would also temporarily contribute to temporary habitat alterations, such as reduced water levels; changes in flow characteristics; reductions in the availability of habitat features, such as pools and riffles, refugia, and prey; and habitat fragmentation. These effects would be temporary, and habitat would return to pre-project conditions after construction.

The Proposed Action would contribute to beneficial effects on steelhead and habitat by improving seepage and internal erosion issues through the dam embankment along the outlet works conduit. Reducing erosion would improve the habitat conditions for steelhead by decreasing the turbidity; thus, the Proposed Action would improve opportunities for foraging and movement. Improvements to the dam would also reduce the risk of a potential complete dam failure. A complete dam failure could cause catastrophic effects downstream, such as flooding downstream of the dam, which could kill fish and destroy habitat.

5.6 Middle Columbia River Steelhead Critical Habitat

PBFs 4 (estuarine areas), 5 (nearshore marine areas), and 6 (offshore marine areas) do not exist in the action area; therefore, they not analyzed in this section.

5.6.1 PBF 1

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). Tree clearing, chipping, and shredding would occur between May and June 2023; tree hauling to the US Forest Service lot would occur between June and July 2023; access road construction and electrical upgrades would occur from July to early October 2023; staging areas would be developed from May to July 2023; and fabrication and delivery of pipes would take place from January to February 2024.

All these activities would occur within the areas shown in **Figure 6–Figure 8.** As shown in the figures, clearing of trees for two permanent operation and maintenance areas would occur adjacent to the outlet works. The outlet works is isolated from the Kachess River, except in the case of backwatering, in which fish may be carried into the outlet works. Where these areas extend south past the outlet works, they would not be directly adjacent to the Kachess River; the edge of the closest area would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel. An additional area would be cleared to the east of the outlet works, over 500 feet from the main channel, and another area would be cleared adjacent to the dam. The location of the access road and buried electrical line would be over 100 feet from the Kachess River and Reservoir.

In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where steelhead critical habitat exists. PBF 1 requires "freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development." The project elements listed above could temporarily affect PBF 1 through a short-term effect on water quality within the Kachess River, which could be used as spawning habitat by steelhead. This would be due to a slight increase in the potential for erosion and subsequent increase in sedimentation and turbidity from tree clearing and construction in areas near steelhead critical habitat. This could also affect freshwater spawning sites by altering sediment embeddedness and grainsize. The potential for these effects would be reduced because, as described above, all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 feet from the Kachess River, except those areas along the outlet works. Most disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**). This would also reduce potential for sedimentation into the Kachess River. Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river or reservoir. After implementing the erosion-control conservation measures, minor amounts of erosion and sedimentation into Kachess River could occur and temporarily affect PBF 1 due to the reduced water quality and increased turbidity. Phase 1 activities would not take place near the Yakima River. Therefore, PBF 1 habitat in the Yakima River would not be impacted from phase 1 activities.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PBF 1**,** through a short-term increase in sedimentation and turbidity within the Kachess River. This could affect water quality and characteristics of spawning sediments, such as substrate embeddedness and grain size.

However, the construction area would be isolated from water, and Reclamation would implement conservation measures to reduce sedimentation, including implementing a sediment and erosion-control plan (**Section 2.1.6, Conservation Measures**). As a result, there would be minimal sediment generated that would run into the river or reservoir during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal effects from reintroducing water into the construction area when the cofferdam is removed.

Repairing the bypass would require a maximum of four, up to 12-hour conduit outages, which is when the low-flow bypass and the gates of the Kachess Dam will need to be closed, and the outlet works would need to be shut off. This does not preclude passing water over the spillway or pumping water when needed. During these outages, Reclamation plans to maintain at least 10 cfs of minimum flows in the Kachess River either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years.

If Reclamation is not able to either pass water over the spillway or pump during one of the four possible conduit outages, dewatering of the Kachess River below the project area could occur, in which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The need for this to occur will depend on reservoir storage and water year, but it would only occur when the reservoir is less than 2,245 feet and during the March–December work window. This dewatering event would coincide with when Easton Lake gates are raised, when it is not dewatered in the winter, to lessen the distance of the impact. This would most likely occur in the fall, but based on water year, there is a chance this might need to take place in the spring or summer. It is anticipated that one dewatering event would be needed and would take place for a time period not to exceed 12 hours. If it is necessary to dewater the Kachess River, at least 30 calendar day advance notice of the event will be given to USFWS, NMFS, WDFW, and other interested parties.

The conduit outages would affect PBF 1 due to reduced flow in the Kachess River, downstream of the dam. Reduced water levels could affect the water quantity and quality of freshwater spawning sites and their ability to support spawning, incubation, and larval development. This is because reducing flow would lower water levels, alter the hydrological features, and potentially expose areas of dry bed. The conduit outages could also affect spawning substrate in Kachess River below the dam. Reducing or stopping flow could alter the distribution of sediments over the channel because it would reduce transport of fine sediments and other material down the channel. This could temporarily alter the substrate amount, size, and composition in areas with finer sediments filling in sediment interstices and reducing the average grain size. Fine sediments could become more concentrated in isolated pools or channels where transport is temporarily halted.

The potential for these effects would be greatest during the potential dewatering event; however, these effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage. The effects on PBF 1 would occur in the Kachess River from the end of the outlet works to its confluence with Lake Easton.

During conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There could be a short-term positive benefit to PBF 1 in this reach resulting from the elevated flow, which could increase water quantity and quality conditions that support spawning, incubation, and larval development.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**. Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect PBF 1 due to a temporary increase in the potential for erosion and the subsequent increase in sedimentation. Erosion and sedimentation could affect substrate embeddedness by filling in sediment interstices and decreasing the average grain size.

The potential for these effects would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River, except those areas along the outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). Implementing erosion-control methods during revegetation (**Appendix F, Revegetation Plan**) would further minimize the chance of sediment entering the river. Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on PBF 1 from restoration activities.

5.6.2 PBF 2

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur out of the water within the areas shown in **Figure 6–Figure 8**. Further details of these project elements are discussed under **Section 2.1.2**.

PBF 2 requires "Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks." The phase 1 project elements listed above could temporarily affect PBF 2 through a short-term effect on water quality within the Kachess River, which could be used as rearing habitat by steelhead. This would be due to a slight increase in the potential for erosion and the subsequent increase in sedimentation and turbidity from tree clearing and construction in areas near steelhead critical habitat.

The potential for this effect would be reduced because, as described above, all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 feet from the Kachess River, except those areas along the outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**). This would reduce sedimentation into the channel. Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river.

Because the project elements listed above would not occur within steelhead critical habitat or within water at all, they would have no effect on water features, such as in-water vegetation, substrate, bank characteristics, or in-stream woody debris that could provide cover and forage for juvenile steelhead. Phase 1 activities would not take place near the Yakima River. Therefore, PBF 2 habitat in the Yakima River would not be impacted from phase 1 activities.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PBF 2**,** through a short-term increase in sedimentation and turbidity within the Kachess River. This could affect water quality in freshwater rearing sites.

Repairing the bypass would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, Reclamation plans to maintain at least 10 cfs of minimum flows in the Kachess River either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The potential dewatering event would occur during the March-December work window, but only if Easton Lake is at full pool, to lessen the distance of the impact (approximately 0.8 miles). This would most likely occur in the fall, but based on the water year, there is a chance this might need to take place in the spring or summer.

The conduit outages would affect PBF 2 due to the reduced water levels in the Kachess River downstream of Kachess Reservoir. Reduced water levels could affect flow characteristics and expose areas of dry bed. This could temporarily reduce floodplain connectivity and the critical habitat's ability to maintain physical habitat conditions and support juvenile growth and mobility. The potential for these effects would be greatest during the dewatering event; however, these effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage. Reclamation would not anticipate impacts on other physical habitat conditions, such as woody debris, large rocks and boulders, banks, or submerged vegetation, during phase 2 project elements.

During conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There could be a short-term positive benefit to PBF 2 in this reach resulting from the elevated flow, which could increase water quantity and quality conditions that support juvenile growth and mobility.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**.

Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect PBF 2 due to a temporary increase in the potential for erosion and the subsequent increase in sedimentation. Erosion and sedimentation could affect substrate embeddedness by filling in sediment interstices and decreasing the average grain size. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River, except those areas along the outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). Implementing erosion-control methods during revegetation (**Appendix F, Revegetation Plan**) would further minimize the chance of sediment entering the river. Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on PBF 2 from restoration activities.

5.6.3 PBF 3

Site preparation, access road construction, staging area construction, electrical upgrades, and pipe delivery and fabrication (phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites. Site preparation would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All these activities would occur out of water within the areas shown in **Figure 6–Figure 8**.

In total, the project would require up to 11.1 acres of surface disturbance (7 temporary and 4.1 permanent). Surface disturbance would occur in areas adjacent to, but not within, the Kachess River, where steelhead critical habitat exists or in the surrounding uplands. PBF 3 requires "Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival."

The phase 1 project elements listed above could temporarily affect this PBF through a short-term effect on water quality within the Kachess River. This would be due to a slight increase in the potential for erosion and the subsequent increase in sedimentation and turbidity from tree clearing and construction in areas near steelhead critical habitat. The potential for this effect would be reduced because, as described above, all tree clearing and grubbing areas, roads, and staging areas would be farther than 50 feet from the stilling basin and farther than 100 feet from the main channel. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**).

The streambanks along both sides of the outlet works are steep and already bare for approximately 20–40 feet before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**). This would reduce sedimentation into the channel. Implementing the erosion-control methods described under **Conservation Measures** (**Section 2.1.6**) would further minimize the chance of sediment entering the river.

Because the project elements listed above would not occur within steelhead critical habitat or within water at all, they would have no effect on water features, such as in-water vegetation, substrate, bank characteristics, or in-stream woody debris that could provide cover and forage for juvenile steelhead. All current migration corridors in the action area would continue to be free of obstructions before, during, and after the project. However, minor amounts of erosion and sedimentation into Kachess River could occur and temporarily affect PBF 3 due to the reduced water quality and increased turbidity. Phase I activities would not take place near the Yakima River. Therefore, PBF 3 habitat in the Yakima River would not be impacted from phase 1 activities.

Conduit extension, low-flow bypass connection, diaphragm filter, stability berm, and auxiliary drain (phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect PBF 3, through a short-term increase in sedimentation and turbidity within the Kachess River. This could affect water quality in freshwater migration corridors.

However, the construction area would be isolated from water. Also, Reclamation would implement conservation measures to reduce sedimentation, including implementing a sediment and erosion-control plan (**Section 2.1.6, Conservation Measures**). As a result, there would be minimal sediment generated that would run into the river or reservoir during construction. Because the excavation area would be recovered with concrete after construction, there would also be minimal effects from reintroducing water into the construction area when the cofferdam is removed.

Repairing the bypass would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, Reclamation plans to maintain at least 10 cfs of minimum flows in the Kachess River either by relying on passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If the reservoir level is insufficient to provide water over the spillway or by pumping, a single dewatering event could occur during which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The potential dewatering event would occur during the March-December work window, but only if Easton Lake is at full pool, to lessen the distance of the impact (approximately 0.8 miles). This would most likely occur in the fall, but based on the water year, there is a chance this might need to take place in the spring or summer.

The conduit outages would affect PBF 3 due to reduced water levels in the Kachess River downstream of Kachess Reservoir. Reduced water levels could affect flow characteristics and expose areas of dry bed. This may temporarily reduce the critical habitat's ability to provide unobstructed migration corridors. The potential for these effects would be greatest during the dewatering event; however, these effects could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12-hour conduit outage.

During conduit outages, the Keechelus Reservoir would be used to compensate for water deliveries, if necessary, by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 cfs during the first three outages or from 30 to 0 cfs during the fourth outage). In these events, the Upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. There could be a short-term positive benefit to PBF 3 in this reach resulting from the elevated flow, which could increase water quantity and quality conditions that support unobstructed migration corridors.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which Reclamation will develop in collaboration with the US Forest Service. All these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**.

Surface disturbance and the use of equipment for grading, planting, and seeding could temporarily affect PBF 3 due to a temporary increase in the potential for erosion and the subsequent increase in sedimentation. Erosion and sedimentation could affect substrate embeddedness by filling in sediment interstices and decreasing the average grain size. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 feet from the Kachess River, except those areas along the outlet works. Also, most of the disturbance areas would be farther away, in the uplands (**Figure 6–Figure 8**). Implementing erosion-control methods during revegetation (**Appendix F, Revegetation Plan**) would further minimize the chance of sediment entering the river.

Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on PBF 3 from restoration activities.

5.6.4 Cumulative Effects

Cumulative effects from a variety of activities are likely to adversely affect the PBFs associated with steelhead critical habitat. These actions include, but are not limited to, industrial and residential development, road construction and maintenance, mining, forest activities, agriculture and grazing, and fire management. Depending on the type of action, the intensity, and the duration, impacts from these activities have the potential to degrade critical habitat within the action area.

This page intentionally left blank.

Chapter 6. Effect Determinations

6.1 Bull Trout

The Proposed Action **may affect and is likely to adversely affect** Bull Trout. Direct effects would primarily be due to noise and vibrations generated during construction and capturing and handling fish during dewatering. There is also potential for indirect effects due to habitat alterations, namely increased potential for sedimentation and turbidity, during site preparation and construction in the outlet works. Incorporating the conservation measures in **Section 2.1.6, Conservation Measures** would reduce or minimize the potential for these effects. However, the effects would not be discountable, insignificant, or completely beneficial.

6.2 Bull Trout Critical Habitat

The Proposed Action **may affect and is likely to adversely affect** Bull Trout critical habitat. Adverse effects on critical habitat PCEs 1–8 are expected to result from site preparation and associated tree clearing and grubbing, construction in the outlet works, and reduced flows in the Kachess River during conduit outages and dewatering. These effects would be temporary in nature and would be minimized by implementing the measures presented in **Section 2.1.6, Conservation Measures**. Therefore, Reclamation does not anticipate that the impacts would measurably diminish the value of the habitat to provide for the survival and recovery of Bull Trout.

6.3 Northern Spotted Owl

The Proposed Action **may affect and is likely to adversely affect** the NSO. The Proposed Action would result in the removal of 7.12 acres of suitable NSO habitat and 2.48 acres of dispersal habitat, for a total of 9.6 acres, from tree clearing and grubbing. Habitat removal would reduce the NSO's ability to disperse and forage within the area. Construction could also result in disturbance to NSOs, if present, within 0.25 miles of construction activities occurring during the early breeding season activities. Implementing modified NSO surveys and timing restrictions (if warranted) would reduce the potential risk of disturbance to NSOs, but they cannot fully eliminate potential adverse effects.

6.4 Northern Spotted Owl Critical Habitat

The Proposed Action **may affect and is likely to adversely affect** NSO critical habitat. The action area overlaps 177.9 acres of NSO critical habitat, and clearing and grubbing would remove canopy cover from 9.6 acres of critical habitat. Adverse effects on critical habitat PBFs 1, 2, and 3 would occur from tree clearing and grubbing, which would reduce canopy cover and features that may provide for NRF. The Proposed Action would remove 0.001 percent of the total East Cascades North critical habitat unit (882,017 acres) and 0.004 percent of the critical habitat subunit (215,240 acres). Reclamation would revegetate some of the 9.6 acres in coordination with a local USFWS biologist and the US Forest Service's replanting plan (**Section 2.1.6, Conservation Measures**). However, it would take decades for the area to reach the early-, mid-, or late-seral stages that support the NSO across its geographical range. Also, the areas cleared for permanent use cannot be replanted with overstory trees.

6.5 Middle Columbia River Steelhead

The Proposed Action **may affect and is likely to adversely affect** Middle Columbia River steelhead. Direct effects would primarily be due to noise and vibrations generated during construction and capturing and handling fish during dewatering. There is also potential for indirect effects due to habitat alterations, namely increased potential for sedimentation and turbidity, during site preparation and construction in the outlet works. Incorporating the conservation measures in **Section 2.1.6, Conservation Measures** would reduce or minimize the potential for these effects. However, the effects would not be discountable, insignificant, or completely beneficial.

6.6 Middle Columbia River Steelhead Critical Habitat

The Proposed Action **may affect and is likely to adversely affect** steelhead critical habitat. Adverse effects on critical habitat PCEs 1, 2, and 3 are expected to result from site preparation and associated tree clearing and grubbing, construction in the outlet works, and reduced flows in the Kachess River during conduit outages and dewatering. These effects would be temporary in nature and would be minimized by implementing the measures presented in **Section 2.1.6, Conservation Measures**. Therefore, Reclamation does not anticipate that the impacts would measurably diminish the value of the habitat to provide for the survival and recovery of steelhead.

Chapter 7. Essential Fish Habitat

The Magnuson-Stevens Act defines essential fish habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Federal action agencies proposing, authorizing, funding or undertaking any action that may adversely affect EFH identified under the Magnuson-Stevens Act for Chinook, Coho, and pink salmon to are required to consult with the Secretary of Commerce. The EFH regulations at CFR section 600.920(e)(l)(i) enable Federal agencies to use existing consultation/environmental review procedures to satisfy EFH consultation.

Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (as identified by the PFMC, 2003), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years).

The historical lakes and tributaries of the Upper Yakima River basin formerly supported anadromous fish species, however, the construction of dams and irrigation storage reservoirs has precluded anadromous fish access to some areas. Kachess Dam is a passage barrier for returning anadromous fish, and no anadromous fish species are present in the reservoir or in tributaries upstream of the dam (Reclamation 2019b). Downstream from the dam, the Yakima River watershed supports anadromous runs of salmon, as well as resident species.

Although passage conditions at Easton Dam compromise access to the Yakima River upstream of Easton Dam for some salmonids, spring-run Chinook salmon, which migrate later in the year, regularly ascend the fish ladder at the dam. Their passage is likely made possible by operational or hydraulic conditions that facilitate use of the fish ladder. Therefore, Easton Dam is at least partially passable to adult salmonids. EFH for Pacific Coast salmonids, including chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*), is identified in the action area from Lake Easton up the upper Yakima River to Keechelus Dam and up the Kachess River to Kachess Dam for a total of 11.4 miles in the rivers and 217.9 acres in Lake Easton (NOAA Fisheries 2021).

7.1 EFH Species and Habitat Description: Chinook Salmon

Chinook salmon follow a generalized life-history that includes the following phases: incubation and hatching of embryos; emergence and initial rearing of juveniles in freshwater; estuarine migration and rearing, migration to oceanic habitats for extended periods of feeding and growth; and return to natal waters for completion of maturation, spawning, and death. Within this general life history strategy, Chinook salmon display diverse and complex life-history patterns. Spawning environments range from just above tidewater to over 1,988 miles from the ocean and from coastal rainforest streams to arid mountain tributaries at elevations over 4,921 ft. At least 16 age categories of mature Chinook salmon have been documented, involving three possible freshwater ages and total ages of 2-8 years, reflecting the high variability within and among populations in freshwater, estuarine, and oceanic residency. Chinook salmon also demonstrate variable ocean migration patterns and timing of spawning migrations (PFMC 2021).

This variation in Chinook life-history has been partially explained by separating Chinook salmon into two distinct races: stream-type and ocean-type fish. Stream-type fish have long freshwater residence as juveniles (1-2 years), migrate rapidly to oceanic habitats, and adults often enter freshwater in spring and summer, spawning far upriver in late summer or early fall. Ocean-type fish have short, highly variable freshwater residency (from a few days to several months), extensive estuarine residency, and adults show considerable geographic variation in month of freshwater entry. Within some large systems like the Columbia River, these two types show extensive genetic divergence. There is also substantial variability in other systems due to a combination of phenotypic plasticity and genetic selection to local conditions. A more detailed overview of Chinook salmon life-history and habitat is provided in Appendix A of the Pacific Coast Salmon Management Plan (PFMP 2021).

Freshwater EFH for Chinook salmon consists of four major components, (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat. Freshwater EFH depends on lateral (e.g., floodplain, riparian), vertical (e.g., hyporheic) and longitudinal connectivity to create habitat conditions for spawning, rearing, and migration including: (1) water quality (e.g., dissolved oxygen, nutrients, temperature, etc.); (2) water quantity, depth, and velocity; (3) riparian stream-marine energy exchanges; (4) channel gradient and stability; (5) prey availability; (6) cover and habitat complexity (e.g., LWD, pools, aquatic and terrestrial vegetation, etc.); (7) space; (8) habitat connectivity from headwaters to the ocean (e.g., dispersal corridors); (9) groundwater-stream interactions; and (10) substrate composition. Chinook salmon EFH includes all habitat currently or historically occupied within Washington, Oregon, Idaho, and California (PFMC 2021).

7.2 EFH Species and Habitat Description: Coho Salmon

Coho salmon spawn in freshwater streams, and most juveniles rear in freshwater for one year and spend about 18 months at sea before reaching maturity as adults. However, there is increasing evidence that that the juvenile coho salmon life-history is much more complex than previously thought. For example, studies have found that some coho salmon fry and parr rear in estuarine environments in summer and fall before returning to freshwater habitats to overwinter and others emigrate directly to sea in the fall at age-0 or briefly enter the estuarine environment before entering other nearby streams to overwinter. Unlike some other Pacific salmon species, where the majority of production comes from large spawning populations in a few river basins, coho salmon production results from spawners using numerous small streams. North American coho salmon populations are widely distributed along the Pacific coast and historically spawned in tributaries to most coastal streams and rivers from the southern Santa Cruz Mountains, California, to Point Hope, Alaska, and through the Aleutian Islands. The species is most abundant in coastal areas from central Oregon through southeast Alaska and widely distributed throughout the North Pacific. A more detailed overview of Coho salmon life-history and habitat is provided in Appendix A of the "Pacific Coast Salmon Management Plan" (PFMC 2021).

Freshwater EFH for coho salmon consists of four major components, (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and (4) adult migration corridors and holding habitat. Freshwater EFH depends on lateral (e.g., floodplain, riparian), vertical (e.g., hyporheic) and longitudinal connectivity to create habitat conditions for spawning, rearing, and migration including:

(1) water quality (e.g., dissolved oxygen, nutrients, temperature, etc.); (2) water quantity, depth, and velocity; (3) riparianstream-marine energy exchanges (4) channel gradient and stability; (5) prey availability; (6) cover and habitat complexity (e.g., LWD, pools, aquatic and terrestrial vegetation, etc.); (7) space; (8) habitat connectivity from headwaters to the ocean (e.g., dispersal corridors, floodplain connectivity), (9) groundwater-stream interactions and (10) substrate composition. Coho salmon EFH includes all habitats currently or historically occupied within Washington, Oregon, and California (PFMC 2021).

7.3 Proposed Action

A detailed description of the Proposed Action, including the phases and timing of activities, project elements, materials and equipment, and conservation measures, is provided in **Chapter 2**.

7.4 Effects of Proposed Action

Effects on Pacific Salmon EFH include the direct or indirect physical, chemical, or biological alterations of water or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. The effects of the Proposed Action on EFH for Chinook and Coho salmon would be similar to those described above for steelhead and steelhead critical habitat (**Sections 5.5 and 5.6**).

Site preparation; access road construction; staging area construction; electrical upgrades; pipe delivery and fabrication (Phase 1)

Site preparation would involve tree clearing, chipping, grubbing, and hauling to prepare sites, and would be followed by construction/development of the access road, contractor use areas, and operation and management areas (**Figure 6–Figure 8**). All of these activities would occur within the areas shown in **Figure 6–Figure 8**. Further details of these project elements are discussed under **Section 2.1.2**.

Phase 1 project elements listed above could temporarily affect chinook and coho EFH through a short-term effect on water quality and substrate composition within the Kachess River. This would be due to a slight increase in the potential for erosion and subsequent increase in sedimentation and turbidity from tree clearing and construction in areas near the river. The potential for this effect would be reduced because all tree clearing and grubbing areas, roads, and staging areas would be a minimum of 50 ft from the Kachess River, with the exception of those areas along the outlet works, and the majority of disturbance areas would be further away, in the uplands (**Figure 6–Figure 8**). The stream banks along both sides of the outlet works are steep and already bare for approximately 20–40 ft before reaching the area that would be cleared of trees along either side of the outlet works (**Figure 8**), which would reduce sedimentation into the channel. Implementing the erosion control methods described under **Conservation Measures** (**Section 2.1.6**), would further minimize the chance of sediment entering the river. Because the project elements listed above would not occur within EFH or within water at all, they would have no effect on physical or hydrological features of EFH such as water quantity, depth or velocity, bank characteristics, habitat complexity, or habitat connectivity.

Conduit Extension; low-flow bypass connection; diaphragm filter; stability berm; auxiliary drain (Phase 2)

Replacement of the outlet works would occur during the second and final phase of construction (January 2024 to July 2025); details of these project elements are discussed under **Section 2.1.2**. All activities and construction associated with these project elements would occur within the outlet works, which would be isolated from water via a cofferdam (**Figure 9**). Minor amounts of sediment produced during construction activities, mainly excavation, could temporarily affect EFH through a short-term increase in sedimentation and turbidity, which could slightly alter water quality and substrate composition within the Kachess River. However, because the construction area would be isolated from water and conservation measures would be implemented to reduce sedimentation (**Section 2.1.6, Conservation Measures**), there would be minimal sediment generated that would run into the river during construction. Therefore, water quality and substrate are unlikely to be altered to a degree that would reduce the overall quality or quantity of EFH. Because the excavation area would be recovered with concrete after construction, there would also be minimal effects from reintroducing water into the construction area when the cofferdam is removed.

Repair of the bypass would require a maximum of four, up to 12-hour conduit outages. During at least three of these outages, at least 10 cfs of minimum flows would be maintained in the Kachess River either by passing water over the spillway or by pumping when the reservoir is above 2,245 feet, which occurs for most of the time in most water years. If Reclamation is not able to either pass water over the spillway or pump during one of the four possible conduit outages, dewatering of the Kachess River below the project area could occur, in which no flow from the reservoir would be released for up to 12 hours; however, seepage from the dam and groundwater recharge would continue. The need for this to occur will depend on reservoir storage and water year, but it would only occur when the reservoir is less than 2,245 feet and during the March–December work window. This dewatering event would coincide with when Easton Lake gates are raised, when it is not dewatered in the winter, to lessen the distance of the impact. This would most likely occur in the fall, but based on water year, there is a chance this might need to take place in the spring or summer. It is anticipated that one dewatering event would be needed and would take place for a time period not to exceed 12 hours. If it is necessary to dewater the Kachess River, at least 30 calendar day advance notice of the event will be given to USFWS, NMFS, WDFW, and other interested parties. Further details of the outages are described under **Section 2.1.3**.

The conduit outages would temporarily affect EFH due to reduced flow, which would reduce water levels in the Kachess River downstream of Kachess Reservoir. Reduced water levels could termporarily alter the habitat conditions for spawning, rearing, and migration, such as water quantity, depth, and velocity, habitat complexity, habitat connectivity, and groundwater-stream interactions. These changes would be due to potential formation of isolated pools and side channels with areas of dry bed exposed. The potential for this effect would be greatest during the potential outage for which no supplemental water is provided, but it could also occur during the three outages with supplemental water provided at 10 cfs. These effects would be temporary, and habitat would return to baseline conditions when normal flows are restored after the up to 12 hour conduit outage. The effect on EFH would occur from the end of the outlet works to Lake Easton; the exact distance would depend on the water year and subsequent level of Lake Easton.

Lake Easton water levels will be in the normal operational range through the coordinated use of Keechelus Reservoir. The Keechelus Reservoir would be used to compensate for water deliveries if necessary by providing an extra 20 to 30 cfs of flow (to make up for the reduction from 30 to 10 csf in the case of the first three outages or 30 to 0 cfs in the case of the fourth outage). In these events, the upper Yakima River between Keechelus Reservoir and Lake Easton would experience increased flow for up to 12 hours. However, it is likely that these elevated flows would be temporary and minimal and therefore have negligible impacts.

Implementing a restoration and monitoring plan (post-project)

Post-project revegetation would involve grading and revegetating the 7 acres of non-permanent disturbance. Further details of the revegetation and monitoring elements will be provided in the revegetation plan (**Appendix F**), which will be developed in collaboration with the US Forest Service. All of these activities would occur out of water within the temporary disturbance areas shown in **Figure 6**.

Surface disturbance and use of equipment for grading, planting, and seeding could temporarily affect EFH through a short-term effect on water quality and substrate composition within the Kachess River. This would be due to a temporary increase in the potential for sedimentation, which could increase turbidity and alter substrate composition. The potential for this effect would be reduced because all revegetation areas would be a minimum of 50 ft from the Kachess River, with the exception of those areas along the Dam and outlet works, and the majority of disturbance areas would be further away, in the uplands (**Figure 6–Figure 8**). Implementing erosion control methods during revegetation (**Appendix F, Revegetation Plan**), would further minimize the chance of sediment entering the river. Because revegetation would restore baseline conditions, Reclamation would not anticipate long-term impacts on EFH from restoration activities.

Cumulative effects

Cumulative effects on EFH would be similar to the cumulative effects described for both the Bull Trout and the Middle Columbia River steelhead critical habitat. Future activities, such as construction, maintenance, and developments, in the action area have the potential to impact EFH. These impacts could include, but are not limited to, degradation of the water quantity and quality, erosion and an increase in sedimentation, an increase in water temperature due to climate change or an alteration of shade trees along banks, and commercial or residential developments that could alter the habitat or water quality.

Determination of effect

Although negative effects on EFH for Pacific coast salmonids would be temporary in nature and primarily related to construction and reduced flow during conduit outages, the Proposed Action **may adversely affect** Pacific salmon EFH. Reclamation would minimize the temporary adverse effects on EFH by implementing the measures presented in **Section 2.1.6, Conservation Measures**.

This page intentionally left blank.

Chapter 8. Literature Cited

Ackerman, N.K. 2005. Fish Salvage from the Tieton Dam Stilling Basin, Tieton River, Washington. Goldendale, WA, Tieton Hydropower, LLC.

Andersson, M. H., S. Andersson, J. Ahlsen, B. L. Andersson, J. Hammar, L. K. Persson, J. Pihl, et al. 2017. A framework for regulating underwater noise during pile driving. A technical Vindal report. Stockholm: Environmental Protection agency, Stockholm, Sweden.

Bash, J., C. Berman, and S. Bolton. 2001. Effects of Turbidity and Suspended Solids on Salmonids. University of Washington Center for Streamside Studies, Seattle.

Bixby, R.J., Cooper, S.D., Gresswell, R.E., Brown, L.E., Clifford, D.N., Dwire, K.A., 2015. "Fire effects on aquatic ecosystems: an assessment of the current state of the science." *Freshwater Science* 34:1340–1350.

Bohling, J., Von Bargen, J., Piteo, M., Louden, A., Small, M., Delomas, T.A. and Kovach, R., 2021. "Developing a Standardized Single Nucleotide Polymorphism Panel for Rangewide Genetic Monitoring of Bull Trout." *North American Journal of Fisheries Management*, *41*(6): 1920–1931.

BTWG (Bull Trout Working Group). 2017. Yakima Bull Trout Action Plan 2017 Action Update. Available at: http://ybfwrb.org/wp-content/uploads/2020/02/2017_BTAP_Update.pdf.

Bruton, M.N. 1985. "The effects of suspensoids on fish". *Hydrobiologia* 125:221–241.

City of Yakima. 2020. Nelson Dam Removal Project: Water Supply, Riverine Process, and Fish Passage Improvements Biological Assessment and EFH Assessment.

Davis, K.T., Higuera, P.E., Dobrowski, S.Z., Parks, S.A., Abatzoglou, J.T., Rother, M.T., and Veblen, T.T. 2020. "Fire-catalyzed vegetation shifts in ponderosa pine and Douglas-fir forests in the western United States." Environmental Research Letters 15: 1010b8

Davis, Raymond J., Bruce Hollen, Jeremy Hobson, Julia E. Gower, and David Keenum. 2016. Northwest Forest Plan—The First 20 Years (1994–2013): Status and Trends of Northern Spotted Owl Habitats. Gen. Tech. Rep. PNW-GTR-929. Portland, Oregon: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.

DiVittorio, J., Grodowitz, M., Snow, J., Manross, T. 2012. Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species. Bureau of Reclamation. Denver, Colorado.

Dunham, J.B. and B.E. Rieman. 1999. "Metapopulation structure of Bull Trout: influences of physical, biotic, and geometrical landscape characteristics." *Ecological Applications* 9: 642-655.

Ecology (Washington State Department of Ecology). 2021. Ecology Water Quality Assessment and 303(d) List. Internet website: https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ApprovedSearch.aspx.

Elliot, J. M., and J. A. Elliot. 2010. "Temperature requirements of Atlantic Salmon *Salmo salar,* Brown Trout *Salmo trutta* and Arctic Charr *Salvelinus alpinus*: predicting the effects of climate change." *Journal of Fish Biology* 77:1793–1817.

EPA (U.S. Environmental Protection Agency). 2021. Water Quality Portal. Internet website: https://www.waterqualitydata.us/.

Fraley, J.J. and B.B. Shepard. 1989. "Life history, ecology and population status of migratory Bull Trout (*Salvelinus confluentus*) in the Flathead Lake and River system, Montana." *Northwest Science* 63(4):133-143.

Fritz, K. M. and W. K. Dodds. 2004. "Resistance and resilience of macroinvertebrate assemblages to drying and flood in a tallgrass prairie stream system." *Hydrobiologia* 527: 99–112.

Ford, M. J. (editor). 2022. Biological Viability Assessment Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-171.

Foster, R. J. 1960. "Tertiary geology of a portion of the central Cascade Mountains, Washington" *Geological Society of America Bulletin.* 71(2):99-126.

Fuhrer, G.J., Morace, J.L., Johnson, H.M., Rinella, J.F., Ebbert, J.C., Embrey, S.S., Waite, I.R., Carpenter, K.D., Wise, D.R., and Hughes, C.A. 2004. "Water Quality in the Yakima River Basin, Washington, 1999–2000" *U.S. Geological Survey Circular.* 1237:34.

Gruen, D. 2020. Toxic-Impaired Waterbodies on 303(d) Lists in the Columbia River Basin. U.S. Environmental Protection Agency, Region 10. Seattle, Washington.

Harris Environmental Group. 2021. Northern Spotted Owl Disturbance-only Surveys in the Vicinity of Kachess Dam, Washington Report. Prepared by Glenn Johnson, Harris Environmental Group, Inc. Fircrest, Washington.

Hastings, M. C., and A. N. Popper. 2005. Effects of Sound of Fish. Prepared for Jones & Stokes, Sacramento, California.

Howell, P., K. Jones, D. Scarnecchia, L. LaVoy, W. Kendra, D. Ortmann, C. Neff, C. Petrosky, and R. Thurow. 1985. Stock assessment of Columbia River anadromous salmonids Volume I: chinook, coho, chum and sockeye salmon stock summaries. Bonneville Power Administration, Portland, Oregon.

Innes, R. J., D. H. Van Vuren, D. A. Kelt, M. L. Johnson, J. A. Wilson, and P.A. Stine. 2007. "Habitat associations of dusky-footed woodrats (*Neotoma fuscipes*) in mixed-conifer forest of the northern Sierra Nevada." *J. Mammal* 88: 1523–1531.

Irwin, L.L., Rock, D.F. and Rock, S.C. 2012. "Habitat selection by northern spotted owls in mixed-coniferous forests". *The Journal of Wildlife Management*. 76: 200–213.

Jones, J. I., J. F. Murphy, A. L. Collins, D. A. Sear, P. S. Naden, and P. E. Armitage. 2012. "The impact of fine sediment on macro-invertebrates." *River Research and Applications* 28: 1055–1071.

Karp, C., W. Larrick, M. Johnston, and T. Dick. 2009. Steelhead Movements in the Upper Yakima River Basin, Fall 2002 – Spring 2006. US Department of the Interior, Bureau of Reclamation Technical Service Center, Technical Memorandum No. 3290-07-05, Denver, Colorado.

Krupka, J., K. Halupka, and J. D. L. Vergne. 2011. Crosswalk between the Bull Trout Matrix and Bull Trout Critical Habitat Primary Constituent Elements. US Fish and Wildlife Service, Wenatchee, Washington.

Leary, R.F., F.W. Allendorf, and S.H. Forbes. 1993. Conservation genetics of Bull Trout in the Columbia and Klamath River drainages. Conservation Biology [CONSERV. BIOL.] 7:856-865.

MacDonald, K., S. Noble, and J. Haskins. 1996. An assessment of the status of aquatic resources within subbasins on the Wenatchee National Forest, U.S. Forest Service.

MBTSG (Montana Bull Trout Scientific Group). 1998. The relationship between land management activities and habitat requirements of Bull Trout. Prepared for Montana Bull Trout Restoration Team. Helena, Montana.

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-42, 156p.

Meyer, W. R. 2002. The effects of seasonal de-watering on three age classes of Bull Trout, *Salvelinus confluentus*. MS Thesis. Central Washington University. Ellensburg, WA. 88 pp.

Mizell, M. and E. Anderson. 2015. An Investigation into the Migratory Behavior, Habitat Use and Genetic Composition of Fluvial and Resident Bull Trout (*Salvelinus confluentus)* in the Yakima River Basin. Report to the USFWS, prepared by the Washington Department of Fish and Wildlife, Yakima, Washington.

Muehlbauer, J. D., M. W. Doyle, and E. S. Bernhardt. 2011. "Macroinvertebrate community responses to a dewatering disturbance gradient in a restored stream." *Hydrol. Earth Syst. Sci.* 15: 1771–1783. Internet website: https://doi.org/10.5194/hess-15-1771-2011.

Neary, D. G., Gottfried, G. J., DeBano, L. F., & Tecle, A2003. "Impacts of Fire on Watershed Resources." *Journal of the Arizona-Nevada Academy of Science*, *35*(1), 23–41.

NMFS (National Marine Fisheries Service). 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. Internet website: https://media.fisheries.noaa.gov/dam-migration/electro2000.pdf.

_____. 2005. Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho; Final Rule. Federal Register, Vol. 70, No. 170. https://www.govinfo.gov/content/pkg/FR-2005-09-02/pdf/05-16391.pdf.

_____. 2009. Middle Columbia Steelhead ESA Recovery Plan November 30, 2009. NMFS Northwest Region.

_____. 2016. 2016 5-Year Review: Summary and Evaluation of Middle Columbia River Steelhead. NMFS West Coast Region. Portland, Oregon. https://www.westcoast.fisheries.noaa.gov/publications/status_reviews/salmon_steelhead/2016/2016_middle-columbia.pdf.

_____. 2020. Endangered Species Act Section 7(a)(2) Biological Opinion for the Cle Elum Dam Fish Passage Facilities Project (Splitter Wall), Kittitas County, Washington. NMFS No: WCRO-2020-01573. Available at: https://doi.org/10.25923/tvsk-t394.

NOAA Fisheries (National Oceanic and Atmospheric Administration Fisheries). 2017. NOAA Fisheries/FHWA Best Management Practices (BMPs) Manual for Transportation Actions in the Greater Atlantic Region.

_____. 2021. Essential Fish Habitat Mapper. Internet website: https://www.habitat.noaa.gov/apps/efhmapper/?page=page_4.

Pacific Fishery Management Council. 2021. Pacific Coast Salmon Fishery Management Plan. Portland, Oregon. Internet website: https://www.pcouncil.org/documents/2016/03/salmon-fmp-through-amendment-20.pdf/.

Popper, A. N., A. D. Hawkins, R. R. Fay, D. A. Mann, S. Bartol, T. Carlsonet et al. 2014. ASA S3 s−1C1. 4 TR-2014 sound exposure guidelines for fishes and sea turtles: A technical report prepared by ANSI-accredited standards committee S3 s−1C1 and registered with ANSI. New York, New York: Springer.

Popper, A. N., and A. D. Hawkins. 2019. "An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes." *Journal of Fish Biology*. 94:692–713.

Popper, A. N., A. D. Hawkins, and M. B. Halvorsen. 2019. Anthropogenic Sound and Fishes. Research Report Agreement Y-11761, Task AD WA-RD 891.1. Prepared for The State of Washington Department of Transportation. Olympia, Washington.

Reclamation. 2011. Design Standards Number 13. Embankment Dams. General Design Standards.

_____. 2012. Yakima River Basin Integrated Water Resource Management Plan Final Programmatic Environmental Impact Statement, Benton, Kittitas, Klickitat, and Yakima Counties, Washington. Available at: https://apps.ecology.wa.gov/publications/documents/1212002.pdf.

______. 2019a. Biological Assessment of Potential Effects to Columbia River Bull Trout (*Salvelinus confluentus*) from Tributary Rescue Operations and Hatchery Rearing in the Upper Yakima River, Washington. Yakima, WA.

____. 2019b. Aquatic Impact Worksheet #2019.10.24. Kachess Dam: Fish Bypass Gate Hydraulic Line Repair.

______. 2019c. Final Environmental Impact Statement. Kachess Drought Relief Pumping Plant and Keechelus Reservoir-to-Kachess Reservoir Conveyance. Volume I. Pacific Northwest Region. Yakima, Washington.

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

Reiss, K.Y., J. Thomas, E. Anderson, and J. Cummins. 2012. Yakima Bull Trout Action Plan. Internet website: https://ybfwrb.org/wp-content/uploads/2017/09/YBTAP-9-2012-FINAL-small.pdf.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of Bull Trout. United States Department of Agriculture, Forest Service, Intermountain Research Station, General Technical Report INT 302, Ogden, Utah.

Rieman, B.E., J.T. Peterson and D.L. Myers. 2006. "Have brook trout (*Salvelinus fontinalis*) displaced Bull Trout (*Salvelinus confluentus*) along longitudinal gradients in central Idaho streams?" *Canadian Journal of Fisheries and Aquatic Sciences*.63(1):63–78.

Small, M.P., D. Hawkins, and J. Von Bargen. 2009. Phase 3: Genetic Analysis of Yakima Basin Bull Trout (*Salvelinus confluentus*). Final report. Federal Contract E-1-81. Washington Dept. Fish & Wildlife. Olympia, Washington.

Spruell, P. and A.N. Maxwell. 2002. Genetic analysis of Bull Trout and Dolly Varden in Washington. Report to the United States Fish and Wildlife Service and the Washington Department of Fish and Wildlife. WTSGL-02-101. Wild Salmon and Trout Genetics Lab, University of Montana, Missoula.

State of Washington Department of Ecology. 2022. Publications and forms. Internet website. https://ecology.wa.gov/Footer/Online-tools-publications/Publications-forms

Stubbington, R., A. M. Greenwood, P. J. Wood, P. D. Armitage, J. Gunn, and A. L. Robertson. 2009. "The response of perennial and temporary headwater stream invertebrate communities to hydrological extremes." *Hydrobiologia* 630: 299–312.

USFWS (U.S. Fish and Wildlife Service) and NMFS. 1998. Endangered species consultation handbook. Procedures for conducting consultation and conference activities under Section 7 of the Endangered Species Act.

______. 1990. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Northern Spotted Owl. *Federal Register*. 20(123): 26114–26194.

______. 1992. Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Northern Spotted Owl. *Federal Register*. 57(10): 1796–1838.

______. 1998. A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale. Internet website: https://www.fws.gov/montanafieldoffice/endangered_species/bull_trout_consultation/matrix.pdf.

______. 2002. Draft Recovery Plan for Bull Trout in the Middle Columbia Recovery Unit. Draft Recovery Unit. Pacific Region. Portland, Oregon.

______. 2004. Surveys for Bull Trout presence in the Waptus River Basin. 2003. Mid-Columbia River Fishery Resources Office. Leavenworth, Washington.

______. 2006. Transmittal of Guidance: Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California. Internet website: https://www.fws.gov/arcata/es/birds/mm/documents/MAMU-NSO%20Harassment%20Guidance%20NW%20CA%202006Jul31.pdf.

______. 2008. Bull Trout (*Salvelinus confluentus*) 5-Year Review: Summary and Evaluation. US Fish and Wildlife Service, Portland, Oregon.

______. 2010. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States, Final Rule. 75 *Federal Register* 200 63898–64070.

______. 2011. Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). US Fish and Wildlife Service, Portland, Oregon.

______. 2012b. Endangered and Threatened Wildlife and Plants: Revised Critical Habitat for the Northern Spotted Owl. *Federal Register*. 77(233): 71876–72068

______. 2012c. Protocol for surveying proposed management activities that may impact northern spotted owls. February 2, 2012, revised January 9, 2012. Internet website: https://www.fws.gov/oregonfwo/species/data/northernspottedowl/Documents/2012RevisedNSOprotocol.2.15.12.pdf.

______. 2015a. Recovery Plan for the Coterminous United States Population of Bull Trout (*Salvelinus confluentus*). Portland, Oregon.

______. 2015b. Mid-Columbia Recovery Unit Implementation Plan for Bull Trout (*Salvelinus Confluentus*). Oregon Fish and Wildlife Office, Portland Oregon.

_____. 2015c. Recovery Plan for the Coterminous United States Population of Bull Trout (*Salvelinus confluentus*). Prepared by the Pacific Region, USFWS, Portland Oregon. 194 pp.

_____. 2018. NWI (National Wetlands Inventory). U.S. Fish and Wildlife Service. https://data.nal.usda.gov/dataset/national-wetlands-inventory. Accessed March 31, 2022.

_____. 2021a. Biological Opinion for Cle Elum Dam Fish Passage Construction Activities in the Upper Yakima River, Washington. Kittitas County, Washington.

_____. 2021b. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Northern Spotted Owl. Internet website: https://www.govinfo.gov/content/pkg/FR-2021-11-10/pdf/2021-24365.pdf#page=1.

Vadher, A. N., J. Millett, R. Stubbington, and P. J. Wood. 2018. "Drying duration and stream characteristics influence macroinvertebrate survivorship within the sediments of a temporary channel and exposed gravel bars of a connected perennial stream." *Hydrobiologia* 814: 121–132. Internet website: https://doi.org/10.1007/s10750-018-3544-9.

Washington Department of Fish and Wildlife (WDFW). 1998. Salmonid Stock Inventory. Appendix; Bull Trout and Dolly Varden. Washington Department of Fish and Wildlife, Olympia, WA.

_____. 2004. Salmonid Stock Inventory; Bull Trout /Dolly Varden. Washington Department of Fish and Wildlife, Olympia, WA.

_____. 2021. Unpublished data from site visit on 11/12/2010.

Williams, D. F., J. Verner, H. F. Sakai, and J. R. Waters. 1992. "General biology of major prey species of the California spotted owl." Pages 207–221 In J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutiérrez, G. I. Gold Jr., and T. W. Beck (technical coordinators) "The California spotted owl: a technical assessment of its current status." General Technical Report PSW-GTR-133, Pacific Southwest Research Station, US Department of Agriculture, Forest FWS, Albany, California.

WSDOT (Washington State Department of Transportation). 2016. WSDOT Fish Exclusion Protocols and Standards. Internet website: https://www.wsdot.wa.gov/sites/default/files/2017/10/26/Env-FW-FishMovingProtocols.pdf.

_____. 2020. Construction Noise Impact Assessment. Available at: https://www.nrc.gov/docs/ML1225/ML12250A723.pdf.

_____. 2021. WSDOT Fish Exclusion - Protocol and Standards (2021 update). Internet website: https://wsdot.wa.gov/sites/default/files/2021-12/FishMoving-Policy-StandardsProtocols.pdf.

Yakima Basin Integrated Plan. 2022. Internet website: https://yakimabasinintegratedplan.org/

YBFWRB (Yakima Basin Fish & Wildlife Recovery Board). 2009. Yakima steelhead recovery plan extracted from the 2005 Yakima Subbasin salmon recovery plan with updates. Internet website: https://ybfwrb.org/wp-content/uploads/2017/09/YakimaSteelheadPlan.pdf.

Appendix A

WSDOT Fish Exclusion Protocols and Standards

This page intentionally left blank.

Washington Fish and Wildlife Office
U. S. Fish and Wildlife Service

Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards

Prepared by
U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office, Lacey, WA
in Cooperation with the
National Marine Fisheries Service - Washington Habitat Branch, and
Washington State Department of Transportation
June 19, 2012

Table of Contents

INTRODUCTION

The Washington Fish and Wildlife Office, U. S. Fish and Wildlife Service (FWS) recommends the following protocols and standards for fish exclusion, capture, handling, and relocation where conducted within the range of the federally listed as threatened bull trout. Electroshocking guidelines and references are also included in this document.

This guidance is to provide methods to isolate, capture, and move/relocate fish to minimize effects of construction activities to federally listed bull trout and unlisted species that are present within the affected area. These measures are intended to reduce exposure and risk of potential injury associated with construction activities. Although these measures may result in negative behavioral and, in some cases, physical injury or death to fish, proper implementation of these methods will reduce the likelihood of these effects. These measures are recommended where their implementation will result in the avoidance of the more severe effects fish would experience if they remained in the work area during construction. Implementation of less protective measures may result in additional requirements as part of the Endangered Species Act (ESA) consultation process and/or recommendations provided under the Fish and Wildlife Coordination Act.

WHEN TO USE THIS GUIDANCE

Work below the Ordinary High-Water Mark (or Mean Higher High-Water Mark) will typically be conducted in isolation from flowing waters. Exceptions to this general rule include the following:

1) Implementation of the work area isolation and fish capture and removal protocols described in this document.

2) Placement or removal of small quantities of material (e.g., wood or rock), or installation of structural best management practices (e.g., turbidity curtain), under site conditions where potential exposures and effects to fish are minimized without isolation from flowing waters[1].

3) Work conducted under a declared emergency or under emergency conditions.

4) Work conducted where flow conditions prevent safe implementation of work area isolation and fish capture and removal protocols.

[1] The applicant shall make this determination with consultation or input from the regulatory agencies with jurisdiction, including the Washington State Department of Fish and Wildlife (WDFW), U.S. Fish and Wildlife Service (FWS), and NOAA-National Marine Fisheries Service (NMFS) as appropriate; also, this exception shall not permit work that requires in-water excavation or that presents a risk of increased turbidity beyond the immediate work area or for a duration of more than 15 minutes.

RESPONSIBILITIES AND TRAINING REQUIREMENTS

Implementation of the work area isolation and fish capture and removal protocols will be planned and directed by a qualified biologist (referred to in this document as the directing biologist), possessing all necessary knowledge, training, and experience. We also recommend that the project proponent/consulting agency coordinate with the FWS as early in the planning process as possible to determine the most appropriate in-water work window and identify any conflicts with effects to other listed species, such the marbled murrelet (*Brachyramphus marmoratus*) or the northern spotted owl (*Strix occidentalis caurina*).

If electrofishing is proposed as a means of fish capture, the directing biologist will have a minimum of 100 hours electrofishing experience in the field using similar equipment, and any individuals operating electrofishing equipment will have a minimum of 40 hours electrofishing experience under direct supervision. All individuals participating in fish capture and removal operations will have the training, knowledge, skills, and ability to ensure safe handling of fish, and to ensure the safety of staff conducting the operations.

STAGING AND SEQUENCING OF WORK

The directing biologist will work with the appropriate person (such as the construction and equipment operators for the project) to plan the staging and sequence for work area isolation, fish capture and removal, and dewatering. This plan will consider the size and channel characteristics of the area to be isolated, the method(s) of dewatering (e.g., diversion with bypass flume or culvert; diversion with sandbag, sheet pile or similar cofferdam; etc.), and what sequence of activities will provide the best conditions for safe capture and removal of fish. Where the area to be isolated is small, depths are shallow, hiding cover is limited, and/or conditions are conducive to fish capture6, it may be possible to isolate the work area and remove all fish life prior to dewatering or flow diversion. Where the area to be isolated is large, water is deeper, uncut banks and other hiding cover is present, flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, it may be necessary to commence with dewatering or flow diversion staged in conjunction with fish capture and removal. The directing biologist will use his/her best professional judgment in deciding what sequence of activities is likely to minimize exposure of fish to conditions causing stress or injury (including stranding, exposure to temperature extremes or reduced dissolved oxygen levels, risk of injury resulting from electrofishing, etc.).

The directing biologist will plan work area isolation, fish capture and removal, and dewatering with consideration for the following: habitat connectivity and fish habitat requirements; the duration and extent of planned in-water work; anticipated flow and temperature conditions over the duration of planned in-water work; and, the risk of exposure to turbidity or other unfavorable conditions during construction. If the area to be isolated includes only a portion of the wetted channel width (e.g., large or deep rivers where diversion from the entirety of the wetted channel is difficult or impossible), or if the bypass flume or culvert will effectively maintain connectivity and fish passage for the duration of construction activities, it may be less important whether fish are herded (and/or captured and released) upstream or downstream of the isolated work area. However, if the area to be isolated includes the entire wetted channel width, or if conditions make it unlikely that connectivity (i.e., upstream/downstream fish passage) can be effectively maintained for the duration of construction activities, then the directing biologist will carefully consider whether to herd fish (and/or capture and release fish) upstream or downstream of the isolated work area to minimize effects to individuals. For example, if conditions upstream of the isolated work area may become unfavorable during construction, then fish will not be herded or released to an upstream location; this situation is probably most common where the waterbody in question is small, where seasonal flows are substantially diminished, and conditions of elevated temperature and/or reduced dissolved oxygen are foreseeable. However, the directing biologist will also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation and exposure of fish herded or released to a downstream location.

If large numbers of fish are to be herded (and/or captured and released), and to avoid overcrowding or concentrating fish in areas where their habitat needs cannot be met, it may be appropriate to relocate fish both upstream and downstream of the isolated work area. At locations where habitat connectivity or quality is poor, including along reaches upstream and/or downstream of the isolated work area, the directing biologist will carefully consider whether relocated fish can meet their minimum habitat requirements for the duration of planned in-water work. On rare occasions it may be appropriate to relocate fish at a greater distance upstream and/or downstream (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met, or where they may be exposed to unfavorable conditions, including increased predation, during construction. On those rare occasions where relocation to a greater distance is deemed necessary, the entity will provide notice to the FWS field office[2] with jurisdiction in that area in advance of the operations.

Work Area Isolation - Block Nets

The directing biologist will determine appropriate locations for the placement of block nets, based on site characteristics and a consideration of the type and extent of planned in-water work. Sites that exhibit reduced flow volume or velocity, uniformity of depth, and good accessibility are preferred; sites with heavy vegetation, large cobble or boulders, undercut banks, deep pools, etc. should be avoided due to the difficulty of securing and/or maintaining nets. Sites with a narrow channel cross-section ("constriction") will be avoided if foreseeable flow conditions might overwhelm or dislodge the block nets, posts, or anchors.

[2] Lacey Field Office, Central Washington Field Office (Wenatchee), or Eastern Washington Field Office (Spokane)

The directing biologist will select suitable block nets. Type of material, length, and depth may vary based on site conditions. Typically block nets will be composed of 9.5 millimeter stretched nylon mesh and will be installed at an angle to the direction of flow (i.e., not directly perpendicular to flow) so as to reduce the risk of impinging fish. Block nets must be secured along both banks and the channel bottom to prevent erosion and failure due to debris accumulation, high flows, and/or flanking. Some locations may require additional block net support (e.g., galvanized hardware cloth, affixed metal fence posts, etc.). Anchor bags filled (or half-filled) with clean, washed gravel are preferred over sandbags, especially for nets and anchors that will or may remain in-place for a long duration (i.e., more than 2 weeks). Native materials will not be used as fill for anchor bags. Any use or movement[3] of native substrates or other materials will be incidental and will not appreciably affect channel bed or bank conditions.

Except when planning and intending to herd fish upstream, an upstream block net will be placed first. With a block net secured to prevent movement of fish into the work area from upstream, a second block net will be used as a seine to herd fish in a downstream direction. Where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish (e.g., thick overhanging vegetation, rootwads, logjams, etc.) it may be appropriate to isolate a portion or portions of the work area in phases, rather than attempting to herd fish from the entirety of the work area in a single downstream pass. Fish capture and removal will be most successful if an effort is made to strategically focus and concentrate fish in areas where they can be easily seined and netted. Care will be taken not to concentrate fish where they are exposed to sources of stress, or to leave them concentrated in such areas for a long duration (e.g., more than 30 minutes).

Field staff will be assigned the responsibility of frequently checking and maintaining the nets for accumulated debris, general stability, and proper function. A qualified biologist, or other field staff trained in safe fish handling, will be assigned the responsibility of inspecting the nets and safely capturing and relocating any impinged fish. The frequency of these inspections will be determined by the directing biologist on a case-by-case basis, dependent upon the site, seasonal, and weather conditions. Block nets placed within a local population of bull trout (defined as areas used by bull trout for spawning and/or rearing) will be checked every 4 hours, 24 hours a day, for the duration the block net is in operation. If any bull trout are impinged or killed on or by the nets, the frequency of net inspection will be increased to once hourly, 24 hours a day, for the duration the block net is in operation. If any bull trout are impinged or killed on or by the nets, the frequency of net inspection will be increased to once hourly, 24 hours a day. In the event fish are found impinged on the net(s), or if weather or flow conditions change significantly, the directing biologist will re-consider and adjust the frequency of net inspections so as to

[3] Small instream boulders may be used temporarily to hold net in place and returned to their previous instream position upon removal of net.

minimize the risk of impinging and injuring fish. Block nets will remain in-place until work is complete and conditions are suitable for the reintroduction of fish[4].

Depending upon site characteristics, and the planned staging and sequence for work area isolation and dewatering, it may or may not be necessary to place a downstream block net. Typically, however, site characteristics and/or the duration of planned in-water work will necessitate placement of a net(s) to prevent upstream movement of fish into the work area. If groundwater seepage or site drainage has a tendency to re-wet the area, if the area to be isolated is low-gradient or subject to a backwatering influence, or if the area to be isolated is large and considerable effort will be expended in capturing and removing fish, a downstream block net will be placed. If foreseeable flow conditions over the duration of planned in-water work might enable fish to re-enter the work area from downstream, a downstream block net will be placed.

In most instances where gradual dewatering or flow diversion is staged in conjunction with fish capture and removal, it is appropriate to delay installation of the downstream block net(s) until after fish have been given sufficient time to move downstream by their own choosing. If flows are reduced gradually over the course of several hours, or the length of an entire workday, some (perhaps many) fish will make volitional movements downstream beyond the area to be isolated. Gradual dewatering can be an effective means by which to reduce the risk of fish stress or injury. Gradual dewatering and the encouragement of volitional movement are particularly important where the area to be isolated is large and may hold many fish. However, where the area to be isolated includes a culvert(s), deep pools, undercut banks, or other cover attractive to fish, some (perhaps many) fish will not choose to move downstream regardless of how gradually flows are reduced. The directing biologist will use his/her best professional judgment in deciding what sequence of activities is likely to minimize fish stress or injury (including stranding).

Where the area to be isolated is small, depths are shallow, and conditions are conducive to fish capture, it may be possible to remove all fish life prior to dewatering or to implement plans for dewatering staged with fish capture over a relatively short timeframe (e.g., 1 to 2 hours). Where the area to be isolated is large, depths are not shallow, where flow volumes or velocities are high, and/or conditions are not conducive to easy fish capture, dewatering or flow diversion will be staged in conjunction with fish capture and removal over a longer timeframe (e.g., 3 to 6 hours). The largest areas and/or most difficult site conditions may warrant or require that plans for dewatering and fish capture proceed over the length of an entire workday, or multiple workdays. Where this is the case, fish will be given sufficient time and a means to move downstream by their own

[4] If plans for work area isolation and fish capture and removal include the installation of temporary cofferdams, and once the directing biologist has confirmed fish have been successfully excluded from the entire area enclosed by the cofferdam(s), it may be appropriate to remove block nets and allow fish to re-enter the previously isolated work area; this approach is particularly relevant and appropriate where many weeks or months of construction are planned for completion within temporary cofferdams (i.e., isolated from flowing waters).

choosing to reduce the total number of fish exposed to sources of stress and injury (including fish handling). Extra time needed for this voluntary fish movement needs to be considered and provided for as part of the dewatering process.

Dewatering and Flow Diversion

If dewatering and/or flow diversion are necessary, this work (including related fish capture and removal operations) will comply with any provisions contained in the Hydraulic Project Approval (HPA), or applicable General HPA, issued by the WDFW. If the FWS has provided relevant Terms and Conditions from a Biological Opinion addressing the work (or action), this work will also comply with those Terms and Conditions.

If pumps are used to temporarily bypass water or to dewater residual pools or cofferdams, pump intakes will be screened to prevent aquatic life from entering the intake. Fish screens or guards will comply with Washington State law (RCW 77.57.010 and 77.57.070), with guidelines prescribed by the NMFS[5], and any more stringent requirements contained in the HPA or General HPA issued by the WDFW. If pumps are to be used on a more permanent basis, as the primary or secondary method for diverting flow around the isolated work area, plans for dewatering will address contingencies (i.e., extremes of flow or weather). These plans will include ready access to a larger or additional "back-up" pump with screened intake. If the directing biologist has confirmed that all fish have been successfully excluded from the area, if there is no risk of entraining fish, and adequate plans are in-place to address contingencies (including a routine schedule for inspection), then pumps may be operated without a screened intake. Use of an unscreened intake pump shall be documented.

Fish Capture and Removal

Methods for safe capture and removal of fish from the isolated work area are described below. These methods are given in order of preference. At most locations, a combination of methods will be necessary. To avoid and minimize the risk of injury to fish, attempts to seine and/or net fish will always precede the use of electrofishing equipment. Visual observation techniques (e.g., snorkeling, surveying with polarized glasses or Plexiglas bottomed buckets, etc.) may be used to assess the effectiveness of these methods, to identify locations where fish are concentrating, or otherwise adjust methods for greater effectiveness.

If the planned fish capture and removal operations have not been addressed through section 7 consultation (for example, due to an emergency), seining and netting are impracticable (i.e., electrofishing is deemed the only viable means of fish capture), and

---

[5] National Marine Fisheries Service. 1997. Fish screening criteria for anadromous salmonids. NMFS Southwest Region, January 1997, 12p. << http://swr.nmfs.noaa.gov/hcd/fishscrn.pdf >>.

bull trout may be present, the directing biologist will provide notice to the FWS. This notice will be provided in advance of the operations, and will include an explanation of the unique site conditions or circumstances. Work conducted under a declared emergency (or emergency conditions) will follow established notification protocols under section 7 of the ESA.

Where bull trout and non-listed fish may be present, the directing biologist will ensure that fish capture and removal operations adhere to the following minimum performance measures or expectations:

1) Only dip nets and seines composed of soft (non-abrasive) nylon material will be used.

2) The operations will not resort to the use of electrofishing equipment unless and until other, less injurious methods have removed most or all of the adult and sub-adult fish (i.e., fish in excess of 300 millimeters); the operations will conduct a *minimum* of three complete passes *without capture* using seines and/or nets prior to the use of electrofishing.

3) The operations will confirm success of fish capture and removal before completely dewatering or commencing with other work within the isolated work area; the operations will conduct a minimum of two complete passes without capture using electrofishing equipment.

4) Fish will not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator.

5) A plan for achieving efficient return to appropriate habitat will be developed before the capture and removal process.

6) Every attempt will be made to release ESA-listed specimens first.

<u>Seining</u>

Seining will be the preferred method for fish capture. Other methods will be used when seining is not possible, or when/after attempts at seining have proven ineffective. Seines, once pursed, will remain partially in the water while fish are removed with dip nets. Seines with a "bag" minimize handling stress are preferred. Seines with a bag are also preferred where obstructions make access to the water (or deployment/ retrieval of the seine) difficult.

In general, seining will be more effective if fish, especially juvenile fish, are moved (or "flushed") out from under cover. Methods which may increase effectiveness and/or efficiency include conducting seining operations at dawn or dusk (i.e., during low-light conditions), in conjunction with snorkeling, and/or flushing of the cover. In flowing waters, and especially where flow volume or velocity is high or moderately-high, seines that employ a heavy lead line and variable mesh size are preferred.

Small mesh sizes are more effective across the full range of fish size (and age class), but also increase resistance and can make deployment/ retrieval more difficult in flowing waters. Seines which use a small mesh size in the bag (or body), and a larger, less resistant mesh size in the wings may under some conditions be most effective and efficient.

Baited Minnow Traps

Baited minnow traps are typically used before and in conjunction with seining. Traps may be left in the isolated work area overnight. Traps will be inspected at least four times daily to remove captured fish and thereby minimize predation within the trap. Traps will be checked more frequently if temperatures are in excess of 15 degrees C.

Predation within the trap may be an unacceptable risk when minnow traps are left in-place overnight; large sculpin and other predators that feed on juvenile fish are typically much more active at night. The directing biologist will consider the need and plan for work outside daylight hours (i.e., inspection and removal) before leaving minnow traps in-place overnight.

Dip Nets

Dip nets will be used in conjunction with seining. This method is particularly effective when employed during gradual dewatering or flow diversion. To be most effective and to minimize stress and risk of injury to fish (including stranding), the directing biologist will coordinate fish capture operations with plans for dewatering or flow diversion. Plans for dewatering and/or flow diversion will proceed at a measured pace (within constraints), to encourage the volitional downstream movement of fish, and reduce the risk of stranding. The directing biologist shall monitor the dewatering process to insure that water is removed slowly to allow for fish capture and preclude stranding. Plans for dewatering and/or flow diversion will not proceed unless there are sufficient staff and materials on-site to capture and safely remove fish in a timely manner. Generally this will require a minimum of two persons (three if electrofishing), but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing).

Once netted, fish will remain partially in water until transferred to a bucket, cooler, or holding tank. Dip nets which retain a volume of water ("sanctuary nets") are preferred. However, sanctuary nets may be ineffective where flow volume or velocity is high or moderately-high (i.e., increased resistance lessens ability to net and capture fish). In addition, where water depths are very shallow and/or fish are concentrated in very small receding pools or coarse substrate, "aquarium" nets may be a better, more effective choice. Use of dip nets in conjunction with snorkeling, flushing of the cover, or around the hours of dawn or dusk (i.e., during low-light conditions), can be effective for capturing fish sheltered below cover.

Connecting Rod Snakes

Connecting rod snakes may be used to flush fish out of stream crossing structures (i.e., culverts). Connecting rod snakes are composed of wood sections approximately 3 feet in length. Like other cover attractive to fish, culverts (especially long culverts), can present a challenge to fish capture and removal operations. The directing biologist will plan a strategy for focusing and concentrating fish in areas where they can be easily seined and netted, and will take active steps to prevent fish from evading capture. When first implementing plans for work area isolation, fish capture and removal, and dewatering, it may be appropriate to place block nets immediately upstream and/or downstream of culverts to minimize the number of fish that might seek cover within the culvert(s). Once most or all of the fish have been removed from other parts of the work area, the block net placed downstream of the culvert(s) will be removed to encourage volitional downstream movement of fish.

Electrofishing

Electrofishing will be performed only when other methods of fish capture and removal have proven impracticable or ineffective at removing all fish. The directing biologist will ensure that attempts to seine and/or net fish always precede the use of electrofishing equipment. Larger fish (i.e., adult and sub-adult fish with comparatively longer spine lengths) are more susceptible to electrofishing injury than smaller fish. To minimize the risk of injury (and the number of fish potentially injured), the directing biologist will confirm that other methods have been effective in removing most or all of the adult and sub-adult fish before resorting to the use of electrofishing equipment; see the related performance measure appearing on page 6. As a general rule or performance measure, electrofishing will not be conducted under conditions that offer poor visibility (i.e., visibility of less than 0.5 meter).

The following performance measures will apply to the use of electrofishing equipment as a means of fish capture and removal:

1) Electrofishing will only be conducted when a directing biologist with at least 100 hours of electrofishing experience or completion of and/or certification from acceptable training[6] is on-site to conduct or direct all related activities. The directing biologist will be familiar with the principles of electrofishing, including the effects of voltage, pulse width and pulse rate on fish, and associated risk of injury or mortality. The directing biologist will have knowledge regarding galvanotaxis, narcosis and tetany, their relationships to injury/mortality rates, and will have the ability to recognize these responses when exhibited by fish.

[6] For example, the National Conservation Training Center's *Principles & Techniques of Electrofishing* course.

2) The directing biologist will ensure that electrofishing attempts use the minimum voltage, pulse width, and rate settings necessary to achieve the desired response (galvanotaxis). Water conductivity will be measured in the field prior to each electrofishing attempt to determine appropriate settings. Electrofishing methods and equipment will comply with guidelines outlined by the NMFS[7].

3) The initial and maximum settings identified below (Table 1) will serve as guidelines when electrofishing in waters that may support bull trout. Use only DC or pulsed DC current. [**Note**: some newer, late-model electrofishing equipment includes a "set-up" or initialization function; the directing biologist will have the discretion to use this function as a means to identify proper initial settings.]

Table 1. Guidelines for initial and maximum settings for backpack electrofishing.[8]

	Initial Settings	**Conductivity (µS/cm)**	**Maximum Settings**
Voltage	100 V	≤ 300 > 300	800 V 400 V
Pulse Width	500 µs		5 ms
Pulse Rate	15 Hz		60 Hz [*In general*, exceeding 40 Hz will injure more fish.]

Each attempt will begin with low settings for pulse width and pulse rate. If fish present in the area being electrofished do not exhibit a response, the settings will gradually be increased until the appropriate response is achieved (galvanotaxis). The lowest effective settings for pulse width, pulse rate, and voltage will be used to minimize risks to both personnel and fish. Safe implementation is a high priority. The directing biologist will ensure the safety of all individuals assisting with electrofishing attempts; this includes planning for and providing all necessary safety equipment and materials (e.g., insulated waders and gloves, first aid/CPR kit, a current safety plan with emergency contacts and phone numbers, etc.). Only individuals that are trained and familiar with the use of electrofishing equipment will provide direct assistance during electrofishing attempts.

4) Electrofishing will not be conducted where spawning adults or redds with incubating eggs may be exposed to the electrical current. As a general rule or performance measure, waters that support bull trout will not be electrofished from October 15 through May 15, and resident waters from November 1 through May

[7] National Marine Fisheries Service. 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. NMFS Northwest Region, June 2000, 5p. << http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf >>.

[8] Adapted from NMFS (June 2000) and WDFW Electrofishing Guidelines for Stream Typing (May 2001).

15. If located within a local bull trout population (i.e., that support spawning and rearing[9]), seasonal limitations on the use of electrofishing equipment may be more restrictive; if you have questions, contact the FWS. If more restrictive work windows have been identified through consultation, those windows will apply. The directing biologist will ensure that electrofishing attempts are made only during appropriate times of year, and not where spawning adults or redds with incubating eggs may be exposed to the electrical current.

5) An individual will be stationed at the downstream block net(s) during electrofishing attempts to recover stunned fish in the event they are flushed downstream and/or impinged against the block net(s). The nets will also be checked after all electrofishing is complete.

6) The operator will use caution to prevent fish from coming into direct contact with the anode. Under most conditions, the zone of potential fish injury extends approximately 0.5 meter from the anode. Netting will not be attached to the anode, as this practice presents an increased risk of direct contact and injury. Extra care will be taken near in-water structures or undercut banks, in shallow waters, or where fish densities are high. Under these conditions, fish are more likely to come into close or direct contact with the anode and/or voltage gradients may be intensified. Re-adjust voltage and other settings to accommodate changing conditions in the field, including channel depth. When electrofishing near undercut banks, overhanging vegetation, large cobble or boulders, or where structures provide cover, fish that avoid capture may be exposed to the electrical current repeatedly. Repeated or prolonged exposures to the electrical current present a higher risk of injury, and therefore galvanotaxis will be used to draw fish out of cover.

7) Electrofishing will be conducted in a manner that minimizes harm to fish. Once an appropriate fish response (galvanotaxis) is achieved, the isolated work area will be worked systematically. The number of passes will be kept to a minimum, but is dependent upon the numbers of fish and site characteristics and will be at the discretion of the directing biologist. Do not conduct electrofishing unless there are sufficient staff and materials on-site, to minimize the number of passes required and to locate, net, recover, and release fish in a timely manner. Generally, this will require a minimum of three persons, but the directing biologist may find that some sites (especially large or complicated sites) warrant or require a more intensive effort (i.e., additional staffing). Care will be taken to remove fish from the electrical field immediately and to avoid exposing the same fish repeatedly. Fish will not be held in dip nets while electrofishing is in progress (i.e., while continuing to capture additional fish). [Note: where flow velocity or turbulence is high or moderately-high (e.g., within riffles) it may be difficult to see and net fish; these fish may evade capture (resulting in repeated

[9] See bull trout draft recovery plans for local population information. This information is available at http://www.fws.gov/pacific/bulltrout/Recovery.html.

exposure), or may become impinged on the downstream block net(s); a "frame" net, or small and portable block net approximately 3 feet in width, can be effective under these conditions when held downstream in close proximity to the anode.]

8) Carefully observe and document the condition of captured fish. Dark bands on the body and/or extended recovery times are signs of stress or injury. When such signs are noted, settings for the electrofishing unit may require readjustment. The directing biologist will also review and consider changes to the manner in which the electrofishing attempt is proceeding. If adjustments to the electrofishing attempt do not lessen the frequency (or severity) of observed stress, the directing biologist will have the authority to postpone fish capture and removal operations[10]. Each fish must be capable of remaining upright and actively swimming prior to release (see Fish Handling, Holding, and Release).

9) Electrofishing will not be conducted when turbidity reduces visibility to less than 0.5 meter, when water conductivity exceeds 350 µS/cm, or when water temperature is above 18°C or below 4°C.

Fish Handling, Holding, and Release

- Fish will not be sampled or anesthetized, unless for valid purposes consistent with the entity's section 10 scientific collection permits.

- Fish handling will be kept to the minimum necessary to remove fish from the isolated work area. Fish capture and removal operations will be planned and conducted to minimize the amount and duration of handling. The operations will maintain captured fish in water to the maximum extent possible during seining/netting, handling, and transfer for release.

- Individuals handling fish will ensure that their hands are free of harmful and/or deleterious products, including but not limited to sunscreen, lotion, and insect repellent.

- The operations will ensure that water quality conditions are adequate in the buckets, coolers, or holding tanks used to hold and transfer captured fish. The operations will use aerators to provide for clean, cold, well-oxygenated water, and/or will stage capture, temporary holding, and release to minimize the risks associated with prolonged holding. The directing biologist will ensure that

[10] If the FWS and/or NMFS have provided an Incidental Take Statement from a Biological Opinion addressing the work (or action), the directing biologist shall ensure limits on take have not been exceeded; if the limits on take are exceeded, or if take is approaching these limits, the directing biologist shall postpone fish capture and removal operations and immediately notify the Federal agency (or agencies) with jurisdiction.

conditions in the holding containers are monitored frequently and operations adjusted appropriately to minimize fish stress. If bull trout will be held for more than a few minutes prior to release, the directing biologist will consider using dark-colored, lidded containers only. Bull trout will not be held in containers for more than 10 minutes, unless those containers are dark-colored, lidded, and fitted with a portable aerator; small coolers meeting this description are preferred over buckets. Bull trout will not be kept in the same holding container or area with aquatic species that may prey on or injure them.

- The operations will provide a healthy environment for captured fish, including low densities in holding containers to avoid effects of overcrowding. Large fish will be kept separate from smaller fish to avoid predation. The operations will use water-to-water transfers whenever possible.

- The release site(s) will be determined by the directing biologist. The directing biologist will consider both site characteristics (e.g., flow, temperature, available refuge, and cover, etc.) and the types of fish captured (e.g., out-migrating smolt, kelt, pre-spawn migrating adult, etc.) when selecting a release site(s). More than one site may be designated to provide for varying needs, and to separate prey-sized fish from larger fish. The directing biologist will consider habitat connectivity, fish habitat requirements, seasonal flow, water temperature, and the duration and extent of planned in-water work when selecting a fish release site(s). If conditions upstream of the isolated work area may become unfavorable during construction, then fish will not be released to an upstream location. However, the directing biologist will also consider whether planned in-water work presents a significant risk of downstream turbidity and sedimentation; fish released to a downstream location may be exposed to these conditions. Site conditions may warrant releasing fish both upstream and downstream, or relocating fish at a greater distance (e.g., thousands of feet or miles), so as to ensure fish are not concentrated in areas where their habitat needs cannot be met. For a fuller discussion of this topic see **Staging and Sequencing of Work**.

- The directing biologist will ensure that each fish is capable of remaining upright and has the ability to actively swim upon release.

- Any ESA-listed fish incidentally killed as a result of fish capture and removal operations will be preserved and delivered to the appropriate authority upon request (see Documentation, p. 14; if applicable, see the reporting requirements of the associated Biological Opinion for the action).

- If the limits on take of ESA-listed species are exceeded (harm or harassment), or if incidental take is approaching and may exceed specified limits, the directing biologist will postpone fish capture and removal operations and immediately notify the Federal agency (or agencies) with jurisdiction. If dewatering or flow diversion is incomplete and still in-progress, the entity will take remedial actions directed at maintaining sufficient quantity and quality of flow and lessening sources of fish stress and/or injury. If conditions contributing to fish stress and/or injury may worsen before the federal agency with jurisdiction can be contacted, the entity will attempt to move fish to a suitable location near the capture site while keeping fish in water and reducing stress as much as possible.

Reintroduction of flow and fish to the isolated work area

If conducting work in isolation from flowing waters has required placement of a block net(s), fish capture and removal, and temporary dewatering, the directing biologist will ensure that the block net(s) remain in-place until work is complete and conditions are suitable for the reintroduction of fish[5]. Flows will be gradually reintroduced to the isolated work area, so as to prevent channel bed or bank instability, excessive scour, or turbidity and sedimentation. The directing biologist will inspect the work area and downstream reach to ensure no fish are stranded or in distress during reintroduction of flows. If conditions causing or contributing to fish stress and/or injury are observed, the entity will take remedial actions directed at lessening these sources of stress. This may include a more gradual reintroduction of flow, so as to reduce resulting turbidity and sedimentation.

All temporary structures and materials (e.g., block nets, posts, and anchors; bypass flume or culvert; sandbag, sheet pile or similar cofferdam; etc.) will be removed at the completion of work. The directing biologist will document in qualitative terms the final condition of the isolated work area (including temporary bypass). The directing biologist will identify and document any obvious signs of channel bed or bank instability resulting from the work, and will report these conditions to the appropriate staff for remedy. The entity will document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

To avoid and minimize the risk of introducing or spreading nuisance or invasive species, aquatic parasites, or disease, the directing biologist will ensure that all equipment and materials are cleaned and dried before transporting them for use at another site or waterbody.

DOCUMENTATION

- The directing biologist will document and maintain accurate records of the operations, including the following: project location, date, methods, personnel, water temperature, conductivity, visibility, electrofishing equipment settings, and other comments, fish species, number, age/size class estimate, condition at release, and release location.

- If at any time, fish are observed in distress, a fish kill occurs, or water quality problems develop (including equipment leaks or spills), the entity will provide immediate notification to the WDFW consistent with any provisions contained in the HPA (or applicable General HPA).

- Bull trout incidentally killed as a result of fish capture and removal operations will be documented with notification provided to the appropriate authority (FWS) within two working days. Initial notifications may consist of a phone call or voice mail message. Initial notifications will be directed to the following: the nearest FWS Law Enforcement Office, and the Washington Fish and Wildlife Office at (360) 753-9440. Any dead specimens will be kept whole and preserved on-ice or frozen until the entity receives a response and further directions from the appropriate authority; if the entity receives no response within 10 working days, the directing biologist will have the discretion to dispose of specimens. Initial notifications will be followed by a second notification in writing. All notifications will provide at a minimum the following: date, time, entity point-of-contact (the directing biologist and/or supervisor), project name (and FWS consultation tracking number), precise location of any incidentally killed or injured and unrecovered fish, number of specimens and species, and cause of death or unrecoverable injury. If the limits on incidental take are exceeded (harm or harassment), the written notification will also include an explanation of the circumstances causing or contributing to observed levels of take.

- The final condition of the isolated work area (including temporary bypass) will be documented in qualitative terms, including any obvious signs of channel bed or bank instability resulting from the work. The entity will document any additional actions taken to correct channel instability, and the final condition of the isolated work area (including temporary bypass).

Appendix B

Northern Spotted Owl Disturbance-only Surveys in the Vicinity of Kachess Dam, Washington, Report

This page intentionally left blank.

Northern Spotted Owl Disturbance-only Surveys in the Vicinity of Kachess Dam, Washington

Report

Photo 1: Looking up at 45-degree angle to mid- and upper-canopy from survey station 5.0, Kachess Dam project.

Prepared for:

On behalf of:
Environmental Management and Planning Solutions, Inc.

Glenn Johnson, Harris Environmental Group, Inc.
Fircrest, Washington
October 2021

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Harris Environmental Group, Inc. was sub-contracted by Environmental Management and Planning Solutions, Inc. (EMPSi) to provide Northern Spotted Owl (NSO; *Strix occidentalis*) survey support for the Kachess Safety of Dams project, in the vicinity of the Kachess Dam in Kittitas County, Washington, hereafter referred to as the Kachess Dam project. The US Bureau of Reclamation (Reclamation) is proposing to reduce the risk of dam failure by improving the embankment dam and dam outlet and installing a stability berm. Other projects in the vicinity of Kachess Dam, specifically the Kachess Drought Relief Pumping Plant (KDRPP) and Keechelus Reservoir-to-Kachess Reservoir Conveyance (KKC) projects (Reclamation and Washington Department of Ecology 2019), determined that proposed activities under those projects would not result in impacts to NSO habitat, but could result in short-term disturbance to any NSO that may be present in the area.

This report summarizes the NSO survey effort implemented in 2021 in the vicinity of the Kachess Dam to inform baseline conditions and support the biological assessment and environmental assessment for the Kachess Safety of Dams project.

Background and Study Site

Reclamation manages the Kachess Dam and associated facilities and is undertaking planning designed to improve the safety of Kachcess Dam, in consultation with the U.S. Fish and Wildlife Service (USFWS). Kachess Dam, the associated spillway, outlets, and Kachess Reservoir is located within rural Kittitas County on the Okanagan-Wenatchee National Forest, in central Washington state (Figure 1). The Kachess Dam project area is within the Eastern Washington Cascades Physiographic Province, one of 12 provinces used in the organization of NSO recovery planning efforts (USFWS 2011).

Previous NSO survey and habitat assessment efforts have occurred in the area and nearby at historical NSO-occupied sites. Between 2014-2019 as part of the KDRPP project planning, NSO surveys and habitat assessments occurred at various locations, including the vicinity of Kachess Dam, and extended northeast throughout forest habitat bordering the reservoir to a historically-occupied NSO site known as Kachess Ridge (Figure 1). These NSO surveys and assessments of potential habitat were conducted by the Washington Department of Fish and Wildlife (WDFW 2016, 2019). The Kachess Ridge site, and many other survey sites on nearby US Forest Service (USFS) land have traditionally been surveyed annually by USFS researchers, who currently work in a joint partnership through Oregon State University. All recent survey efforts by WDFW or USFS/Oregon State University did not detect any NSO in the vicinity of the Kachess Dam project. The nearest USFS calling stations have historic but not recent occupancy of NSO: Kachess Ridge was occupied in 1995, 1998 and 1999, and Cabin Creek was occupied from 1991-2002 (Figure 1; Ashlee Mikkelson and Stan Sover, USFS, personal communication). Three other USFS calling station sites within and adjacent to the general area mapped in Figure 1 (but further than the historic sites mapped, i.e., > 6 kilometers from Kachess Dam) have had at least some NSO occupancy since 2017 (Ashlee Mikkelson and Stan Sover, USFS, personal communication), though these are not mapped in order to safeguard exact locations of potentially active NSO territories.

In the vicinity of the Kachess Dam and the Kachess Ridge NSO survey site, and in between along the forested shore of the reservoir, WDFW documented a mix of forest ages with the very limited to no nesting, roosting, or foraging habitat for NSO, though the area contains some "mature coniferous forest," with individual or small clusters of isolated large trees in a matrix of younger forests that would be considered dispersal habitat (Bureau of Reclamation 2019; WDFW 2016, 2019).

The Kachess Dam project area was included in prior NSO critical habitat designations (WDFW 2019) and is included in a 2021 update to the NSO Critical Habitat designation (USFWS 2021a), as indicated in current maps of critical habitat for NSO (Figure 1; see USFWS 2021b for GIS layers, USFWS 2021a for maps). The 2021 critical habitat designation is undergoing a rule-making process which may change the extent of total designated habitat acreage in some areas of the species' distribution, but there are no proposed changes to the 2021 rule which would affect NSO critical habitat in Kittitas County (USFWS 2021c), including in the project area.

Qualifications of Survey Team

Glenn Johnson of Harris Environmental Group implemented the survey, coordinating with Julie Remp of EMPSi, who also participated in the survey effort.

Glenn Johnson (M.S. in Wildlife Biology) managed the project in collaboration with EMPSi staff as needed, including coordinating the survey schedule, station placement, surveys, and developing this report. Mr. Johnson performed all NSO surveys, while training Ms. Remp throughout the survey season. Mr. Johnson has coordinated biological survey, monitoring, and research projects in the western United States since the late 1990s when he helped establish the Klamath Bird Observatory in southern Oregon. The majority of his career has been focused on birds in the Pacific Northwest, including conducting numerous NSO and Marbled Murrelet surveys in Washington and Oregon. From 2010-2013, he worked for Hammer Environmental and was personally trained to survey NSO by Tom Hammer, a well-known regional expert focusing on Threatened and Endangered Species, including NSO and Marbled Murrelet. Mr. Johnson managed and conducted NSO field surveys for Snohomish County Public Utility District at potential geothermal energy development sites across a large potential project area of the Mount Baker-Snoqualmie National Forest, utilizing the current NSO protocol after it was published in 2012 (USFWS 2012). Mr. Johnson has led wildlife projects for Harris Environmental Group for diverse species in the Pacific Northwest since 2015, including raptor and Common Raven point count surveys and nest monitoring, and Common Raven banding projects in Kittitas and Yakima counties, and marine mammal and marbled murrelet monitoring at marine construction sites throughout Puget Sound. Mr. Johnson has supported numerous federal agencies on a variety of biological studies and consultations involving the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA), as well as other protected species (native birds, marine mammals), watershed protection, native vegetation and fuels management, aviation, and new facilities and infrastructures.

Julie Remp, (B.S. in Wildlife and Conservation Biology; minor in Avian Sciences), of EMPSi is an accomplished avian biologist with an extensive background directing field studies and impacts analyses for NEPA- and ESA-related studies. Ms. Remp accompanied Mr. Johnson for all survey efforts and was trained throughout the season on NSO protocol implementation. Ms. Remp also reviewed and contributed to this report.

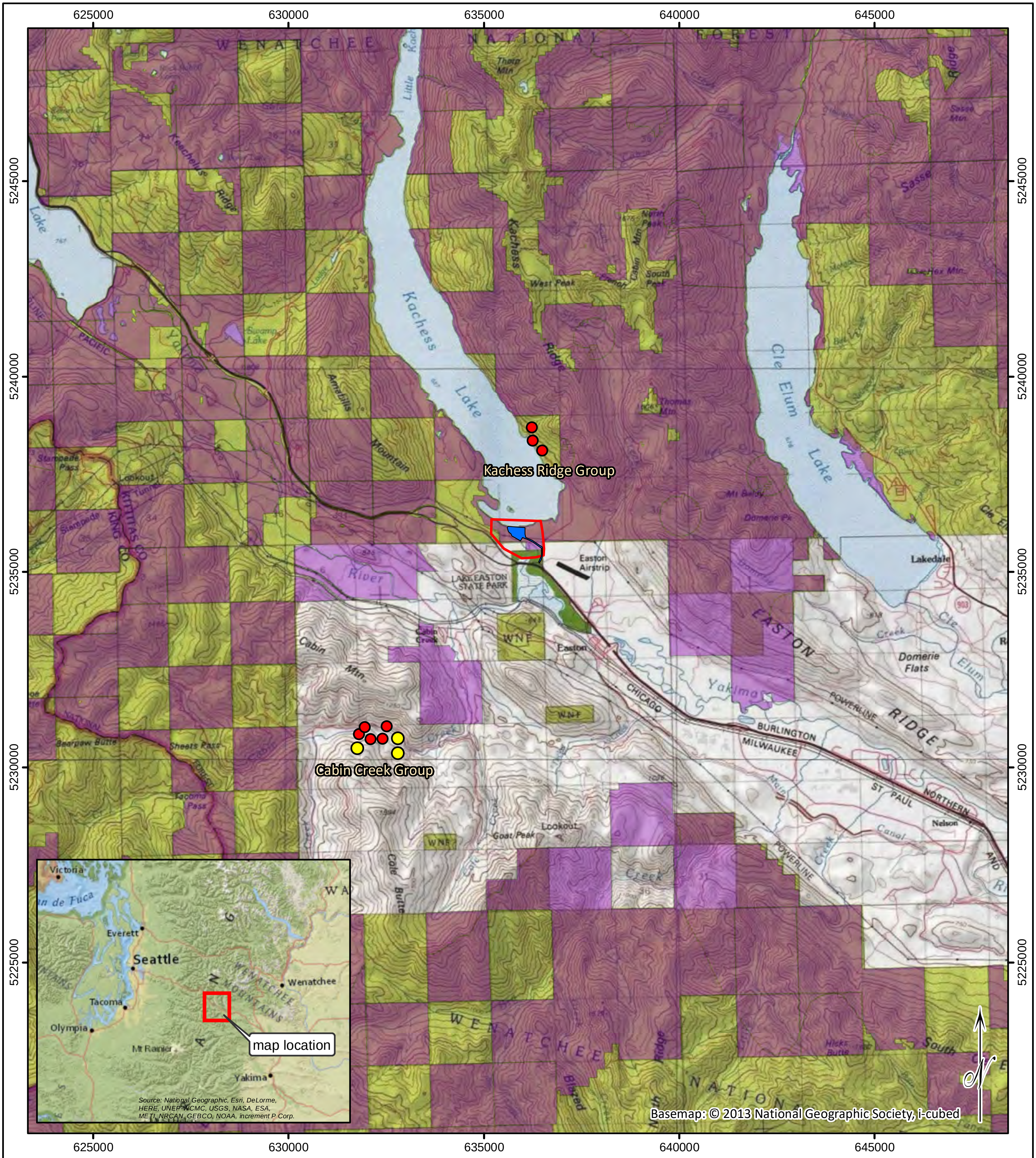


Figure 1. Northern Spotted Owl 2021 Survey, Kachess Dam Project, and Nearby USFS Survey Sites

Kittitas County, WA
T 21N R 13E Sections 33, 34,
T 20N R 13E Sections 02, 03
USGS Topo Quadrangle:
Kachess Lake

- Current USFS/OSU Calling Station
- Historic USFS Calling Stations
- Project Area
- NSO Survey Area
- NSO Critical Habitat (USFWS 2021a, GIS layers USFWS 2021b)

0 1 2 3 4 5 km
0 1 2 3 4 mi

Scale: 1:125,000

Coordinate System: NAD 1983 UTM Zone: 10N
Projection: Transverse Mercator
Harris Environmental Group 2021

METHODS

Calling surveys, whereby vocalizations are broadcast from strategically-located, fixed survey stations, were used to locate potential NSO using the area during the breeding season (March 1 - August 31). We reviewed conventional survey procedures (i.e., Forsman 1983) and followed the most recent NSO survey protocol endorsed by the USFWS (USFWS 2012) for guidance on calling station placement, survey timing, number, and type of survey. We used the "disturbance-only" survey approach, which is a one-year, six-visit survey effort applicable to projects predicted to disturb NSO only through actions such as smoke or noise and is intended to detect any NSOs using habitat within 0.25 mile from the footprint of a project that may disturb NSO (USFWS 2012). Reclamation worked with USFWS to determine that the needs for the Kachess Safety of Dams project could be met by performing the disturbance-only methodology.

Various NSO territorial and contact calls were broadcast at high volume; typically three to five calls were played, followed by one to two minutes of listening. We used a FoxPro® NX4 model digital wildlife caller, programmed with NSO vocalizations downloaded from the USFWS (https://www.fws.gov/oregonfwo/species/data/northernspottedowl/surveyprotocol.asp).

Habitat quality was assessed throughout the season opportunistically using a qualitative approach—we looked for high-quality habitat throughout the time we were scouting the project area, and during surveys.

Calling station Placement

Per USFWS protocol (2012) the potential footprint of project activities was considered the Project Area, with the wider Survey Area including any potential habitat within at least a 0.25 mile of the Project Area (Figure 1). Preliminary calling stations were placed using Google Earth Pro after a review of prior unpublished modeling efforts in the project area by Reclamation. These models included a determination of where taller canopy layers occur (Figure 2), the potential for NSO habitat in the immediate area (Figure 3) and areas with ≥ 50 percent probability of containing NSO habitat (Figure 4). In addition, local topography, aerial imagery, access and land ownership were used to place preliminary calling stations within 0.25 to 0.5-mile of all potential NSO habitat in the survey area. The preliminary station locations were loaded into a GPS unit (Garmin GSMap 64S) and calling station locations were visited in the field during daylight hours prior the first nighttime survey visit on April 14, 2021. During the field visit, station locations were adjusted where necessary to establish stations in ideal acoustic or habitat conditions (Figure 5).

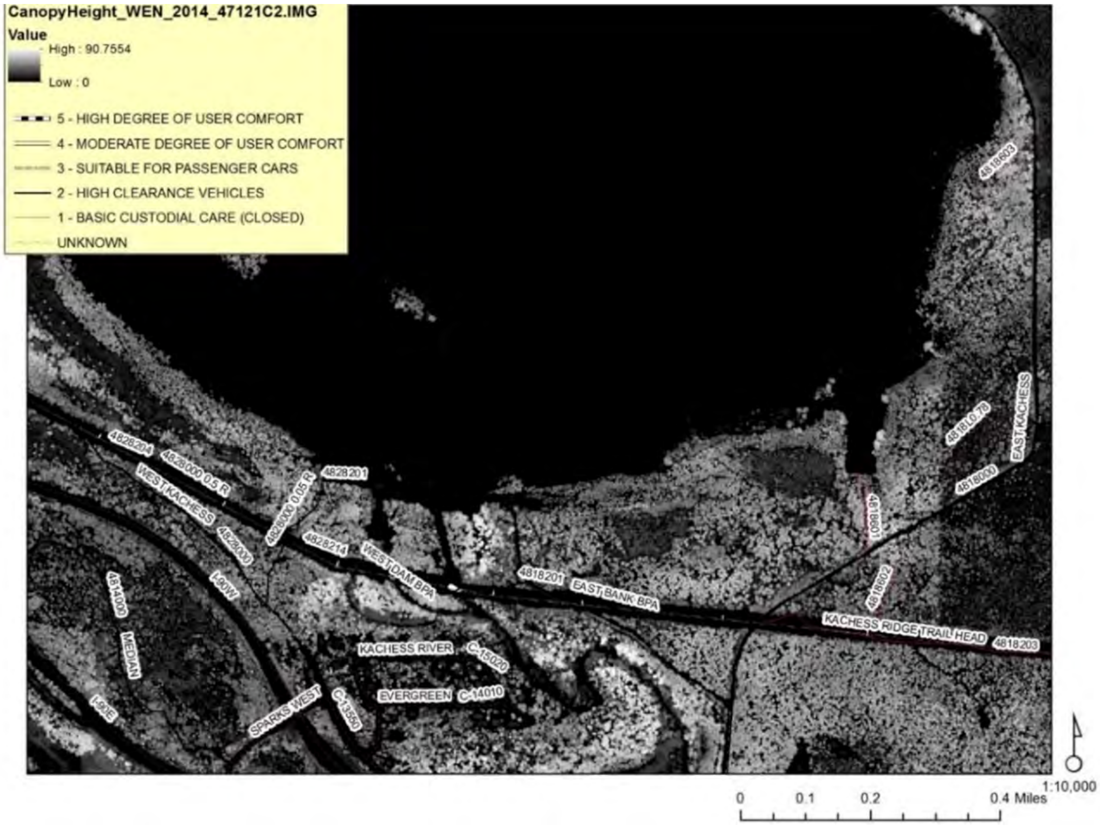


Figure 2. Forest canopy heights (in feet) in the vicinity of the Kachess Dam Project, Kittitas County, Washington. Unpublished USFS model image 2019.

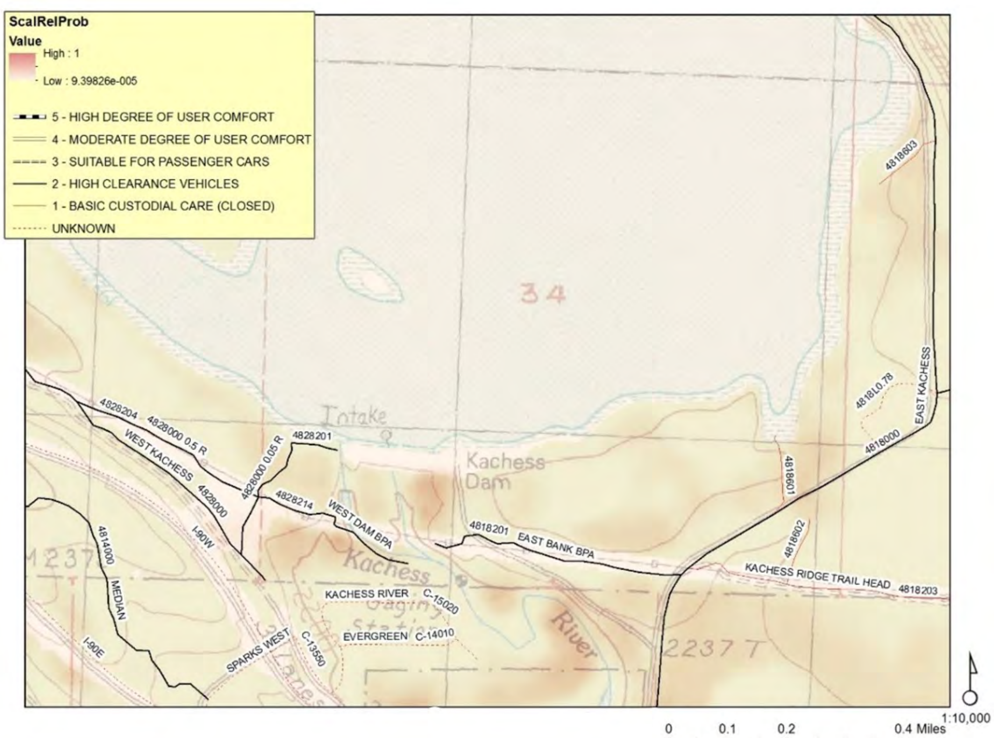


Figure 3. Potential for Northern Spotted Owl Nesting and Roosting habitat in the vicinity Kachess Dam Project, Kittitas County, Washington. Unpublished USFS model image 2019.

Figure 4. Northern spotted owl habitat using the Okanogan-Wenatchee National Forest Lidar model modeled on USFS lands only (dark green boundary). The green represents northern spotted owl nesting-roosting-foraging habitat and the yellow represents NSO dispersal habitat. The white represents non-habitat. Kachess Dam Project, Kittitas County, Washington. USFWS unpublished model image (2021).

Figure 5. Kachess Dam NSO Survey Area and Stations

Northern Spotted Owl 2021 survey stations in the vicinity of the Kachess Dam Project, Kittitas County, Washington. Aerial Imagery: Google Earth. Map prepared by Harris Environmental Group, Inc.

RESULTS

We conducted surveys at five stations on each of six survey visits from April 14 through August 31, 2021; surveys were spaced out over the nesting period, with three visits before June 30, and the remaining three visits after June 30 (Table 1). Several adjustments to calling station locations were implemented after the first survey visit (see below).

Owl Detections

No Spotted Owls were detected (Table 2). A Barred Owl (Strix varia) was detected on two occasions responding to the broadcasted NSO calls, and a Northern Pygmy-Owl was (Glaucidium gnoma) detected on one occasion, possibly in response to broadcasted NSO calls. Survey effort and all results are summarized in Table 2, and data forms from field visits are included in Appendix A.

Calling Stations

After stations had been preliminarily set up via the desktop exercise, sites were finalized during a daytime field visit prior to the first surveys on April 14, 2021 (Table 1).

Table 1. Northern Spotted Owl calling stations, 2021, with station name, geographic coordinates (NAD 1983), number and dates of visits, and notes on station placement and/or visit history; Kachess Dam Project, Kittitas County, WA.

Station	Northing, Easting	No. of Survey Visits	Date/s of Survey Visits	Notes on station placement/visit history
1.X	47.26428, -121.20222	1	4/14	After this survey visit, moved Station 80 m SE, where considered “1.0” for subsequent visits.
1.0	47.26384, -121.20326	5	4/28, 5/26, 6/17, 8/4, 8/31	Station moved 80 m to this location, due to larger trees, more central location. First survey from 1.X was in same general area, 1.0 was ensonified during first survey.
2.0	47.26226, -121.20800	6	4/14, 4/28, 5/26, 6/17, 8/4, 8/31	Station finalized on first visit.
3.0	47.26622, -121.21406	6	4/14, 4/28, 5/26, 6/17, 8/4, 8/31	Station location scouted, then finalized on first visit.
4.0	47.26067, -121.19683	6	4/14, 4/28, 5/26, 6/17, 8/4, 8/31	Station finalized on first visit.
5.0	47.25887, -121.19909	5	4/28, 5/26, 6/17, 8/4, 8/31	Added station after first survey visit, to reach lower project area.
3.X	47.26409, -121.20964	1	4/14	One of five calling stations surveyed on first visit (with 1.X, 2.0, 3.0, 4.0), but dropped after first survey visit--too close to station 2.0 (242 m), and lower habitat quality. Labeled "Pre-3" on data sheet.

Adjustments to Calling Station Locations

After the first survey, three calling station locations were adjusted, dropped or added to provide the best coverage of the area, resulting in a final station configuration (Figure 5, Table 1). The station which had been placed preliminarily as Station 3 [“3.X (cancelled]” on Figure 5; “Pre-3” on data form) was surveyed while in the field on April 14, but was later determined to be overlapping acoustically with the area ensonified when Station 2.0 was surveyed, Station 2.0 contained taller, older trees and more forest canopy layers overall, and so this preliminary Station 3 was dropped from future survey efforts.

Station 1.0 was originally placed in the field at a location determined to be ideal acoustically (i.e., away from spillway noise which could interfere with NSO detection). However, after surveying the first date we moved this station from its original location (labeled "1.X (moved to 1.0)" in Figure 5) to its final location ("1.0" in Figure 5) after it was determined that spillway noise would likely be minimal for most of the survey season, and larger trees were present as well, at a location approximately 80 meters southwest.

We established Station 5.0 during daylight hours prior to visit 2 and surveyed this on survey visits 2 through 6 (Table 1, Table 2). After the first survey we were able to establish contact with a local landowner who provided directions on accessing the lower project area through a publicly-available access point on West Sparks Road, on the west side of the Kachess River. From there, we could hike west into a part of the *Survey Area* with taller trees west of the Kachess River and south of the main project area.

Habitat Quality

Informal, qualitative assessments of habitat quality in the *Project Area* and wider *Survey Area* were noted during the initial scouting and throughout the survey effort. In general, we found that the area lacked old growth forest with multi-storied canopy structure ideal for NSO habitat. The highest quality habitat at the survey stations was at Station 2.0 and Station 5.0. For example, in the immediate vicinity of Station 2.0 there appeared to be decent quality NSO habitat compared to the rest of the *Survey Area*, with multiple canopy layers and trees approaching 36 inches diameter at breast height (d.b.h.). However, it is a small, isolated patch (60 meters in diameter) and is within 110 meters of a residential development. At Station 5.0 in the lower portion of the project east of the Kachess River, some larger Douglas Fir (*Pseudotsuga menziesii*) and Western white pine (*Pinus monticola*) trees were present, with the d.b.h. of largest trees approximately 36 inches (Figure 6), but the structure of the canopy was such that lower and mid-canopy coverage is limited, and the overall canopy coverage is less than 60 percent (Figure 7, and see cover page for view looking up at a 45 degree angle through mid- and upper canopy layers).

We agree with prior habitat characterizations in the area (Reclamation and Washington Department of Ecology 2019; WDFW 2016, 2019). Those assessments determined that the area lacks NSO nesting, roosting, or foraging habitat, and is better characterized as dispersal habitat, with only small patches of potentially suitable habitat found in isolated clusters within the area.

Table 2. Northern Spotted Owl calling station survey results, 2021, Kachess Dam Project, Kittitas County, WA. BAOW = Barred Owl, NPOW = Northern Pygmy-Owl.

Date	Visit	Station	Time Start	Time End	Total Minutes	Species	Notes
4/14	1	3.0	19:57	20:10	0:13	None	No detections. Clear, 60°F, Wind <4mph. Sunset 19:53.
4/14	1	Pre-3	20:26	20:37	0:11	None	No detections. Station to be dropped from future survey effort (proximity is too close to station 2.0 (240 m).
4/14	1	2.0	20:59	21:10	0:11	None	No detections
4/14	1	1.0	21:39	21:50	0:11	None	No detections; after this first survey (location “1.X” on Figure 2), moved calling station approx. 80 m SE (“1.0” on Figure 2), which is closer to more suitable habitat (larger trees) in project area.
4/14	1	4.0	22:25	22:29	0:04	BAOW	Audio cue: BAOW disturbance call at 2229 in response to NSO 4-note on digital caller. Sex Unknown, 330° at 170 meters. Did not detect again.
4/14	1	4.0	22:29	22:31	0:02	None	Arrested digital call player for 2 minutes in order to listen.
4/14	1	4.0	22:32	22:38	0:06	None	Continued calling with digital caller. No more BAOW detections.
4/14	1	4.0	22:39	22:44	0:05	None	Listened additional 5 minutes for BAOW/NSOW without using caller.
4/28	2	5.0	20:16	20:28	0:12	None	No detections. Overcast, 60°F, No wind. Set up additional calling station #5.0 in southern portion adjacent to Kachess River, lower project area.
4/28	2	2.0	21:19	21:30	0:11	None	No detections
4/28	2	3.0	21:46	21:58	0:12	None	No detections
4/28	2	3.0	21:50	21:51	0:01	NPOW	Audio cue: Northern Pygmy Owl several notes of typical call at 2150-2151. Sex Unknown, 345° at 90 meters.
4/28	2	1.0	22:14	22:27	0:13	None	No detections; extended survey due to excessive highway road noise.
4/28	2	4.0	22:50	23:01	0:11	None	No detections.
5/26	3	4.0	20:47	20:57	0:10	None	No detections. Calm. 61°F
5/26	3	5.0	21:21	21:31	0:10	None	Highway noise apparent, but still allowed for hearing.
5/26	3	1.0	22:06	22:17	0:11	None	No detections.
5/26	3	3.0	22:34	22:45	0:11	None	No detections.
5/26	3	2.0	23:00	23:11	0:11	BAOW	At 23:03. Audio cue (NSO call) elicited downward-whiney from Barred Owl (i.e., last part of 8-note call). Sex Unknown, 178° at 30 meters.
5/26	3	2.0	23:11	23:16	0:05	None	Extended survey to listen (no digital caller) for 5 minutes.

Date	Visit	Station	Time Start	Time End	Total Minutes	Species	Notes
6/17	4	5.0	21:19	21:39	0:20	None	No detections. Clear, Calm, 69°F
6/17	4	2.0	22:21	22:31	0:10	None	No detections.
6/17	4	3.0	22:46	22:56	0:10	None	No detections.
6/17	4	1.0	23:14	23:24	0:10	None	No detections.
6/17	4	4.0	23:36	23:48	0:12	None	No detections.
8/4	5	1.0	20:39	20:49	0:10	None	No detections. Clear night. 82°F
8/4	5	3.0	21:12	21:22	0:10	None	No detections.
8/4	5	2.0	21:34	21:44	0:10	None	No detections.
8/4	5	4.0	22:04	22:14	0:10	None	No detections.
8/4	5	5.0	22:37	22:49	0:12	None	No detections. Road Noise. 80°F
8/31	6	5.0	20:12	20:23	0:11	None	No detections. Light mist, 60% cloud cover, 46°F, Wind 1-2mph
8/31	6	4.0	20:52	21:02	0:10	None	No detections. Clear weather.
8/31	6	1.0	21:12	21:22	0:10	None	No detections.
8/31	6	2.0	21:32	21:42	0:10	None	No detections.
8/31	6	3.0	21:55	22:05	0:10	None	No detections.

Figure 6. Larger trees visible from the center of Northern Spotted Owl survey calling Station 5.0, Kachess Dam Project, Kittitas County, Washington. Note 12.5-inch by 9.5-inch clipboard for scale at base of largest tree.

Figure 7. Canopy cover directly above Northern Spotted Owl calling Station 5.0, Kachess Dam Project, Kittitas County, Washington. Note lack of canopy closure, and lack of lower and mid canopy layers.

CONCLUSION

No NSO were detected during surveys in 2021 in the vicinity of the Kachess Dam project area, similar to what WDFW found in a wider survey area encompassing additional areas northeast of the Kachess Dam, which included surveys of historic NSO territories not active since 1999 (WDFW 2016, 2019). USFS/ Oregon State University surveys in 2020 and 2021 detected no NSO in any close-by historically-occupied site. The area in the vicinity of Kachess Dam project and nearby areas possesses habitat characteristics suggesting that it is largely dispersal habitat, due to a multispecies composition, overstory trees with an average diameter at breast height of 16 inches, and downed wood of small size (WDFW 2016; Reclamation and Washington Dept of Ecology 2019).

While several other sites on USFS land within 10 miles of the project area have been active since 2017, no NSO activity has ever been documented within the Kachess Dam project area. Due to habitat conditions and limited population size, it is highly unlikely that NSO would utilize the project area for anything other than dispersing.

LITERATURE CITED

Forsman, E. D. 1983. Materials and methods for locating and studying Spotted Owls. USDA Forest Service General Technical Report PNW-12. Available at:

U.S. Bureau of Reclamation and Washington State Department of Ecology. 2019. Kachess Drought Relief Pumping Plant and Keechelus Reservoir-to-Kachess Reservoir Conveyance, Final Environmental Impact Statement. Volume 1. Yakima, Washington. Ecology Publication Number: 18-12-011. Volumes I-III and Executive Summary available at: https://apps.ecology.wa.gov/publications/SummaryPages/1812011.html

U.S. Fish and Wildlife Service. 2011. Revised Recovery Plan for the Northern Spotted Owl (*Strix occidentalis caurina*). U.S. Fish and Wildlife Service, Portland, Oregon. xvi + 258 pp. Available at: https://www.fws.gov/oregonfwo/documents/RecoveryPlans/NSO_RevisedRP_2011.pdf

U.S. Fish and Wildlife Service. 2021a. Northern Spotted Owl Information Site, Oregon Fish and Wildlife Office. Available at: https://www.fws.gov/oregonfwo/promo.cfm?id=177175734

U.S. Fish and Wildlife Service. 2021b. Revised Designation of Critical Habitat for the Northern Spotted Owl. Federal Register / Vol. 86, No. 10 / Friday, January 15, 2021 / Rules and Regulations DEPARTMENT OF THE INTERIOR Fish and Wildlife Service 50 CFR Part 17 [Docket No. FWS–R1–ES–2020–0050; FF09E21000 FXES11110900000 212] RIN 1018–BF01. Pages 4820-4860. PDF available at: https://www.govinfo.gov/content/pkg/FR-2021-01-15/pdf/2021-00484.pdf

U.S. Fish and Wildlife Service. 2021c. Rule-making Docket: Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Northern Spotted Owl. Available at: https://www.regulations.gov/docket/FWS-R1-ES-2020-0050/document.

Washington Department of Fish and Wildlife. 2016. Deliverable 2G: Northern Spotted Owl Surveys Report for Capital Water Storage Infrastructure Project Support. Unpublished report developed by WDFW for “Contract Deliverable for Contract IAA C1600076: Yakima Basin Integrated Plan”, under “Task 2. Capital Water Storage Infrastructure Project Support: Keechelus to Kachess Pipeline, Cle Elum Pool Rise, Kachess Drought Relief Pumping Plant. 18pp.

Washington Department of Fish and Wildlife. 2019. Deliverable 2A-3: 2018-19 Northern Spotted Owl Surveys Within KDRPP Project Area. Unpublished report developed by Scott Kline & Scott Downes of WDFW, for “Contract Deliverable for Contract IAA C1800167: Yakima Basin Integrated Plan”, under “Task 2. Capital Water Storage Infrastructure Project Implementation Support: Kachess Drought Relief Pumping Plant (KDRPP)”. 11 pages.

APPENDIX A: Field Survey Data Forms

APPENDIX A: FIELD SURVEY DATA FORMS

Appendix 6: Template Field Data Collection Form
SITE VISIT FORM

SITE ID NUMBER: KSOD-01 SITE NAME Kachess Dam STATE: WA

VISIT #: 1 OUTING #: 1 YEAR: 2021 OUTING DATE: 14 April 2021

LANDOWNER: USFS PHYSIOGRAPHIC PROVINCE ____________

COMPLETE VISIT: (Y/N) Y OBSERVERS: Glenn Johnson, Julie Remp

TYPE OF SURVEY: ACS SC CC FO RV AV OPP
ACS=Activity Center Search SC=Station Calling CC=Continuous Calling FO=Follow Up Outing RV=Reproductive Visit
AV=Additional Visit OPP=Opportunistic Siting

Disturbance-only Survey project.

HISTORICAL SITE CENTER LOCATION (use if historical site center is being surveyed)
T____ R____ Sec____ 1/4____ 1/16____ WEATHER: Clear, 66°F, wind < 4 mph.
Sunset: 1953

OWLS DETECTED: (Y/N) BAOW only

Station	Start	End	SPP	Obs Type[1]	Sex	Bearing/ Distance	T / R / Sec	1/4	1/16	UTM East	UTM North
3.0	1957	2010	—			No Detections					
Pre-3	2026	2037	—			" "					
2.0	2059	2110	—			" "					
1.0	2139	2150	—			" "					
4.0	2225	2229	BAOW	A	U	330°, 170m					
	2229-	2231	-arrested		Calls	to listen.					
	2232	2238	Continued	Calling.	no	more BAOW	Detections.				
	2239	2244	Listened	additional	5	minutes	for	BAOW.			

Station to be dropped for future surveys (too close to others)

2029 - First response Disturbance call

[1]ObsType = V=Visual A=Audio S=Sign

Hiked to station 3.0, awaited sunset. Surveyed station 3.0, Then went to "Preliminary" Station "pre-3" and Surveyed, but later determined this was too close to other Stations So will not survey in future visits. Continued to Stations 2.0, 1.0, and 4.0. Detected BAOW at Station 4.

SITE VISIT FORM

SITE ID NUMBER: KSOD-01 SITE NAME Kachess Dam STATE: WA

VISIT #: 2 OUTING #: 1 YEAR: 2021 OUTING DATE: 4/28/2021

LANDOWNER: USFS PHYSIOGRAPHIC PROVINCE Eastern WA Cascades

COMPLETE VISIT: (Y/N) Y OBSERVERS: Glenn Johnson, Julie Kemp

TYPE OF SURVEY: ACS SC CC FO RV AV OPP

ACS=Activity Center Search SC=Station Calling CC= Continuous Calling FO=Follow Up Outing RV=Reproductive Visit AV=Additional Visit OPP=Opportunistic Siting

- Disturbance-only Survey project

HISTORICAL SITE CENTER LOCATION (use if historical site center is being surveyed)
T___ R___ Sec___ 1/4___ 1/16___ WEATHER: overcast, 60°F no wind

OWLS DETECTED: (Y/N) Y - only northern pygmy owl

Station	Start	End	SPP	Obs Type[1]	Sex	Bearing/ Distance	T / R / Sec	1/4	1/16	UTM East	UTM North
5.0	2016	2028	—								
2.0	2119	2130	—								
3.0	2146	2158	—								
	2150		NPygy Owl	A	U	345°, 90m					
1.0	2214	2227	—								
	Went long due to road noise 2218-2220. Station moved (80m SE) for this + future visits.										
4.0	2250	2301	—								

[1]ObsType = V=Visual A=Audio S=Sign

Set up additional calling station #5.0 in lower/southern portion of Kachess River, adjacent to project area.

SITE VISIT FORM

SITE ID NUMBER: KSOD-01 SITE NAME Kachess Dam STATE: WA

VISIT #: 3 OUTING #: 1 YEAR: 2021 OUTING DATE: 5/26/2021

LANDOWNER: USFS PHYSIOGRAPHIC PROVINCE Eastern WA Cascades

COMPLETE VISIT: (Y/N) Y OBSERVERS: Glenn Johnson, Julie Remp

TYPE OF SURVEY: ACS SC CC FO RV AV OPP

ACS=Activity Center Search SC=Station Calling CC=Continuous Calling FO=Follow Up Outing RV=Reproductive Visit
AV=Additional Visit OPP=Opportunistic Siting

Disturbance-only Survey Project

HISTORICAL SITE CENTER LOCATION (use if historical site center is being surveyed)

T___ R___ Sec___ 1/4___ 1/16___ WEATHER: CALM START: 61°F

OWLS DETECTED: (Y/N) Y BAOW only

Station	Start	End	SPP	Obs Type[1]	Sex	Bearing/ Distance	T / R / Sec	1/4	1/16	UTM East	UTM North
4	2047	2057									
5	2121	2131								Highway noise	
1	2206	2217									
3	2234	2245									
2	2300	2316	2303 Barred Owl	A		178°/30m					

[1]**ObsType** = V=Visual A=Audio S=Sign

Appendix 6: Template Field Data Collection Form

SITE VISIT FORM

SITE ID NUMBER: KS00Ø0 SITE NAME Kachess Dam STATE: WA

VISIT #: 4 OUTING #: 1 YEAR: 2021 OUTING DATE: 6/17/2021

LANDOWNER: USFS PHYSIOGRAPHIC PROVINCE Eastern WA Cascades

COMPLETE VISIT: (Y/N) Y OBSERVERS: Glenn Johnson, Julie Romp

TYPE OF SURVEY: ACS SC CC FO RV AV OPP

ACS=Activity Center Search **SC**=Station Calling **CC**= Continuous Calling **FO**=Follow Up Outing **RV**=Reproductive Visit
AV=Additional Visit **OPP**=Opportunistic Siting

Disturbance-only Survey project.

HISTORICAL SITE CENTER LOCATION (use if historical site center is being surveyed)

T____ R____ Sec____ 1/4____ 1/16____ WEATHER: Clear, calm, Ø precip

Start temp: 69°

OWLS DETECTED: (Y/N)

Station	Start	End	SPP	Obs Type[1]	Sex	Bearing/ Distance	T / R / Sec	¼	1/16	UTM East	UTM North
05	2129	2139									
02	2221	2131									
03	2246	2256									
01	2314	2324									
04	2336	2348									

[1]**ObsType** = V=Visual A=Audio S=Sign

SITE VISIT FORM

SITE ID NUMBER: KS0D-01 SITE NAME Kachess Dam STATE: WA

VISIT #: 5 OUTING #: 1 YEAR: 2021 OUTING DATE: 8/4/2021

LANDOWNER: BoR/USFS PHYSIOGRAPHIC PROVINCE Eastern WA Cascades

COMPLETE VISIT: (Y/N) Y OBSERVERS: Glenn Johnson/Julie Kemp

TYPE OF SURVEY: ACS SC CC FO RV AV OPP

ACS=Activity Center Search SC=Station Calling CC= Continuous Calling FO=Follow Up Outing RV=Reproductive Visit
AV=Additional Visit OPP=Opportunistic Siting

Disturbance-only Survey project.

HISTORICAL SITE CENTER LOCATION (use if historical site center is being surveyed)

T____ R____ Sec____ 1/4____ 1/16____ WEATHER: Start: Ø cloud temp 82°F Ø wind

END: Ø cloud Ø wind temp 80°F

OWLS DETECTED: (Y/N) N

Station	Start	End	SPP	Obs Type[1]	Sex	Bearing/ Distance	T / R / Sec	1/4	1/16	UTM East	UTM North
1.	2039	2049	—								
3	2112	2122	—								
2.	2134	2144	—								
4.	2204	2214	—								
5.	2237	2249	—							Road noise ~2 min	

[1]ObsType = V=Visual A=Audio S=Sign

SITE VISIT FORM

SITE ID NUMBER: KSOD-01 SITE NAME Kachess Dam STATE: WA

VISIT #: 6 OUTING #: 1 YEAR: 2021 OUTING DATE: 8/31/2021

LANDOWNER: USFS/BOR PHYSIOGRAPHIC PROVINCE Eastern WA Cascades

COMPLETE VISIT: (Y/N) Y OBSERVERS: Glenn Johnson, Julie Remp.

TYPE OF SURVEY: ACS SC CC FO RV AV OPP

ACS=Activity Center Search **SC**=Station Calling **CC**= Continuous Calling **FO**=Follow Up Outing **RV**=Reproductive Visit
AV=Additional Visit **OPP**=Opportunistic Siting

Disturbance-only Survey Project

HISTORICAL SITE CENTER LOCATION (use if historical site center is being surveyed)

T____ R____ Sec____ 1/4____ 1/16____ WEATHER: START: LIGHT MIST, 60% Cloud → 2030 Clear, wind 1-2 TEMP 46°F

OWLS DETECTED: (Y/N) N

Station	Start	End	SPP	Obs Type[1]	Sex	Bearing/ Distance	T / R / Sec	¼	1/ 16	UTM East	UTM North
5	2012	2023	—								
4	2052	2102	—								
1	2112	2122	—								
2	2132	2142	—								
3	2155	2205	—								

[1]**ObsType** = V=Visual A=Audio S=Sign

Appendix C
Dewatering Plan

[placeholder]

This page intentionally left blank.

Appendix D

Tree Removal Report

To: Keenan Arnold
From: Al Pancoast
RE: Kachess Dam Tree Removal
11/19/2021

Dear Mr. Arnold

I have revised the tree count estimates to reflect the updated removal boundaries and formatted the summary tables as requested. I did my best to accurately reflect only the forested portions of the removal area in the acre estimates, as these are sample based estimates and accurate acre calculations are important to accurately estimate tree counts. Attached to this letter are summaries of each area and a map showing the sample point locations. I have also included the "raw" cruise data. A georeferenced PDF map and excel workbook containing the summary data will accompany this letter.

You will notice that the locations in Area A appear to be outside the boundary, however that was due to GPS inaccuracy as the cruiser approached the spillway. We are not sure what would have caused the GPS signal to wander like this, but we are certain that the points were indeed located within the boundary and the discrepancy was due to GPS error.

4 to 5 variable radius plots (VRP) were installed with a basal area factor (BAF) of 40 in each area, resulting in 3-11 trees being sampled on each plot (5.9 trees per plot average over 18 plots). The resulting tree count and species/size distributions are applied to their corresponding areas, resulting in an estimated total tree count by species and size class. All cruise data are compiled using the Forest Biometrics Research Institute's (FBRI) Forest Projection System (FPS) version 7.57.

Please let me know if you have any questions or would like to follow up with additional information/explanation.

Regards,

Al Pancoast
Forest Biometrician
Northwest Management Inc.
(541) 410-5754
Pancoast@northwestmanagement.com

Area A **0.52 acres**

SPECIES	GROUP	DBH_CLASS (in)	TREE_COUNT	AVERAGE_HEIGHT (ft)
DF	Live	10-19"	18	90
DF	Live	20-29"	13	113
DF	Live	30-39"	3	117
LP	Live	0-9"	15	60
LP	Live	10-19"	29	83
LP	Live	20-29"	2	106
RC	Live	20-30"	1	83

Area B **1.20 acres**

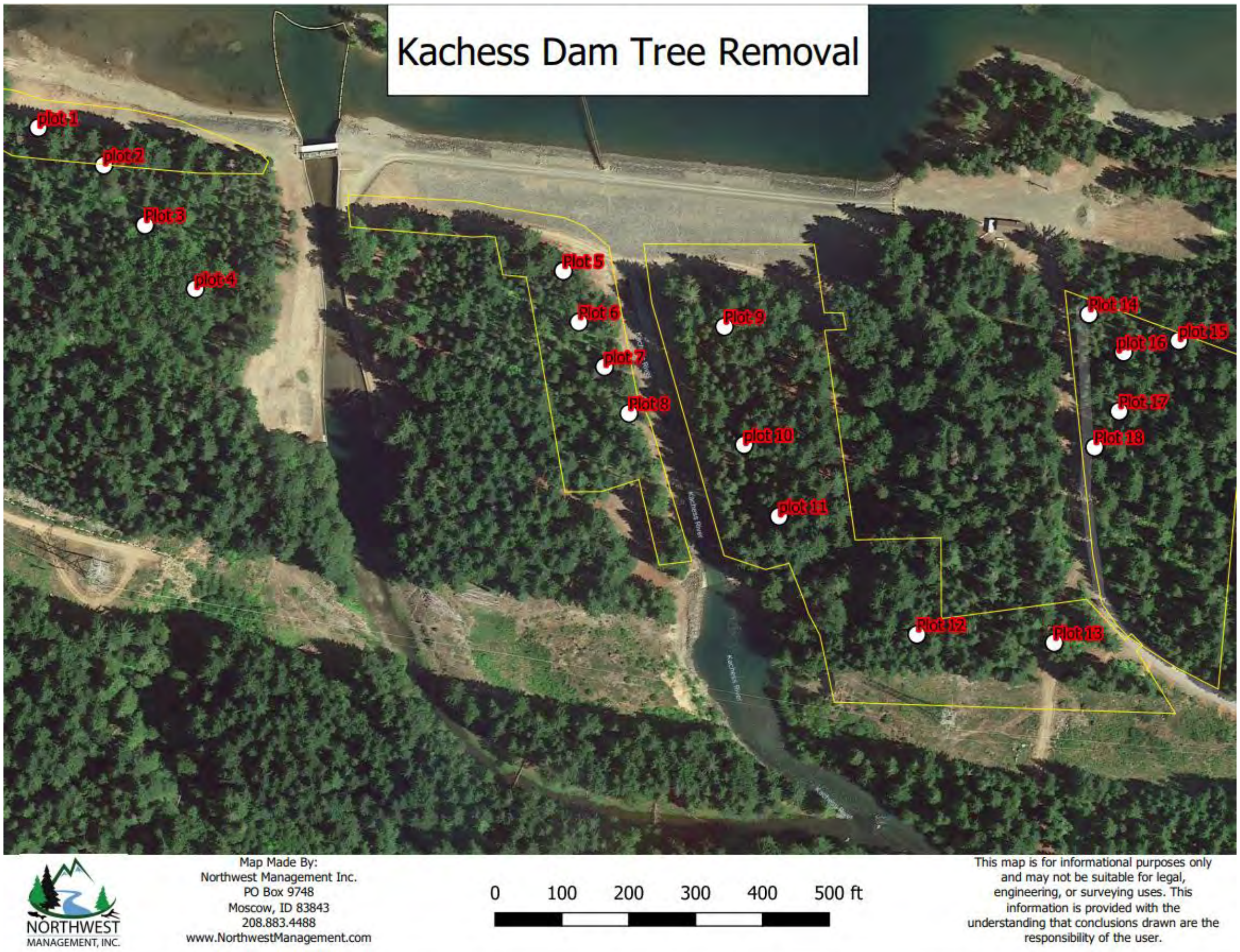
SPECIES	GROUP	DBH_CLASS (in)	TREE_COUNT	AVERAGE_HEIGHT (ft)
BC	Live	10-19"	13	68
BC	Live	30-39"	2	79
DF	Live	10-19"	11	83
DF	Live	20-29"	13	112
DF	Live	30-39"	4	124
DF	Live	40-49"	1	127
LP	Live	0-9"	34	67
LP	Live	10-19"	123	82
WP	Live	20-29"	5	101

Area C **3.60 acres**

SPECIES	GROUP	DBH_CLASS (in)	TREE_COUNT	AVERAGE_HEIGHT (ft)
DF	Live	0-9"	82	53
DF	Live	10-19"	321	100
DF	Live	20-29"	98	114
DF	Live	30-39"	5	147
LP	Live	10-19"	23	92
RC	Live	10-19"	18	71
WH	Live	10-19"	16	93
WP	Live	10-19"	44	75
WP	Dead	10-19"	21	81

Area D **2.50 acres**

SPECIES	GROUP	DBH_CLASS (in)	TREE_COUNT	AVERAGE_HEIGHT (ft)
DF	Live	10-19"	14	97
DF	Live	20-29"	60	120
DF	Live	30-39"	7	125
GF	Live	10-19"	30	86
LP	Live	0-9"	91	82
LP	Live	10-19"	126	89
LP	Dead	10-19"	44	80
RC	Live	10-19"	86	59
WH	Live	0-9"	57	49


Kachess Dam Tree Removal
plot 1
plot 2
Plot 3
plot 4
Plot 5
Plot 6
plot 7
Plot 8
Plot 9
plot 10
plot 11
Plot 12
Plot 13
Plot 14
plot 15
plot 16
Plot 17
Plot 18
NORTHWEST MANAGEMENT, INC.
Map Made By:
Northwest Management Inc.
PO Box 9748
Moscow, ID 83843
208.883.4488
www.NorthwestManagement.com
0 100 200 300 400 500 ft
This map is for informational purposes only and may not be suitable for legal, engineering, or surveying uses. This information is provided with the understanding that conclusions drawn are the responsibility of the user.

Appendix E

NSO Modified Survey Memorandums and the 2012 NSO Revised Survey Protocol (USFWS 2012b)

This page intentionally left blank.

United States Department of the Interior

BUREAU OF RECLAMATION
Columbia-Cascades Area Office
1917 Marsh Road
Yakima, WA 98901-2058

IN REPLY REFER TO:
CCA-1603
2.2.4.22

VIA ELECTRONIC MAIL ONLY

Randi Riggs
Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Ecological Services Division
Washington East Cascades Zone
Central Washington Field Office

Subject: Request for approval of modified Northern Spotted Owl (NSO) survey protocol for the Kachess Safety of Dams Project.

Dear Ms. Riggs:

The Bureau of Reclamation is submitting this proposal for a modified NSO survey protocol as part of their responsibilities to help protect NSO under the Endangered Species Act. The modified protocol is outlined below.

- Year 2022. Reclamation will have a qualified biologist(s) familiar with NSO and the NSO survey protocol lead full-level six visit surveys to cover suitable NSO habitat within 1.8 miles of project activities as described in the 2012 Revised *Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls*.

    - Some areas within the 1.8-mile buffer do not have habitat, such as Kachess Reservoir, Easton Lake, the I-90 corridor, and residential developed areas, or have dispersal habitat. Figure 1 shows proposed 0.25 mile or 0.5-mile radius call points in orange and yellow (18 total). Much of the analysis area has a high level of ambient noise from the I-90 corridor and residential areas, therefore greater overlap or 0.25 radius call points are proposed near these areas. The white dots are U. S. Forest Service and Oregon State University ARU points from 2021; if they conduct 2022 surveys then Reclamation can use these points to cover the northeastern survey area and minimize overlap of survey efforts. If they are not implemented in 2022, an additional proposed call points would be added (green circle). More overlap of proposed call points is concentrated around the project area. Areas that are not covered by proposed call points are either in areas likely of non-suitable habitat (see black outline polygon) or access is very difficult or restricted. Orange circles show call points that would require hiking to reach and depends on road access through private property and rights-of-way. We anticipate in order to cover all the proposed call points; it would take approximately two survey nights for each of the six survey visits. This does not account for delays for inclement weather.

- Year 2023. Reclamation will conduct NSO spot check surveys as described in the revised NSO protocol. A qualified biologist(s) will conduct 3 spot checks at least 7 days apart starting March 15 with an aim to be completed by mid-April. Spot check surveys will cover all spotted owl habitat within the project footprint and within 0.25 mile of the project footprint in NRF habitat. One 0.5-mile spot check would cover the entire project footprint and outward of 0.25 miles. However, Reclamation proposes two to three call points to account for high ambient noise in the area.

    - If a barred owl(s) is detected, up to two additional spot checks would be conducted within 0.5 mile of the detection call point. If the detection occurs on spot check 1 with no repeat detections on spot check 2 or 3 then no additional spot check would be needed. If the detection occurs on spot check 2, but not spot check 3 then one additional survey would be conducted. If a barred owl is detected on spot check 3, two additional spot checks would be conducted. Additional spot checks would only be conducted at the call point were a barred owl detection occurred.

    - If an NSO is detected, follow-up surveys will be conducted as described in the revised protocol to determine status. If a resident pair or nesting pair are determined, then any habitat modification activity within 0.5 mile of the pair will be postponed until after the NSO breeding period of September 15 (or earlier date if determined and approved by USWFS).

    - If follow-up surveys result in a non-breeding resident NSO then Reclamation will coordinate with USFWS on the appropriate protection measures such as timing restrictions and buffer distances from resident NSO detection. No habitat modification work will occur until this coordination and USFWS approved conservation measures are established.

    - If follow-up surveys result in no further detections or if NSO status is determined as a non-resident or a floater owl, then no timing restrictions are needed.

    - Habitat removal operations 0.5 mile or greater from resident NSO(s) may begin June 2023 or as soon as NSO spot checks have been completed.

- Year 2024 and 2025. All habitat modification activities will have been completed. The project anticipates noise disturbance activities to start as soon as possible in 2024 (prior to the start of the NSO survey period of March 15) and be continuous throughout 2024 through winter of 2025. There is no blasting or other similar louder than normal construction activities proposed. *[Since there is no anticipated break in disturbance, can it be assumed that any potential resident or breeding NSO choosing to occupy the project area would be tolerant to project activities and therefore, the risk of take is low? Input from USFWS is pending*]

- In the unlikely event that there is an extended break in project disturbance activities, Reclamation will conduct spot checks if there is a break in disturbance activities greater than 14 days during the early NSO breeding period (March 15-July 31). Night spot checks could be conducted concurrently with daytime project construction activities (if they resumed) in order to meet the schedule needs of the project. If an NSO is detected, immediate coordination with USFWS will occur and follow-up surveys started to determine NSO status.

We request a review of our proposed modified survey and to provide an official response that would authorize Reclamation to move forward with an approved NSO survey approach for the Kachess Safety of Dams Project. If there is further information you require, please don't hesitate to contact Shannon Archuleta, Fisheries Biologist, at (509) 573-8022 or by email at sarchuleta@usbr.gov.

Thank you for your consideration and quick response.

Sincerely,

Candace McKinley
Environmental Program Manager

Enclosure

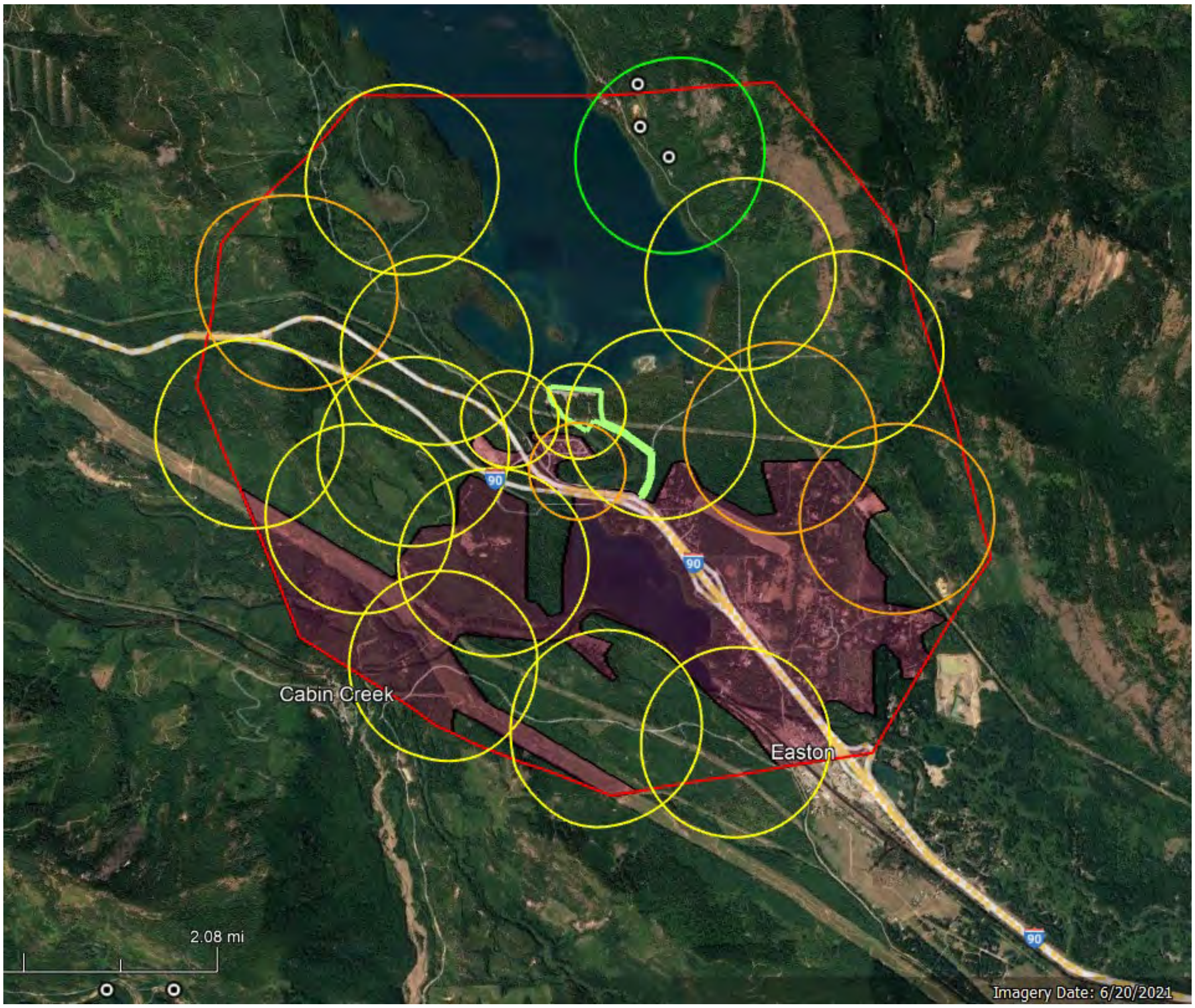


Figure 1 Proposed Call points for NSO Survey Area (1.8 mile from project footprint) for the Kachess SOD Project

Central Washington Field Office
215 Melody Lane, Suite 103
Wenatchee, Washington 98801

Memorandum

To: Shannon Archuleta, Fisheries Biologist
and
Candace McKinley, Environmental Program Manager,
Columbia Pacific Northwest Interior Region 9, Bureau of Reclamation, Columbia Cascades Area Office, Yakima, WA

From: Sonja Kokos, Washington Eastslope Cascades Zone Supervisor,
Central Washington Field Office, Ecological Services, Wenatchee, Washington

Subject: Request for approval of modified Northern Spotted Owl (NSO) survey protocol for the Kachess Safety of Dams Project.

Purpose: To provide approval of modified NSO survey protocol for the Kachess Safety of Dams Project.

This memorandum is in response to your March 7, 2022, request for approval of a modified Northern Spotted Owl (NSO) survey protocol for the Kachess Safety of Dams (SOD) Project, in Kittitas County, Washington. Our goal in preparing this memo is to provide approval of a modified survey protocol for Northern Spotted Owl for the Project and to provide clarification of how to proceed, depending on the outcome of the NSO Surveys. In addition to this documentation, we can arrange a time to meet and further discuss if there are questions.

USFWS responses to Kachess SOD Memorandum: "Request for approval of modified Northern Spotted Owl (NSO) survey protocol for the Kachess Safety of Dams Project."

For habitat modifying actions, such as the Kachess SOD Project, the "Protocol for surveying proposed management activities that may impact northern spotted owls" (NSO Survey Protocol) (USFWS 2012) typically requires 2 years of full habitat modification surveys (with the 1.8 mile radius) and spot checks in years of implementation if barred owls or NSO are detected during the surveys. However, as we have agreed, we are accepting a modified NSO survey protocol for this project of 1 year of disturbance only surveys, 1 year of habitat modification surveys and spot check surveys in the 2 years of project implementation, with all survey types being conducted according to the methodology of the 2012 NSO Survey Protocol, and as described in your March 7, 2022 Memorandum.

- 2021: NSO disturbance only surveys were conducted (6 visits as in the NSO survey protocol in the project area) and results were shared with the USFWS in the Kachess SOD Draft BA. Additional information was provided about surrounding activity center survey efforts and results in recent years. Because a barred owl was detected, even though NSO were not detected, spot check surveys in the two years of project implementation are required (USFWS 2012).

- 2022: As we agreed and according to the USFWS 2012 NSO Survey protocol, full 'habitat modification' NSO surveys will be conducted to protocol (at least 6 visits in the 1.8 mile radius of project footprint, with follow ups if required per the protocol), because the project action is a habitat modification action, and not only a disturbance action.

- 2023: As we have agreed, and as required by the USFWS 2012 NSO Survey protocol, when barred owls or spotted owls are detected in the first two years of full surveys, spot check surveys will occur with three visits, to protocol (with follow ups if required per the protocol), in March and April prior to habitat modification and disturbance actions. If owls are found in the habitat modification area or disturbance buffer, follow up surveys to determine residency and pair status will be required and a timing restriction from March 1 to July 31 will be implemented in 2023. As we agreed, the project action would be modified to require habitat modification actions and noise disturbance actions not be conducted until after July 31 with no rootwad removal to minimize the chance of project delays. However, if the 2023 spot checks are completed and no resident owls are detected in the disturbance buffer or habitat modification area, then the project's tree removal component can proceed as planned with rootwad removal, which may start as early as mid-April (once spot checks are complete to protocol in 2023). The likelihood of detecting resident NSO is very low, and the most likely scenario is that tree removal can start in mid to late April after spot checks. Implementing the project with these surveys and timing restrictions results in a Not Likely to Adversely Affect determination for NSO for noise disturbance that season and a Likely to Adversely Affect determination for NSO and NSO Critical Habitat, due to removal of suitable habitat and the small reduction in ability of NSO to occupy or use that area in the future.

- If NSO are detected in any surveys, please immediately inform us.

- In either scenario, tree removal will be complete by early fall of 2023 and the rest of the project action will proceed as planned, through the winter. Construction noise at the site from late summer through fall and winter will most likely preclude any NSO from attempting to set up residency in Spring of 2024.

- In Spring of 2024, spot-check surveys will occur concurrent with other project actions. You mentioned there is a possibility that noise-disturbance-causing activities could be paused in March for a few weeks, which would be our preference, but concurrent spot check surveys are acceptable. Because the habitat will be removed at this point, potential effects would be to NSO attempting to set up residency in the noise disturbance buffer of the project area (the surrounding ¼ mile area in suitable habitat), or NSO that established residency in the area the previous year.

This results in a Likely to Adversely Affect determination to NSO for the noise disturbance actions occurring in the early breeding season of 2024, however there will not be a reasonable certainty that take would occur. Therefore, we will not issue an incidental take statement.

• Reasonable and Prudent Measures and Terms and Conditions for NSO are that the Bureau of Reclamation must report to USFWS the results of all NSO surveys and the 2024 spot checks when completed. The project will not be halted, but if resident NSO are detected by the spot checks in 2024, then USFWS will immediately issue an emergency take statement and update our jeopardy analysis (although getting to actual jeopardy in this case from a small amount of noise disturbance would be highly unlikely).

We appreciate the opportunity to work with you on the Kachess SOD Project. We look forward to your response and further discussions if needed. If you have any questions regarding this memorandum or would like to schedule a meeting, please contact either Randi Riggs (randi_riggs@fws.gov) or Sonja Kokos (sonja_kokos@fws.gov).

Sincerely,

Sonja Kokos

Washington Eastslope Cascades Zone Supervisor,
Central Washington Field Office,
Ecological Services
Wenatchee, Washington

References

USFWS (U.S. Fish and Wildlife Service) 2012. Protocol for surveying proposed management activities that may impact northern spotted owls. U.S. Fish and Wildlife Service, Portland, OR. (https://www.fws.gov/project/northern-spotted-owl-population-monitoring)

Appendix F
Draft Revegetation Plan

[placeholder]

This page intentionally left blank.