Columbia River Basin Hatcheries Environmental Assessment

Touchet River Endemic Summer Steelhead
Umatilla River Summer Steelhead
Round Butte Hatchery Summer Steelhead
Round Butte Hatchery Spring Chinook Salmon
Hood River Winter Steelhead
Hood River Spring Chinook Salmon

April 2, 2020

Touchet River Endemic Summer Steelhead, Umatilla River Summer Steelhead, Round Butte Hatchery Summer Steelhead, Round Butte Hatchery Spring Chinook Salmon, Hood River Winter Steelhead, and Hood River Spring Chinook Salmon Hatchery Programs

Draft Environmental Assessment

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Bonneville Power Administration

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Appendix

Appendix A. Population Viability of Salmon and Steelhead in the Study Area A-1

Acronym List

Acronym	Definition
BKD	Bacterial kidney disease
BMP	Best Management Practice
BOD	Biochemical oxygen demand
BPA	Bonneville Power Administration
cfs	Cubic feet per second
Council	Northwest Power and Conservation Council
CRITFC	Columbia River Inter-Tribal Fish Commission
CTWSRO	Confederated Tribes of the Warm Springs Reservation of Oregon
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWT	Coded-wire tag
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
HGMP	Hatchery Genetics Management Plan
HOR	Hatchery-origin return
HSRG	Hatchery Scientific Review Group
ICTRT	Interior Columbia Technical Recovery Team
IHN	Infectious hematopoietic necrosis
IHNV	Infectious hematopoietic necrosis virus
ISAB	Independent Scientific Advisory Board
LSRCP	Lower Snake River Compensation Plan
mm	Millimeter
MPG	Major population group
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service

Acronym	Definition
NOR	Natural-origin return
NPCC	Northwest Power and Conservation Council
NPDES	National Pollutant Discharge Elimination System
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OHWM	Ordinary high water mark
O&M	Operations and maintenance
PGE	Portland General Electric
pHOS	proportion of hatchery-origin fish on spawning grounds
PIT	Passive Integrated Transponder
PNI	proportionate natural influence
PNOB	proportion of natural-origin broodstock
RM	river mile
RM&E	Research, monitoring, and evaluation
TMDL	Total Maximum Daily Load
USBR	U.S. Bureau of Reclamation
USC	U.S. Code
USEPA	U. S. Environmental Protection Agency
USFWS	U. S. Fish and Wildlife Service
WDE	Washington Department of Ecology
WDFW	Washington Department of Fish and Wildlife

1 Introduction

The National Marine Fisheries Service (NMFS) is the lead agency responsible for administering the Endangered Species Act (ESA) as it relates to listed salmon (*Oncorhynchus* spp.) and steelhead (*O. mykiss*). Actions that may affect listed species are reviewed by NMFS under Section 7, Section 10, or Section 4(d) of the ESA. Under Section 4(d), the Secretary of the Interior issues regulations that are "necessary and advisable to provide for the conservation of such species." NMFS is considering authorizing under ESA Section 4(d) the continued operation and maintenance (O&M) of six hatchery programs in the Columbia River Basin in Washington and Oregon. Each program includes the collection and spawning of adult salmon or steelhead, incubation of eggs, and rearing and release of juveniles as described in Hatchery and Genetic Management Plans (HGMPs). The 4(d) determination would affirm that the programs do not jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Determinations under Section 4(d) have no expiration date. These programs are designed to enhance the propagation and survival of Columbia River spring Chinook Salmon (*Oncorhynchus tshawytscha*) and Columbia River steelhead. The six hatchery programs, including facility operations specific to these programs, under consideration and their operators are (Table 1-1):

- Touchet River Endemic Summer Steelhead, Washington Department of Fish and Wildlife (WDFW)
- Umatilla River Summer Steelhead, Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and Oregon Department of Fish and Wildlife (ODFW)
- Round Butte Hatchery Summer Steelhead (Deschutes River), ODFW and
- Round Butte Hatchery Spring Chinook Salmon (Deschutes River), ODFW and Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO)
- Hood River Winter Steelhead, ODFW and CTWSRO
- Hood River Spring Chinook Salmon, CTWSRO and ODFW

The Section 4(d) authorization applications submitted to NMFS by WDFW, the CTUIR, ODFW, and the CTWSRO include HGMPs that outline the rearing and release of spring Chinook Salmon, summer steelhead, and winter steelhead using existing facilities (WDFW 2015; CTWSRO and ODFW 2017; ODFW 2017, 2019; ODFW and CTUIR 2017; ODFW and CTWSRO 2017). NMFS' Section 4(d) determinations of the HGMPs constitute a federal action that is subject to analysis as required by the National Environmental Policy Act (NEPA) and is the topic of this environmental assessment (EA).

NMFS is choosing to evaluate these programs as the Proposed Action in one EA because many overlaps and links exist among the programs. All of the programs would be implemented during the same time and include the same or similar activities that lead to the release of spring Chinook Salmon, summer steelhead, or winter steelhead.

The following activities are included in the HGMPs, and are described in more detail in Section 1.3, Description of the Proposed Action:

- Broodstock collection, including methods and facility operations
- Identification, holding, and spawning of adult fish
- Egg incubation and rearing

- Marking of hatchery-origin juveniles
- Juvenile releases
- Adult management
- Research, monitoring, and evaluation (RM&E) to assess program performance

As a cooperating agency for development of this EA, the Bonneville Power Administration (BPA) is considering whether to fund portions of certain hatchery programs included in the HGMPs under consideration, specifically by providing funding for the Umatilla River Summer Steelhead, Hood River Spring Chinook Salmon, and Hood River Winter Steelhead programs, and the quantity of fish production related to that funding. Prior to making these funding decisions, BPA is required under NEPA to assess the potential environmental effects related to program funding. If, based on the analysis in this EA, BPA determines these impacts are not significant, BPA would issue a Finding of No Significant Impact (FONSI). If, however, BPA determines any of these potential impacts are significant, it would proceed with preparation of an Environmental Impact Statement (EIS) for the proposal. At the conclusion of the NEPA process – either issuance of a FONSI or completion of the EIS process – BPA would decide on whether to provide the requested funding and at what level.

The Round Butte Hatchery Summer Steelhead and Spring Chinook Salmon programs are funded by Portland General Electric (PGE). PGE co-owns the Round Butte Hydro Project with the CTWSRO, and both operate under the same Federal Energy Regulatory Commission (FERC) license. The Touchet River Endemic Summer Steelhead Program is funded through the Lower Snake River Compensation Plan (LSRCP). Although not within the Snake River Basin, the Touchet River was included as part of the LSRCP mitigation responsibilities for construction of the four Lower Snake River federal dams. These programs are further described in Section 1.3, Description of the Proposed Action.

Table 1-1. Proposed Releases for the Six Hatchery Programs Included in this EA.

Program	Operator[1]	Funding Source[2]	Proposed Releases[3]	Life Stage at Release
Touchet River Endemic Summer Steelhead	WDFW	LSRCP	50,000	Smolts
Umatilla River Summer Steelhead	ODFW/CTUIR	BPA	150,000	Smolts
Round Butte Hatchery Summer Steelhead	ODFW	PGE	162,000	Smolts
			33,000[4]	Post-smolts
			100,000[5]	Smolts
Round Butte Hatchery Spring Chinook Salmon	ODFW	PGE	310,000	Smolts
			430,000[5]	Fry
Hood River Winter Steelhead	ODFW/CTWSRO	BPA	50,000	Smolts
Hood River Spring Chinook Salmon	CTWSRO/ODFW	BPA	250,000[6]	Smolts

Source: NMFS 2014

[1]WDFW = Washington Department of Fish and Wildlife, ODFW = Oregon Department of Fish and Wildlife, CTUIR = Confederated Tribes of the Umatilla Indian Reservation, CTWSRO = Confederated Tribes of the Warm Springs Reservation of Oregon

[2]LSRCP = Lower Snake River Compensation Plan, BPA = Bonneville Power Administration, PGE = Portland General Electric.

[3]Hatchery managers have agreed to target release numbers; however, because of the variability in within-hatchery survival, some flexibility is needed. Therefore, release level targets include a cushion, not to exceed an additional 10 percent of each program's release target, by the hatchery annually, which must be approved by the managers (NMFS 2018b).

[4]Resident trout program

[5]Reintroduction above Round Butte Dam

[6] An increase in production from the current level of 150,000 spring Chinook Salmon smolts to 250,000 smolts is pending approval of the Master Plan currently before the Northwest Power and Conservation Council.

1.1 Purpose and Need

The purpose for the proposed action is to evaluate the submitted HGMPs for the proposed hatchery programs for compliance under ESA Section 4(d). The need for the proposed action is to provide sustainability of Columbia River salmon and steelhead by conserving the productivity, abundance, diversity, and distribution of listed species of salmon and steelhead in the Columbia River Basin. NMFS will ensure it (1) is consistent with tribal treaty rights and the Federal government's trust and fiduciary responsibilities and (2) works collaboratively with co-managers to protect and conserve ESA-listed species.

BPA needs to respond to requests from the CTUIR, CTWSRO, and ODFW for funding of three (Umatilla River Summer Steelhead, Hood River Summer Steelhead, and Hood River Spring Chinook Salmon) of the six programs and associated O&M and RM&E. BPA is also responding to requests from the CTWSRO and ODFW to fund an increase in the annual production and release of Hood River spring Chinook salmon juveniles from 150,000 up to 250,000. BPA's need is to take funding action to ensure the proposed action:

- Support efforts to mitigate effects of the development and operation of the Federal Columbia River Power System on fish and wildlife in the Columbia River and its tributaries under the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act; 16 U.S. Code [USC] 839 et seq.) in a manner consistent with the Northwest Power and Conservation Council's Columbia River Basin Fish and Wildlife Program
- Fulfill commitments to CTWSRO and CTUIR related to proposed projects that are identified for funding in the 2008 Columbia River Basin Fish Accords Memorandum of Agreement among the CTUIR, the CTWSRO, the Confederated Tribes and Bands of the Yakama Nation, the Columbia River Inter-Tribal Fish Commission, BPA, the U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation (Columbia Basin Fish Accords), as extended in 2018 (Fish Accord Extension)
- Implement BPA's Fish and Wildlife Implementation Plan EIS and Record of Decision policy direction, which calls for protecting weak stocks such as Middle Columbia River steelhead, Lower Columbia steelhead, and Lower Columbia Chinook Salmon, while sustaining overall fish populations for their economic and cultural values (BPA 2003)
- Minimize harm to natural and human resources, including species listed under the ESA (16 USC 1531 et seq.)

The U.S. Fish and Wildlife Service (USFWS), through the LSRCP, needs to continue funding the production of salmon and steelhead as part of the program's mitigation responsibility for construction of the four Lower Snake River federal dams. As part of the LSRCP, the USFWS responds to requests from WDFW for funding of the Touchet River Endemic Summer Steelhead program (USACE 1976).

Under terms of the FERC license for the Pelton Round Butte Project, PGE and CTWSRO need to restore native fish passage and improve fish habitat upstream of Round Butte Dam (PGE and CTWSRO 2004a). The license includes mandatory conditions by the USFWS and NMFS, and requires implementation of the Pelton Round Butte Fish Passage Plan (PGE and CTWSRO 2004b). Reintroductions of steelhead and Chinook Salmon above Round Butte Dam are components of the Round Butte Hatchery Summer Steelhead and Round Butte Hatchery Spring Chinook Salmon programs.

1.2 Project Area and Study Area

The Project Area is the geographic area where the HGMPs under consideration in the Proposed Action would take place. It includes the fish traps and collection sites, hatchery facilities, and release locations as described in the HGMPs (Section1.3, Description of the Proposed Action). It also includes the broader area where direct and indirect impacts of program operations could affect environmental and human resources. As such, the Project Area includes the four subbasins addressed by the HGMPs under consideration in the Proposed Action: the Walla Walla River Subbasin including the Touchet River, Umatilla River Subbasin, Deschutes River Subbasin, and Hood River Subbasin (Figure 1-1). It also includes the mainstem Columbia River from the Walla Walla River downstream to Bonneville Dam. In general, for most affected resources, the EA considers impacts throughout the Project Area.

The Study Area is a geographic area where particular resources are being evaluated more narrowly. Although the project area encompasses the full extent of project influence, the Study Area is specific to the resource being analyzed. For some resources, such as wildlife and human health, the EA has identified a Study Area which is limited to the area immediately surrounding the project facilities where operations could have a direct effect on a particular resource. For other resources, such as salmon and steelhead, project operations could have wider reaching impacts. The Study Area for each resource is described in Section 3, Affected Environment. In addition, a larger Study Area was defined to consider past, present, and reasonably foreseeable future actions that, with the Proposed Action, could result in cumulative impacts on the human or natural environment. The evaluation of this larger Study Area for cumulative impacts is described in Section 5, Cumulative Impacts.

1.3 Description of the Proposed Action

The HGMPs identified in Section 1, Introduction, collectively describe the management of Touchet River, Umatilla River, and Round Butte Hatchery (Deschutes River) summer steelhead, Hood River winter steelhead, and Round Butte Hatchery (Deschutes River) and Hood River spring Chinook Salmon under the six programs that are the subject of this EA, and are incorporated herein (WDFW 2015; CTWSRO and ODFW 2017; ODFW 2017, 2019; ODFW and CTUIR 2017; ODFW and CTWSRO 2017).

1.3.1 Touchet River Endemic Summer Steelhead

Although not in the Snake River Basin, the Touchet River Endemic Summer Steelhead Program is operated as part of the LSRCP to mitigate salmon and steelhead losses caused by the construction and operation of the four Lower Snake River dams. Both the Touchet River endemic summer steelhead population, listed as threatened under the ESA as part of the Middle Columbia River Distinct Population Segment (DPS) (March 25, 1999; FR 64 No. 57: 14517-14528) and Wallowa Stock summer steelhead (not ESA-listed) are produced at Lyons Ferry Hatchery and released into the Touchet River. This EA covers only the Touchet River Endemic Steelhead Program (Figure 1-2; Table 1-2). The program investigates the development of endemic stock programs to replace the use of non-endemic hatchery production.

1.3.2 Umatilla River Summer Steelhead

The Umatilla River Summer Steelhead Program is intended to augment and supplement the natural population (Figure 1-2; Table 1-2). Steelhead from the program are included as part of the Middle Columbia River DPS. The goals of the program are to 1) enhance production through supplementation with hatchery-produced fish using both natural-origin and hatchery-origin broodstock; 2) provide sustainable tribal and non-tribal harvest opportunities, and 3) maintain the genetic influence of the natural population over hatchery-produced fish on the natural spawning grounds. Under current operations,

returning Umatilla River hatchery summer steelhead are incorporated into the broodstock at a rate of no more than 33% of the actual spawners, with no hatchery x hatchery crosses (Latif 2015).

1.3.3 Round Butte Hatchery Summer Steelhead

The purpose of the Round Butte Hatchery Summer Steelhead Program is to (1) mitigate for lost harvest from construction and operation of the Pelton Round Butte Dam complex; (2) produce post-smolt steelhead yearlings for release into Lake Simtustus as catchable trout; and (3) reintroduce steelhead above Round Butte Dam (Figure 1-3; Table 1-2). Smolt releases for reintroduction support the evaluation of the downstream juvenile fish collection facility at Round Butte Dam. Under the Proposed Action, natural-origin adults will be incorporated into the broodstock and the release of steelhead fry and parr juveniles will be eliminated and replaced by an increase in the number of smolts released. Steelhead from all components of the program are included as part of the Middle Columbia River DPS; however, fish upstream from Round Butte Dam are designated as experimental under Section 10(j) of the ESA. This designation is currently set to expire in 2025.

1.3.4 Round Butte Hatchery Spring Chinook Salmon

The purpose of the Round Butte Hatchery Spring Chinook Salmon Program is to (1) mitigate for spring Chinook Salmon production lost due to construction and operation of the Pelton Round Butte Project, and (2) reintroduce spring Chinook Salmon above Rounde Butte Dam (Figure 1-3; Table 1-2). Fish from both program components are included as part of the Middle Columbia River Chinook Salmon Evolutionarily Significant Unit (ESU), which is not ESA-listed.

1.3.5 Hood River Winter Steelhead

The Hood River Winter Steelhead Program (Figure 1-4; Table 1-2) is operated under the *U.S. v Oregon* Management Agreement. The goals of the program are 1) to provide in-basin harvest opportunity for sport and tribal anglers, as harvest opportunity is currently limited for the indigenous wild production, and 2) to increase the number of natural-origin spawners while maintaining the long-term fitness of the natural population and minimizing ecological and genetic impacts on other populations in the Hood River Subbasin. Steelhead from the program are part of the Lower Columbia River DPS, which is ESA-listed as threatened.

1.3.6 Hood River Spring Chinook Salmon

The goal of the Hood River Spring Chinook Salmon program (Figure 1-4; Table 1-2) is to re-establish and maintain a naturally sustaining spring Chinook Salmon population in Hood River Subbasin with sustainable and consistent in-basin tribal and sport harvest opportunities. Under the Proposed Action the release of hatchery spring Chinook salmon smolts would increase from 150,000 to 250,000 smolts pending approval of the Master Plan by the Northwest Power and Conservation Council. Chinook Salmon from the program are not included as part of the Lower Columbia River ESU, which is ESA-listed as threatened; however, naturally spawning fish in the Hood River are part of the listed ESU.

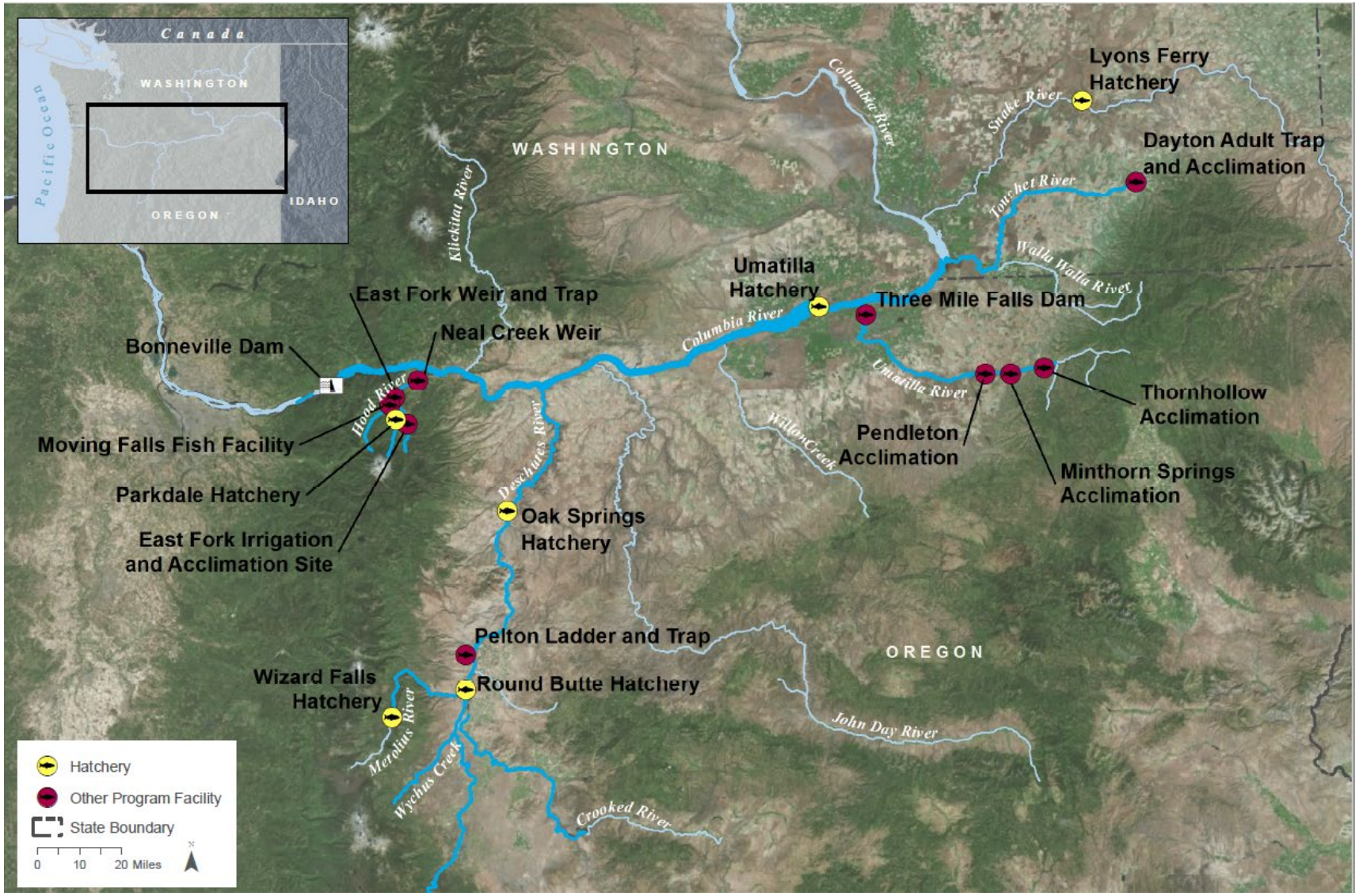

Figure 1-1. Map of Project Area, Highlighting the River Reaches (Dark Blue Shading) and Hatchery Facilities Included (the Snake River adjacent to Lyons Ferry Hatchery is included in the Project Area)

Table 1-2. Operations Overview for the Six Hatchery Programs in this EA

Parameter	Touchet River Endemic Summer Steelhead	Umatilla River Summer Steelhead	Round Butte Hatchery Summer Steelhead	Round Butte Hatchery Spring Chinook Salmon	Hood River Winter Steelhead	Hood River Spring Chinook Salmon
Adults						
Component and Purpose	Integrated Harvest	Integrated Harvest	Segregated Harvest; Resident Fish; Reintroduction (Transitioning to integrated harvest and reintroduction)	Segregated Harvest; Reintroduction	Integrated Harvest	Integrated Harvest and Supplementation
Broodstock number and type (HOR vs. NOR)[1]	9 HOR; 27 NOR	40 HOR; 70 NOR	188 HOR; 92 NOR[2]	700 HOR	40 NOR	210 HOR; 70 NOR
Collection location	Dayton Adult Trap	Three Mile Falls Dam	Pelton Trap	Pelton Trap	East Fork Weir and Trap[3]	Moving Falls Fish Facility
Collection timing	Mid-March - April	September - mid April	October - March	May - July	February - June	Mid May – mid August
Adult holding location	Lyons Ferry Hatchery	Minthorn Springs Acclimation Facility	Round Butte Hatchery	Round Butte Hatchery	Parkdale Hatchery	Parkdale Hatchery
Adult spawning location	Lyons Ferry	Minthorn Springs	Round Butte	Round Butte	Parkdale	Parkdale
Incubation, Rearing, and Release						
Incubation location	Lyons Ferry	Umatilla Hatchery	Round Butte; Wizard Falls Hatchery	Round Butte	Oak Springs Hatchery	Parkdale; Round Butte
Rearing location	Lyons Ferry	Umatilla Hatchery and Acclimation Facilities	Round Butte; Wizard Falls	Round Butte	Oak Springs	Moving Falls; Parkdale; Round Butte; Pelton Ladder
Acclimation location	Dayton Acclimation Pond	Pendleton Acclimation Facility; Thornhollow Acclimation Facility	Whychus Creek; Crooked River (Reintroduction only)	Segregated Harvest: Pelton Ladder	East Fork Irrigation Acclimation Site	Moving Falls; Parkdale

Parameter	Touchet River Endemic Summer Steelhead	Umatilla River Summer Steelhead	Round Butte Hatchery Summer Steelhead	Round Butte Hatchery Spring Chinook Salmon	Hood River Winter Steelhead	Hood River Spring Chinook Salmon
Release locations	Dayton Acclimation Pond	Pendleton Acclimation Facility; Thornhollow Acclimation Facility	Segregated Harvest: Deschutes River below Pelton Re-regulating Dam Resident Fish: Lake Simtustus, Reintroduction: Whychus Creek, Deschutes River, Crooked River	Segregated Harvest: Deschutes River below Pelton Re-regulating Dam Reintroduction: Whychus Creek, Deschutes River, Crooked River, Metolius River	East Fork Irrigation Acclimation Site	Moving Falls; Parkdale
Release timing	Mid to late April	Late April	Late March – early April	Mid April - May	Early May	Late April
Release number[4]	50,000	150,000	Segregated Harvest: 162,000; Resident Fish: 33,000 post-smolts Reintroduction: 100,000	Segregated Harvest: 310,000 Reintroduction: 430,000 fry	50,000	250,000[a]
Marks[5]	CWT = 100% PIT = 10%	CWT and left ventral fin clip = 40% Adipose fin clip = 100% PIT = 3%	Segregated Harvest: Adipose fin clip =100% Maxillary clip = 100%; Resident Fish: Adipose fin clip =100% Pectoral fin clip = 100%; Reintroduction: Maxillary clip = 100%	Segregated Harvest: CWT = 100% Adipose fin clip = 100% Reintroduction: Maxillary clip = 100%	Adipose fin clip = 100% Maxillary clip = 100% PIT = about 12%	Adipose fin clip = 100%; PIT = 10%

Parameter	Touchet River Endemic Summer Steelhead	Umatilla River Summer Steelhead	Round Butte Hatchery Summer Steelhead	Round Butte Hatchery Spring Chinook Salmon	Hood River Winter Steelhead	Hood River Spring Chinook Salmon
Other						
Maximum surface water use by facility (cubic feet per second [cfs])	Dayton = 6.0	Three Mile Falls = 11.1; Minthorn = 8.2; Pendleton = 14.3	Pelton Ladder and Trap = 16; Round Butte = 20.0; Whychus Creek and Crooked River acclimation = 2.1	Pelton Ladder and Trap = 16; Round Butte = 20.0	Parkdale = 5.6	Moving Falls =3.1 Parkdale = 5.6; Pelton trap = 3; Round Butte = 33.6
Maximum groundwater/spring water use by facility (cfs)	Lyons Ferry = 119.5	Umatilla Hatchery = 12.3	Wizard Falls = 13.5	--	Parkdale = 1.4; Oak Springs = 50.0	Parkdale = 1.4
Adult management goal[1]	pHOS = <30% pNOB = 75%	pHOS = <0.33 pNOB = 100%	pHOS = 0 pNOB = 0	pHOS = 0 pNOB = 0	pHOS = <50%[6] pNOB = 100%	pHOS = -- pNOB = 10%-100%
Method of adult management	All excess endemic stock is released upstream of the Dayton trap. Broodstock carcasses are used for nutrient enhancement.	100% marked; excess wild broodstock planted in Meacham Creek; excess hatchery returns sacrificed for CWT recovery or released immediately upstream	100% marked; excess fish are provided to Tribes or local food banks and food share organizations	100% marked; excess fish are provided to Tribes or local food banks and food share organizations	100% marked; broodstock are returned to the river; hatchery adults may be provided to Tribes or outplanted to standing waters to supplement fisheries	100% marked; all broodstock hatchery fish are passed upstream
Within basin targeted fisheries	No	Yes	Segregated: Yes Resident Fish: Yes Reintroduction: No	Segregated: Yes Reintroduction: No	Yes	Yes

[1]HOR = hatchery-origin returns, NOR = natural-origin returns, pHOS = percent hatchery-origin fish on the spawning grounds, pNOB = percent natural-origin fish in broodstock

[2]Round Butte Hatchery Summer Steelhead Program is transitioning to the integration of approximately 92 NOR for the reintroduction and mitigation components of the program.

[3]Other locations that may be used as backup trapping facilities include the East Fork Irrigation District's Headgate fish ladder and Parkdale Hatchery

[4]All releases are smolts unless otherwise indicated. The Round Butte summer steelhead reintroduction program will transition from fry to smolt releases. An increase in production for the Hood River Spring Chinook Salmon program from the current level of 150,000 up to 250,000 smolts is pending approval of the Master Plan currently before the Northwest Power and Conservation Council

[5]CWT = coded-wire tag, PIT = passive integrated transponder

[6]Information on the proportion of hatchery- and natural-origin spawners on natural spawning grounds for steelhead is limited; applicants remove hatchery-origin fish from the wild to the extent possible in the Hood River Subbasin.

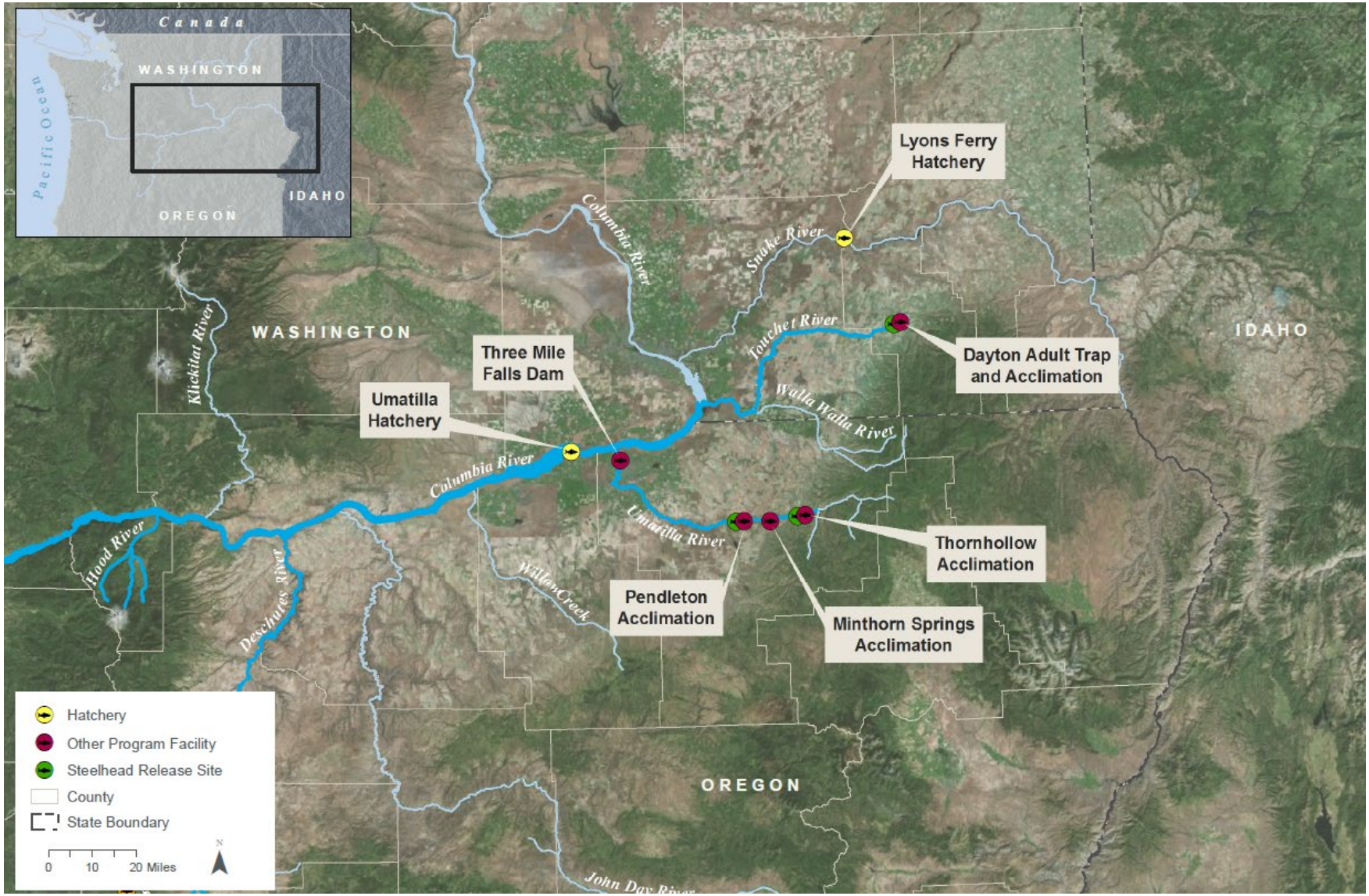

Figure 1-2. Hatchery Facilities and Release Sites for the Touchet River Endemic and Umatilla River Summer Steelhead Programs

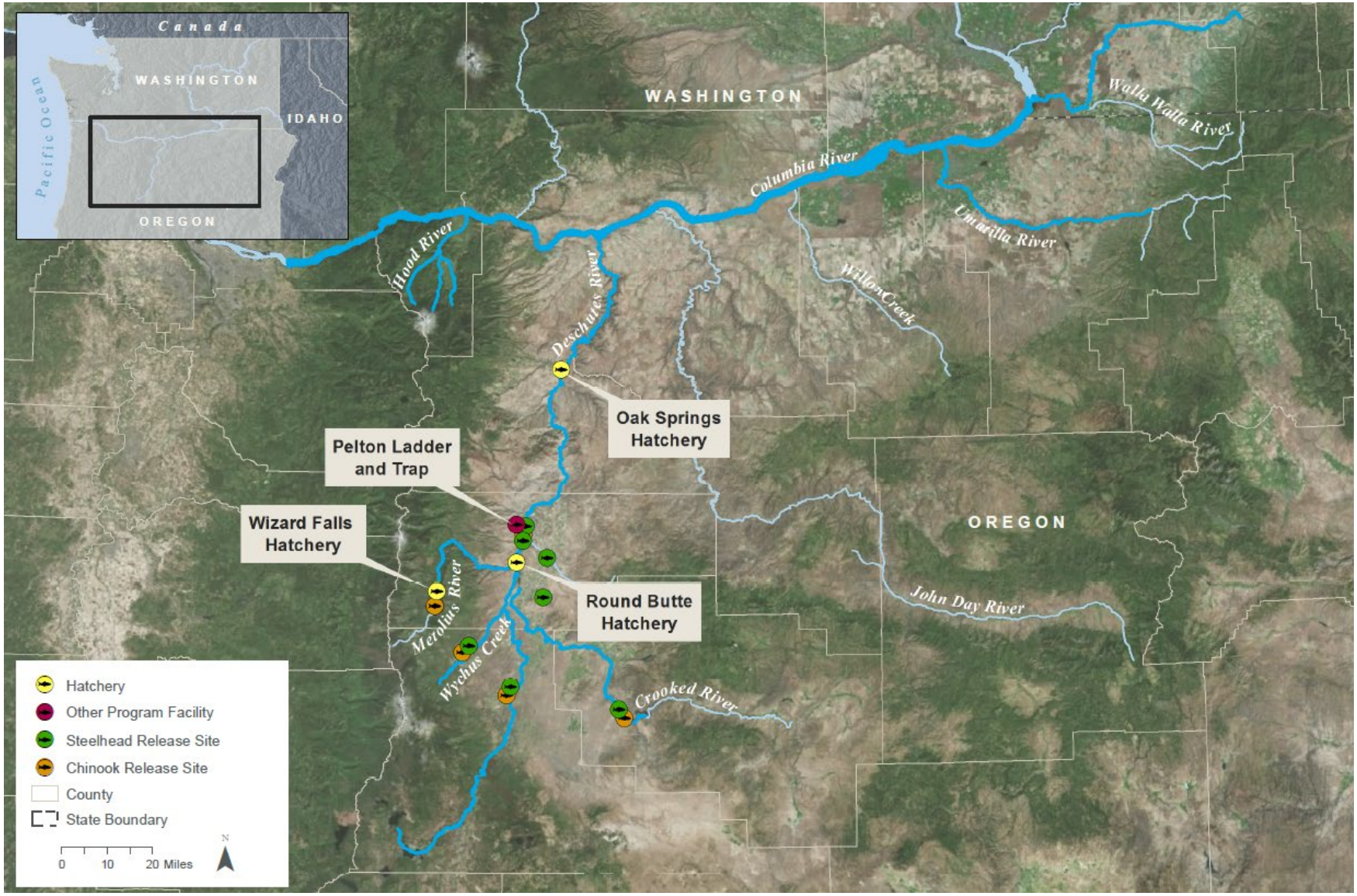

Figure 1-3. Hatchery Facilities and Release Sites in the Deschutes River Subbasin for the Round Butte Hatchery Summer Steelhead and Spring Chinook Salmon Programs, and the Hood River Winter Steelhead Program (Oak Springs Hatchery only)

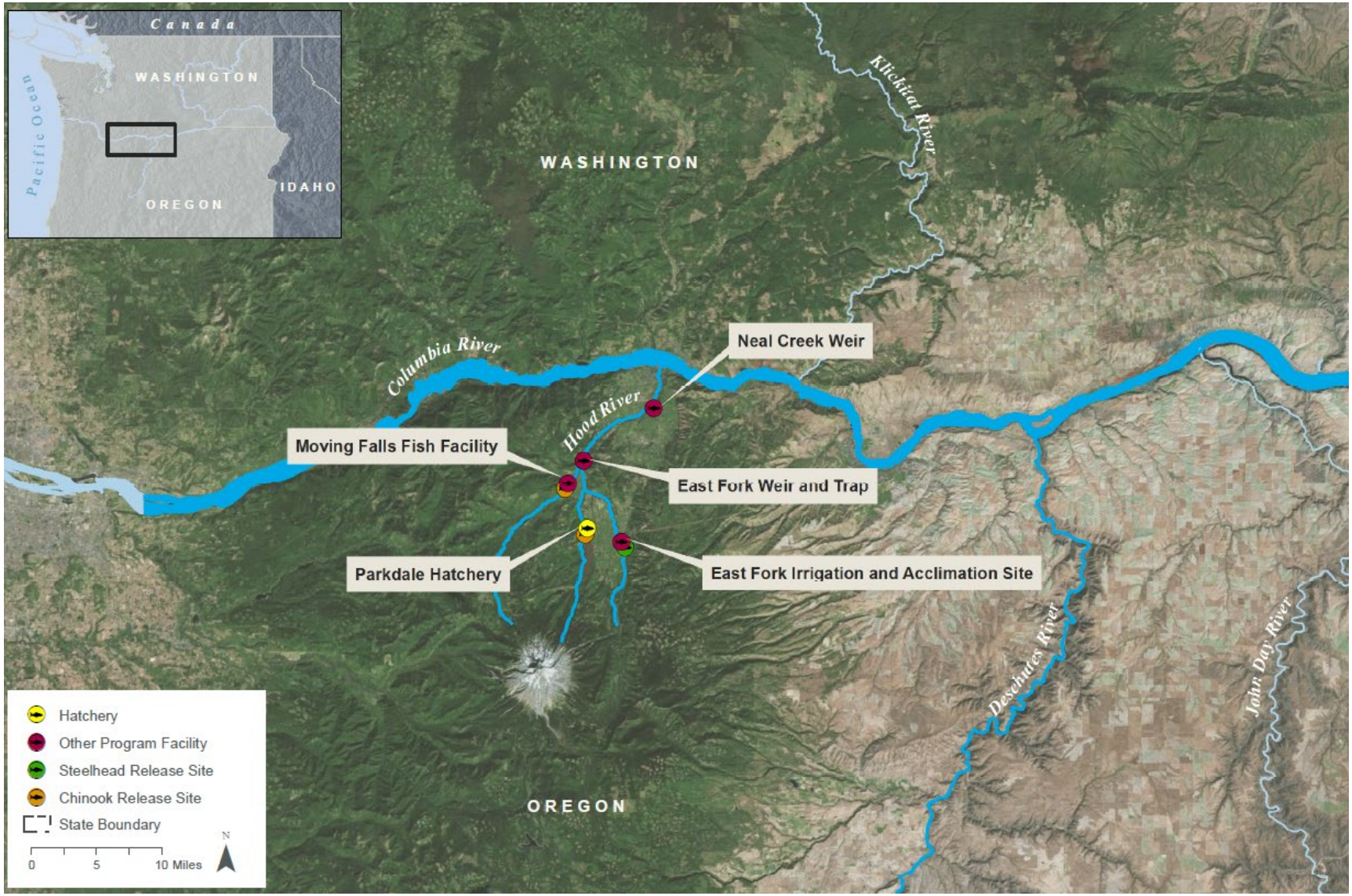

Figure 1-4. Hatchery Facilities and Release Sites in the Hood River Subbasin for the Hood River Winter Steelhead and Spring Chinook Salmon Programs

1.4 Relationship to Other Plans, Regulations, Agreements, Laws, Secretarial Orders, and Executive Orders

1.4.1 Tribal Trust Responsibility under the Endangered Species Act

The United States government has a trust or special relationship with tribes. The unique and distinctive political relationship between the United States and tribes is defined by treaties, statutes, executive orders, judicial decisions, and agreements, and differentiates tribes from other entities that work with or are affected by the Federal Government.

Secretarial Order, *American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the ESA* (Secretarial Order) clarifies the responsibilities of the agencies when actions are taken under the ESA (USFWS and NMFS 1997). Specifically, USFWS and NMFS shall, among other things:

- Work directly with tribes on a government-to-government basis to promote healthy ecosystems
- Recognize that tribal lands are not subject to the same controls as federal public lands
- Assist tribes in developing and expanding tribal programs so that healthy ecosystems are promoted and conservation restrictions unnecessary
- Be sensitive to tribal culture, religion, and spirituality

NMFS considers the responsibilities described above when taking ESA actions, such as making Section 4(d) determinations associated with this EA. Furthermore, NMFS has specified that the statutory goals of the ESA and federal trust responsibility to Indian tribes are complementary (Terry Garcia, U.S. Department of Commerce, letter sent to Ted Strong, Executive Director, Columbia River Inter-Tribal Fish Commission [CRITFC], July 21, 1998, regarding federal trust responsibility). The federal trust responsibility is independent of the statutory duties and informs how statutory duties are implemented.

1.4.2 U.S. v. Oregon

The court in *U.S. v. Oregon* (302 F. Supp. 899, 1978) ruled that state regulatory power over Indian fishing is limited because the 1855 treaties between the United States and the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes preserved the tribes' right to fish at all usual and accustomed places, whether on or off reservation. Because of this decision, fisheries in the Columbia River Basin are governed through the *U.S. v. Oregon* Management Agreement (Management Agreement; NMFS 2018a), which was negotiated by the Federal and state governments and the involved treaty Indian tribes. The most recent Management Agreement, entered as a court order in 2018 and set to expire on December 31, 2027, provides the current framework for managing fisheries and hatchery programs in much of the Columbia River Basin. The agreement includes a list of hatchery programs with stipulated production levels, and a list of tribal and non-tribal salmonid fisheries in the Columbia River Basin, including designated off-channel sites that are intended to: (1) provide fair sharing of harvestable fish between tribal and non-tribal fisheries in accordance with Treaty fishing rights and *U.S. v. Oregon*, and (2) be responsive to the needs of ESA-listed species. For more details about the history of the Management Agreement, see the Mitchell Act Final Environmental Impact Statement (FEIS) Subsection 1.7.4, *U.S. v. Oregon* (NMFS 2014).

1.4.3 Northwest Power Act

The Northwest Power Act directs BPA to protect, mitigate, and enhance fish and wildlife affected by development and operation of federal hydroelectric facilities on the Columbia River and its tributaries in a manner consistent with the Northwest Power and Conservation Council's (the Council) Columbia River

Basin Fish and Wildlife Program (Program). The Council recommends fish and wildlife mitigation for BPA funding and the Council's Independent Scientific Review Panel periodically reviews BPA-funded fish and wildlife mitigation projects for consistency with the Program.

Production of the hatchery programs included in this EA receiving BPA funding were reviewed and recommended by the Council through the three-step process in 2011.

1.4.4 Columbia Basin Fish Accords and Extension

On May 2, 2008, BPA signed the 2008 Columbia Basin Fish Accords and extended this agreement in 2018. The 2018 Fish Accord Extension includes funding commitments for portions of the Hood River Winter Steelhead, Hood River Spring Chinook and Umatilla River Summer Steelhead programs, subject to compliance with applicable law, including environmental review under NEPA.

1.4.5 Lower Snake River Compensation Plan

The LSRCP Program was authorized by the Water Resources Development Act of 1976 (Public Law 94 587) to mitigate salmon and steelhead losses caused by the construction and operation of the four Lower Snake River dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite). The combined LSRCP mitigation return goals for Idaho, Oregon, and Washington include 293,500 adult Chinook salmon and 165,300 adult steelhead annually. These return goals assume a 4:1 ratio of catch downstream of Lower Granite Dam to escapement upstream of Lower Granite Dam for Chinook salmon. That is, for every four adult Chinook salmon caught below Lower Granite Dam, one adult Chinook salmon is assumed to escape upstream of Lower Granite Dam. This ratio is 2:1 for steelhead under the mitigation return goals. The Touchet River Endemic Summer Steelhead Program is the only program included in this EA that is part of the LSRCP mitigation responsibilities. All other LSRCP programs are in the Snake River Basin (USACE 1976).

1.4.6 Pelton Round Butte Hydropower Project License and Settlement Agreement

FERC issued a new license to PGE and CTWSRO for the Pelton Round Butte Project on June 21, 2005. The license includes mandatory conditions by the USFWS and NMFS, and requires implementation of the Pelton Round Butte Fish Passage Plan (PGE and CTWSRO 2004a) to reinitiate fish passage through the Pelton Round Butte Project. The license incorporates the terms of a Settlement Agreement entered into by the licensees and 20 other parties, including ODFW. All licensee fish passage and reintroduction responsibilities are described in the Fish Passage Plan and include fish passage improvements, a wide variety of test and verification studies, and longer term monitoring efforts. The license includes a schedule for meeting those obligations. The FERC license also mandates that PGE shall mitigate for steelhead production lost due to the hydroelectric project by funding hatchery operations to release 162,000 steelhead smolts each year (PGE and CTWRSO 2004a).

1.4.7 Mitchell Act

In 2014, NMFS completed the Mitchell Act FEIS to assess Columbia River Basin hatchery operations and funding of the Mitchell Act hatchery programs (NMFS 2014). The Mitchell Act FEIS analyzed a wide range of hatchery programs throughout the Columbia River Basin, including programs included in this EA,

across a suite of alternatives[1]. These alternatives were related to how hatcheries might be operated to manage effects (negative and positive) on natural salmon and steelhead populations, both ESA-listed and non-listed. Alternative 6 was selected by NMFS to implement (NMFS 2017).

Although the Mitchell Act FEIS analyzed the likely comprehensive effects of hatchery production on broad scales, it did not contain site-specific analyses for the programs included in this EA. Where relevant, this EA compares production levels from the six included programs to the alternatives analyzed in the Mitchell Act FEIS and production levels assumed there for these same programs, to inform the analysis of program effects relative to the range of alternatives analyzed in the Mitchell Act FEIS. In general, releases from the four steelhead programs included in this EA are slightly lower than or similar to those described in the Mitchell Act FEIS, whereas releases from the two Chinook Salmon programs included in this EA are greater than those described in the Mitchell Act FEIS.

[1] The Mitchell Act FEIS alternatives were designed to consider distributing funds in a manner that would reduce or minimize the adverse effects or increase the benefits of hatchery operations on natural-origin salmon and steelhead populations. The alternatives are varying applications of two hatchery performance goals that are either intermediate or stronger than the baseline conditions:

- Alternative 1 – No action: the Columbia River Basin hatchery production would continue as baseline conditions.
- Alternative 2 – No Mitchell Act funding: all Mitchell Act-funded hatchery programs and facilities would be closed. Other programs would operate to intermediate performance goals, and production levels would be reduced for those programs designed to meet mitigation requirements only when those production levels conflicted with the ability of a hatchery program to meet performance goals.
- Alternative 3 – All Hatchery Programs Meet Intermediate Performance Goal; under this alternative, all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations would meet the intermediate performance goal.
- Alternative 4 – Willamette/Lower Columbia River Hatchery Programs Meet Stronger Performance Goal: all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Interior Columbia Recovery Domain would meet the intermediate performance goal, and all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain would meet the stronger performance goal.
- Alternative 5 – Interior Columbia River Hatchery Programs Meet Stronger Performance Goal: all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain would meet the intermediate performance goal, and all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations in the Interior Columbia Recovery Domain would meet the stronger performance goal.
- Alternative 6 – All Hatchery Programs Meet Stronger Performance Goal (Preferred Alternative); under this alternative, all hatchery programs in the Columbia River Basin affecting primary and contributing salmon and steelhead populations would meet the stronger performance goal.

2 Description of Alternatives

Four alternatives are considered in this EA:

- Alternative 1, No Action: NMFS would make ESA Section 4(d) determinations. BPA would provide funding for the Hood River Winter Steelhead, Hood River Spring Chinook Salmon, and/or Umatilla River Summer Steelhead programs, and the USFWS would fund the Touchet River Endemic Steelhead program, but all six programs would be operated at 2018 production levels.
- Alternative 2, Proposed Action: NMFS would make Section 4(d) determinations consistent with the HGMPs and programs would be operated as proposed in the HGMPs (Table 1-2). The USFWS would provide funding for the Touchet River Endemic Steelhead program, and BPA would provide fundingfor the Umatilla River Summer Steelhead, Hood River Winter Steelhead, and Hood River Spring Chinook Salmon programs. PGE would continue to fund the Round Butte Hatchery Summer Steelhead and Round Butte Hatchery Spring Chinook Salmon programs.
- Alternative 3, Reduced Production: NMFS would make Section 4(d) determinations consistent with the HGMPs, but juvenile releases from all programs would be reduced by 50 percent. The USFWS would provide funding for the Touchet River Endemic Steelhead program, BPA would provide funding for the Umatilla River Summer Steelhead, Hood River Winter Steelhead, and Hood River Spring Chinook Salmon programs, and PGE would provide funding for the Round Butte Hatchery Summer Steelhead and Round Butte Hatchery Spring Chinook Salmon programs to produce juvenile releases that are reduced by 50 percent of the number outlined in the HGMPs.
- Alternative 4, Program Termination: NMFS would not make ESA Section 4(d) determinations. The USFWS would not fund the Touchet River Endemic Steelhead program, and BPA would not provide funding for the Umatilla River Summer Steelhead, Hood River Winter Steelhead, and Hood River Spring Chinook Salmon programs. PGE would not provide funding for the Round Butte Hatchery Summer Steelhead and Round Butte Hatchery Spring Chinook Salmon programs (thereby not meeting obligations of the FERC license and Settlement Agreement), and all six programs would terminate.

2.1 Alternative 1, No Action

Under Alternative 1, NMFS would make a Section 4(d) determination, and BPA would provide funding for the Umatilla River Summer Steelhead, Hood River Winter Steelhead, and Hood River Spring Chinook Salmon programs and the USFWS would fund the Touchet River Endemic Steelhead program. For analysis purposes, NMFS has defined the No Action Alternative as the choice by the applicants to continue operating the programs as they have been as described in the HGMPs, except that BPA would limit funding to the current production level of 150,000 sping Chinook salmon smolts in the Hood River. Therefore, analysis of the No Action Alternative would reflect HGMP production for the hatchery programs (Table 1-1; Table 1-2), RM&E (Section 2.1.1, Research, Monitoring, and Evaluation), and O&M (Section 2.1.2, Operation and Maintenance).

2.1.1 Research, Monitoring, and Evaluation

Surveying and sampling to assess program objectives and goals may increase the risk of injury and mortality to salmon and steelhead that are the focus of the actions, or that may be incidentally encountered. RM&E activities discussed in this EA are related directly to the hatchery programs in each

watershed (Table 2-1). RM&E may include, but is not limited to, monitoring survival and growth within hatcheries and sampling outside hatcheries, to assess the effects of hatchery fish on the natural-origin population, productivity, genetic diversity, run and spawn timing, spawning distribution, and age and size at maturity. This information may be collected from:

- Spawning ground surveys to assess abundance, distribution, and origin (hatchery or natural) of spawners through mark-(i.e., coded-wire tags [CWT] and adipose fin-clips)recapture
- Stock composition sampling to determine population age, sex, size distribution, genetics, and fish health
- Juvenile sampling in the hatchery to determine fish health, smoltification status, size distribution, and precocial maturation
- Smolt trapping using screw traps to determine emigration timing and size of juveniles
- Passive integrated transponder (PIT) tagging and detection to track downstream migration of juveniles, provide information on residualism rates of hatchery fish, and determine emigration timing, population abundance, overwinter survival, and emigration survival of natural-origin fish
- PIT tagging and detection to assess adult straying.

2.1.2 Operation and Maintenance

Most facilities used for program operations in this EA divert surface water and return it to the diverted waterbody (minus any leakage and evaporation) a short distance downstream of the diversion location. Lyons Ferry, Umatilla, and Oak Springs hatcheries utilize groundwater or springs, and Parkdale Hatchery utilizes both surface water and groundwater. Surface water and groundwater used at all facilities are withdrawn in accordance with state-issued water rights. Screens at all facilities drawing surface water accessible to anadromous fish are in compliance with NMFS (2011) screening and passage criteria.

For additional information regarding facility water sources for each program, refer to Section 3.1, Water Quantity, and Section 3.2, Water Quality, and to the Biological Opinions (NMFS 2018b; 2018c) or HGMP recently issued for each program (WDFW 2015; CTWSRO and ODFW 2017; ODFW 2017, 2019; ODFW and CTUIR 2017; ODFW and CTWSRO 2017). Programs that rear over 20,000 pounds of fish annually operate under applicable National Pollutant Discharge Elimination System (NPDES) general permits for upland fin fish hatching and rearing.

Several routine (and semi-routine) maintenance activities occur in or near waterbodies that could affect fish. These activities include sediment/gravel removal/relocation and debris removal from intake and/or outfall structures, pond cleaning, pump maintenance, and maintenance and stabilization of existing bank protection. All in-water maintenance activities considered routine (occurring on an annual basis) or semi-routine (occurring with regularity, but not necessarily on an annual basis) occur within existing structures or the footprint of areas that have already been impacted. No such activities occur at Round Butte Hatchery because the hatchery is at the base of Round Butte Dam. The intake for Parkdale Hatchery is located in non-anadromous waters above an impassable road culvert. When maintenance activities occur in surface water, they are implemented under the following conditions:

- In-water work:
  - Is done during the allowable freshwater work times established for each location, or complies with an approved variance of the allowable freshwater work times with WDFW, ODFW, NMFS, and USFWS

- Follows a pollution and erosion control plan that addresses equipment and materials storage sites, fueling operations, staging areas, cement mortars and bonding agents, hazardous materials, spill containment and notification, and debris management
- Ceases if fish are observed in distress at any time as a result of the activities
- Includes notification of NMFS staff
- Is conducted using equipment retrofitted with vegetable-based synthetic fuel oil

- Equipment:
  - Is inspected daily and free of leaks before leaving the vehicle staging area
  - Is operated above ordinary high water mark (OHWM) or in the dry whenever possible
  - Is sized correctly for the work to be performed and has approved oils/lubricants when working below the OHWM
  - Is staged and fueled in appropriate areas 150 feet from any waterbody
  - Is cleaned and free of vegetation before it is brought to the site and prior to removal from the project area

Table 2-1. RM&E Activities Associated with Each Hatchery Program

Program	Adult	Juvenile
All	• Measure and examine for gender, tags, and marks • Recover CWTs	• Monitor survival metrics for all life stages in the hatchery from spawning to release • CWT and/or mark representative groups
Touchet River Endemic Summer Steelhead	• Install temporary adult traps in Coppei Creek and Patit Creek. Sample fish for origin, sex, length, and marks/tags. Collect scales from natural-origin fish. • Conduct spawning ground surveys to estimate the number of redds and spawners, and use trapping data to estimate the proportions of natural and hatchery-origin steelhead in the spawning population.	• PIT tag representative groups to estimate migration timing, outmigration survival rate, and adult returns • Operate a smolt trap on the Touchet River to (1) estimate abundance, timing, and age composition of natural-origin smolts, and (2) insert PIT tags into hatchery-origin and natural-origin juveniles • Electrofish to estimate total abundance of juveniles within specific sections of stream • Conduct angling or beach seine surveys to supplement distribution and abundance data
Umatilla River Summer Steelhead	• Enumerate adult returns to Three Mile Falls Dam by species, hatchery-natural origin, and adult age class by trapping fish that ascend the ladder. Fish passage is monitored by video when the trap is not operating. • Conduct steelhead redd surveys at a minimum of 25 sites. • Operate and maintain a PIT tag detection system that can assess adult straying.	• Operate a smolt trap at the mouth of Birch Creek and an inclined plane trap within the West Extension Canal to (1) identify fish species, race, and origin, (2) collect biological data from natural-origin steelhead, (3) examine fish for marks/tags, and (4) insert PIT tags into unmarked natural-origin juveniles • Operate smolt traps to capture and insert PIT tags into steelhead emigrating from Meachem Creek and the Umatilla River above Meachem Creek. • Operate an in-stream PIT tag detection array in lower Birch Creek to evaluate hatchery steelhead use of Birch Creek and to estimate the percentage of returning natural-origin adult steelhead to the Umatilla River that spawn in Birch Creek. • Operate and maintain PIT tag detection system at Three Mile Falls Dam and use the data, in combination with data from other detection sites (e.g., John Day, and Bonneville dams) to assess smolt survival and migration performance.
Round Butte Hatchery Summer Steelhead	• Trapping and marking adults at the Sherars Falls fish ladder. Sample fish for origin, sex, length, and marks/tags. Collect scales from natural-origin fish.	• None
Round Butte Hatchery Spring Chinook Salmon	• None	• None

Program	Adult	Juvenile
Hood River Winter Steelhead	• Capture fish via angling in the mainstem Hood River downstream from trapping facilities to insert radio tags. Insert PIT tags into untagged fish. Track radio-tagged fish by mobile tracking and fixed telemetry sites.	• Conduct summer snorkeling surveys to observe and enumerate rearing fish. Initial observations may be calibrated by multiple pass electrofishing surveys. • Operate smolt traps from March to November in the mainstem Hood River, West Fork Hood River, Middle Fork Hood River, and East Fork Hood River to collect emigrating smolts. Insert PIT tags into untagged fish >100 millimeter (mm) fork length. Collect scale samples from some juvenile steelhead. • If necessary to increase the number of PIT-tagged juvenile steelhead, use beach seines to collect additional fish. • Stock PIT-tagged hatchery-origin juveniles above Clear Branch Dam on the Middle Fork Hood River to investigate downstream passage success and injury rates.
Hood River Spring Chinook Salmon	• Sample spring Chinook Salmon at Moving Falls Fish Facility to collect scales, determine sex, measure length, and detect any marks/tags. Insert PIT tags into untagged fish. • Conduct spawning ground surveys to estimate the number of redds, live fish, and carcasses. • Capture fish via angling in the lower West Fork Hood River to insert radio tags. Insert PIT tags into untagged fish. Track radio-tagged fish by mobile tracking and fixed telemetry sites.	• Conduct summer snorkeling surveys to observe and enumerate rearing fish. Initial observations may be calibrated by multiple pass electrofishing surveys. • Operate smolt traps from March to November in the mainstem Hood River, West Fork Hood River, Middle Fork Hood River, and East Fork Hood River to collect emigrating smolts. Insert PIT tags into untagged fish >100mm fork length. • Stock PIT-tagged hatchery-origin juveniles above Clear Branch Dam on the Middle Fork Hood River to investigate downstream passage success and injury rates.

2.2 Alternative 2, Proposed Action

Under Alternative 2, Proposed Action, NMFS would make ESA Section 4(d) determinations for the six hatchery programs to operate as described in the HGMPs, primarily as described for Alternative 1, No Action, including RM&E (Section 2.1.1, Research Monitoring, and Evaluation) and O&M (Section 2.1.2, Operation and Maintenance). However, three new activities not previously described will be implemented in the near future: (1) the Round Butte Hatchery Summer Steelhead Program will complete a transition to incorporating up to 92 NOR adults into the broodstock for both the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program will include the release of up to 100,000 smolts rather than 430,000 fry beginning in 2020 (ODFW 2019), and (3) Hood River spring Chinook Salmon production will increase from 150,000 smolts to 250,000 smolts. The submitted HGMP (CTWSRO and ODFW 2017) and the resulting Biological Opinion analysis (NMFS 2018c) was based on the proposed release of up to 250,000 smolts pending BPA's funding decision to increase production of Hood River spring Chinook Salmon. The effects of these

program changes are not included under the analysis of Alternative 1 but will be evaluated under Alternative 2.

2.3 Alternative 3, Reduced Production

Under this alternative, hatchery production would be reduced by 50 percent of what is described in the HGMPs. NMFS would make ESA Section 4(d) determinations for the six hatchery programs described for the No Action Alternative 1 and the Proposed Action Alternative 2. BPA would provide enough funding to the Umatilla River Summer Steelhead, Hood River Winter Steelhead, and Hood River Spring Chinook Salmon programs to produce 50 percent of the production levels described in the HGMPs, and the USFWS would provide enough funding to the Touchet Endemic Steelhead program to produce 50 percent of the proposed production. To meet mitigation requirements under the LSRCP, the reduction in production under this alternative would need to be released at some location outside the Touchet River. The RM&E would continue to operate at the same levels. This alternative would not provide sufficient hatchery production to contribute to restoration and recovery of ESA-listed Lower Columbia River Chinook Salmon, Middle Columbia River steelhead, or Lower Columbia River steelhead.

2.4 Alternative 4, Program Termination

Under Alternative 4, Program Termination, NMFS would determine that the six hatchery programs described for the No Action Alternative 1 and the Proposed Action Alternative 2 do not meet the criteria for Section 4(d) determinations and all actions related to those programs would be terminated. The USFWS would not fund the Touchet River Endemic Steelhead program, and BPA would not provide funding to the Umatilla River Summer Steelhead, Hood River Winter Steelhead, and Hood River Spring Chinook Salmon programs. PGE would not provide funding for the Round Butte Hatchery Summer Steelhead and Round Butte Hatchery Spring Chinook Salmon programs (thereby not meeting obligations of the FERC license and Settlement Agreement). Termination would occur whether or not those actions may already have existing ESA authorizations. None of the six hatchery programs would operate under this alternative.

With the complete termination of hatchery programs, facilities would not be used for these programs, but some would continue to operate for other salmon or steelhead programs described by NMFS (2014; 2018b; 2018c). Facilities dedicated to programs considered in this EA that may cease operation include the Dayton Adult Trap and Dayton Acclimation Pond, Minthorn Springs acclimation facility, Round Butte Hatchery and the Pelton Trap, and Parkdale Hatchery, the East Fork Hood River Trap, and the Moving Falls Fish Facility. This alternative would not provide sufficient hatchery production to contribute to restoration and recovery of ESA-listed Chinook Salmon and steelhead in the Columbia River Basin.

2.5 Alternatives Considered but not Analyzed in Detail

The following alternatives were considered, but not analyzed in detail because they would not meet federal purpose and need.

2.5.1 Hatchery Programs with Increased Production Levels

Under this alternative, NMFS would issue an ESA Section 4(d) determination for increased production levels associated with the six hatchery programs, as compared to the level described in the HGMPs. This alternative was not analyzed in detail because substantially higher production levels would be outside the scope of current agreements and consultation limits (NMFS 2014; 2018a).

2.5.2 Hatchery Programs with Other Decreased Production Levels

A version of a reduced production level alternative is analyzed in this EA as Alternative 3, and termination of all production is analyzed as Alternative 4. Alternatives that reduce production for select programs but not others were not analyzed. Any further reduction in production levels or the termination of programs for select species, while maintaining other programs, would not provide additional insight compared to Alternatives 3 and 4, and/or meet NMFS's purpose and need to conserve and protect listed species; therefore, other reduced production alternatives will not be further analyzed in this document.

2.5.3 Increased Harvest to Reduce Hatchery Fish on Spawning Grounds

Fishery harvest could be used to reduce the number of hatchery-origin adults on spawning grounds to reduce genetic and ecological risks of hatchery-origin fish interacting with natural-origin fish. However, this is likely not possible without also increasing impacts on ESA-listed fish in the project area that are incidentally taken while removing the hatchery-origin adults, which may require an ESA consultation. Harvest fishery is not a necessary component of the proposed programs, and other methods of reducing the number of hatchery-origin adults on the spawning ground are considered under Alternative 1 and Alternative 2.

3 Affected Environment

This Chapter describes current conditions for ten resources that may be affected by implementation of the EA alternatives:

- Water Quantity—Section 3.1
- Water Quality—Section 3.2
- Salmon and Steelhead—Section 3.3
- Fisheries—Section 3.4
- Other Fish Species—Section 3.5
- Wildlife—Section 3.6
- Socioeconomics—Section 3.7
- Cultural Resources—Section 3.8
- Environmental Justice—Section 3.9

Internal scoping by NMFS identified no other resources that would potentially be impacted by current operation, the Proposed Action, or other alternatives.

3.1 Water Quantity

Many of the rivers or streams on which hatchery facilities included in this EA are located have been historically subjected to artificially altered flows. Flows in some streams have been annually depressed because of natural variability and human water use. Water diversions, primarily for agriculture, substantially reduce flows in some stream reaches. Reductions of stream flows has been historically severe in reaches of the Touchet, Walla Walla, Umatilla, and Deschutes rivers, although recent water management practices have helped to reduce occurrences of dewatering (NPCC 2004; Phelps 2004; Walla Walla County and Walla Walla Basin Watershed Council 2004). Water quantity in the Deschutes River is highly regulated by reservoirs. Some streams in the Hood River Subbasin are subjected to reduced flows because of diversions, but others may experience unnaturaly high flows because they are used as part of irrigation transfer systems (Coccoli et al. 2004).

Each of the six currently operating hatchery programs included in this EA takes water from a nearby stream or reservoir (surface water), or wells or springs (groundwater or spring water) to use in the hatchery facility (Table 3-1). The use of surface water for hatchery programs may reduce instream flow, sometimes leading to substantial reduction in stream flow between the water intake and discharge structures. In particular, operation of adult holding tanks, egg incubation, juvenile fish rearing, and/or acclimation ponds affect water quantity. Surface water use is nonconsumptive because, with the exception of small amounts lost through leakage or evaporation, water that is diverted from a river or reservoir is discharged back to the river (downstream from the reservoir where applicable) after it circulates through the hatchery facility. Although groundwater is not directly replenished, it is also discharged after circulating through the facility, sometimes increasing a small amount of stream flow below the discharge point.

Facilities are located along the Snake (Lyons Ferry Hatchery) and Columbia (Umatilla Hatchery) rivers, and in the Walla Walla River (Touchet River watershed), Umatilla River, Deschutes River, or Hood River subbasins (Figure 1-1). The Study Area for water quantity is limited to the stream reaches between intake and outfall for each facility, which range in length from about 70 feet to about 3 miles (Table 3-1). The

longest diversion is associated with withdrawals from Lake Simtustus into the Pelton Fish Ladder, which is approximately 3 miles long. However, this diversion and the long diversion at the East Fork Irrigation acclimation facility (Table 3-1) were in place prior to being used as acclimation facilities.

3.1.1 Surface Water

Surface water withdrawal for hatchery programs often fluctuates seasonally based on propagation needs, with the highest hatchery water demand often occurring in the spring when streamflow levels are highest. Prior to juvenile release in spring, hatcheries have more fish on hand, fish under propagation are at their largest size, and the need for rearing flows for fish health maintenance is greatest. Hatchery water withdrawal for fish rearing is often lowest in the late summer months (when river flows are also at their lowest) because fewer fish are on station after release.

Adult collection facilities included in this EA generally use water (1) destined for or already in a fish ladder (Three Mile Dam Trap and Pelton Trap), (2) remaining instream and flowing through a temporary barrier (East Fork Weir and Trap), or (3) diverted for a relatively short time and distance before being returned to the stream (Dayton Adult Trap and Moving Falls Fish Facility). Rearing and acclimation facilities on small streams generally withdraw the highest proportions of stream flow. The surface water source for Parkdale Hatchery on Rogers Spring Creek is inaccessible to anadromous fish. The East Fork Irrigation acclimation facility uses a sediment retention pond that is part of the larger East Fork Hood River irrigation diversion that has been in use since before the acclimation facility was constructed. The outflow from both acclimation facilities for the Round Butte Hatchery Summer Steelhead Progam are located adjacent to the inflow, thereby eliminating loss of flow in the streams.

Round Butte Hatchery receives its water from seepage through Round Butte Dam. Although considered surface water, the water travels from Lake Billy Chinook through cracks in the basalt on either side of the dam. The seepage time from the lake through the basalt to the hatchery is at least two weeks (CTWSRO and ODFW 2017).

3.1.2 Groundwater and Spring Water

Five facilities included in this EA obtain water from wells or springs (Table 3-1). Lyons Ferry Hatchery uses production wells to provide all water necessary for operation. Umatilla Hatchery uses a Ranney well system to withdraw groundwater that has a direct connection to the Columbia River. No surface water is collected. Parkdale Hatchery may use groundwater to supplement surface water when needed. Well and surface water sources can be used independently or can be mixed to achieve desired temperatures for holding adults. Oak Springs Hatchery utilizes a series of large springs on the steep Deschutes River Canyon wall to provide all water needed. Wizard Falls Hatchery obtains water from two sets of springs to provide all water needed.

Table 3-1. Water Source and Use at Facilities Utilized by the Hatchery Programs in this EA

Program, Facility	Maximum Water Use (cfs)	Maximum Surface Water Use (cfs)	Maximum Groundwater or Spring Water Use (cfs)	Surface Water Source	Discharge Location	Surface Water Diversion Distance (Feet)	Maximum Surface Water Use Relative to River Flow (%)[1]
Touchet River Endemic Summer Steelhead							
Dayton Adult Trap and Acclimation Pond	6.0	6.0	0	Touchet River	Touchet River	70	1.0
Lyons Ferry Hatchery	119.5	0	119.5	--	--	--	--
Umatilla River Summer Steelhead							
Three Mile Falls Dam Trap	11.1	11.1	0	Umatilla River	Umatilla River	140	14.7
Umatilla Hatchery	12.3	0	12.3	--	--	--	--
Minthorn Acclimation Facility	8.2	8.2	0	Minthorn Springs Creek	Minthorn Springs Creek	200	--
Pendleton Acclimation Facility	14.3	14.3	0	Umatilla River	Umatilla River	430	1.1
Thornhollow Acclimation Facility	6.7	6.7	0	Umatilla River	Umatilla River	410	0.5
Round Butte Hatchery Summer Steelhead and Spring Chinook Salmon							
Pelton Ladder and Trap	16.0	16.0	0	Lake Simtustus	Deschutes River	15,840	0.4
Round Butte Hatchery	20.0	20.0	0	Lake Billy Chinook	Deschutes River	--	--
Wizard Falls Hatchery	13.5	0	13.5	--	Metolius River	--	--
Whychus Creek Acclimation[2]	2.1	2.1	0	Whychus Creek	Whychus Creek	0	--
Crooked River Acclimation[2]	2.1	2.1	0	Crooked River	Crooked River	0	--
Hood River Winter Steelhead							
East Fork Weir and Trap	--	--	0	East Fork Hood River	East Fork Hood River	--	--
Parkdale Hatchery	7.0	5.6	1.4	Rogers Spring Creek; Middle Fork Hood River	Rogers Spring Creek	1,300	--
Oak Springs Hatchery	50.0	0	50.0	Springs	Deschutes River	--	--

Program, Facility	Maximum Water Use (cfs)	Maximum Surface Water Use (cfs)	Maximum Groundwater or Spring Water Use (cfs)	Surface Water Source	Discharge Location	Surface Water Diversion Distance (Feet)	Maximum Surface Water Use Relative to River Flow (%)[1]
East Fork Irrigation Acclimation Site	127.0[3]	127.0	0	East Fork Hood River	East Fork Hood River	3,090	--
Hood River Spring Chinook Salmon[4]							
Moving Falls Fish Facility[5]	5.0	5.0	0	West Fork Hood River	West Fork Hood River	520	3.2

Sources: Coccoli et al. 2004, WDFW 2015, CTWSRO and ODFW 2017, ODFW 2017, 2019, ODFW and CTUIR 2017, ODFW and CTWSRO 2017

[1]Stream flows at nearest gage were used to estimate maximum water use relative to flow for the Touchet and Umatilla rivers and Pelton Ladder. Round Butte Hatchery uses seepage water. No appropriate gages were available for Hood River facilities. Lowest mean monthly flow of 157 cfs reported by Coccoli et al (2004) was used for the West Fork Hood River.

[2]Acclimation facilities used for steelhead program only. Outflow is located adjacent to inflow to eliminate loss of water from stream.

[3]Water is diverted for the irrigation district and utilized by the Hood River Winter Steelhead Program.

[4]Information on additional facilities utilized is provided under the Hood River Winter Steelhead Program.

[5]Water Source and use under current production levels of 150,000.

3.2 Water Quality

Most of the rivers or streams on which hatchery facilities included in this EA are located are considered impaired for one or more water quality parameter. Human-related activities that may affect water quality have included irrigation, livestock grazing, forest practices, and domestic water needs. The most common impairments in the Study Area are high water temperature and sediment. High pH was also implicated for some areas of the Touchet River, but was judged to be less severe than temperature and sediment (USEPA 2010). In addition to temperature and sediment, impairments include high pH and low dissolved oxygen in the Umatilla River and Deschutes River subbasins (NPCC 2004; Phelps 2004), and high levels of phosphorous and nitrogen in the Hood River Subbasin (Cocolli et al. 2004).

Hatcheries primarily affect water quality by discharging treated wastewater from adult holding, spawning, incubation, and juvenile rearing activities to downstream receiving waters. Adult collection and juvenile release activities may also have temporary and minor impacts to water quality through disturbance of the streambed at collection or release sites.

Because large numbers of fish are concentrated within hatcheries, effluent with elevated water temperature, ammonia, organic nitrogen, total phosphorus, biochemical oxygen demand (BOD), pH, and solids levels is typically produced (WDE 1989; Kendra 1991; USEPA 2006a). Nutrients discharged to receiving waters from hatchery effluent may cause an increase in algal growth that may lead to increased fluctuations in dissolved oxygen and pH because of increased algal photosynthesis and respiration. Decay of senesced algae may also decrease dissolved oxygen concentrations in receiving waters.

Most recent water quality for receiving waters downstream from the existing hatcheries is from 2015 (Table 3-2). Temperature and total dissolved gas are common water quality impairments throughout all receiving waters in the Snake, Columbia, Hood, and Deschutes rivers. Dioxins are also an issue in the Columbia River.

All of the hatcheries used for the Columbia River programs (except for Parkdale Hatchery) are permitted to discharge treated wastewater to receiving waters under the United States Environmental Protection Agency (USEPA) general NPDES permit system (Table 3-2). The USEPA (2006b) summarizes past compliance with general permit limits. Most aquaculture facilities in Washington and Oregon complied with permit conditions.

Table 3-2. Current Hatchery Program Facility NPDES Permit and Receiving Water Attributes

Program	Facility	Permit No.	Receiving Waters	Impairment Listings
Touchet River Endemic Summer Steelhead	Lyons Ferry Hatchery	WAG137006	Snake River	Temperature, Habitat, Total Dissolved Gas
Umatilla River Summer Steelhead	Umatilla Hatchery	300 J[1]	Columbia River	Toxic Substances; Fecal Coliform; pH; Sedimentation; Temperature; Turbidity
Umatilla River Summer Steelhead	Umatilla Hatchery	300 J[1]	Columbia River	Dioxin (2,3,7,8-TCDD); Dioxin (2,3,7,8-TCDD); pH; Total Dissolved Gas
Round Butte Hatchery Summer Steelhead; Round Butte Hatchery Spring Chinook Salmon	Round Butte Hatchery	300 J[1]	Deschutes River	Dissolved Oxygen, pH, Temperature
Hood River Winter Steelhead; Hood River Spring Chinook Salmon	Parkdale Hatchery	Not required[2]	Middle Fork Hood River	Biological Criteria, Iron, Temperature
Hood River Winter Steelhead	Oak Springs Hatchery	300 J[1]	Deschutes River	Dissolved Oxygen, pH, Temperature

Source: WDFW (2015), ODFW and CTUIR (2017), ODFW and CTWSRO (2017), ODFW (2017, 2019), ODFW and CTWSRO (2017), CTWSRO and ODFW (2017)

[1] All hatcheries in Oregon operated by the Oregon Department of Fish and Wildlife operate under general permit 300 J

[2] NPDES permits are not required because the facility produces less than 20,000 pounds of fish per year or distributes less than 5,000 pounds of feed at any one time

3.3 Salmon and Steelhead

Adult and juvenile fish currently propagated at the six hatchery programs included in this EA have the potential to interact with salmon and steelhead in the natural environment. This subsection describes the affected environment for salmon and steelhead and how ongoing hatchery operations may potentially affect salmon and steelhead, including effects of fish ladders, weirs, traps, and surface water intakes.

NMFS has prepared two biological opinions (NMFS 2018b, 2018c) that consider the effects of five of the six hatchery programs included in the proposed action on ESA-listed salmon and steelhead. In each biological opinion, NMFS determined that the programs do not jeopardize listed species, nor result in destruction or adverse modification of their designated critical habitat. The biological opinions provide additional detail on the anticipated effects of the programs on ESA-listed salmon and steelhead, and are consistent with the pertinent portions of the analysis provided herein.

3.3.1 Study Area

Hatchery fish from Columbia River Basin hatchery programs may currently interact with salmon and steelhead during three different life phases: as smolts for those released from facilities; as juveniles rearing in streams for those released from facilities as fry; and as adults upon return. Therefore, the Study Area for salmon and steelhead includes all areas accessible to anadromous salmonids in the four subbasins of the Proposed Action: the Walla Walla River Subbasin including the Touchet River, the Umatilla River Subbasin, the Deschutes River Subbasin, and the Hood River Subbasin (Figure 1-1). It also includes the mainstem Columbia River downstream from the Walla Walla River to Bonneville Dam (Section 1.3, Description of the Proposed Action).

NMFS (2018b, 2018c) determined that the area affected directly and indirectly by the programs included in this EA extended downstream in the Columbia River only to Bonneville Dam. This is because Chinook

Salmon and steelhead move rapidly through the lower Columbia River to the estuary and ocean and have a low potential for interacting meaningfully with other salmonids downstream of Bonneville Dam. NMFS (2017a) found that subyearling Chinook Salmon and Coho Salmon (*O. kisutch*) are the most likely hatchery fish to have effects, and the programs included in this EA do not release any subyearling salmon.

Although fish for the Touchet River Endemic Summer Steelhead Program are reared at Lyons Ferry Hatchery on the Snake River, the Snake River is not included in the Study Area for salmon and steelhead. No adult fish are collected and no juvenile fish are released at Lyons Ferry Hatchery, and straying into the Snake River by returning adults from the programs included in this EA is minimal (Section 3.3.5.1, Genetics). NMFS (2018b, 2018c) did not include the Snake River in the area affected directly and indirectly by the programs included in this EA.

3.3.2 ESA-Listed Salmon and Steelhead Populations

The ESA-listed salmon and steelhead populations spawning in the Study Area are part of major population groups (MPGs) within the Middle Columbia River Steelhead DPS (79 FR 20802, April 14, 2014), Lower Columbia River Steelhead DPS (79 FR 20802, April 14, 2014), Lower Columbia River Chinook Salmon ESU (79 FR 20802, April 14, 2014), Lower Columbia River Salmon ESU (79 FR 20802, April 14, 2014), and Columbia River Chum Salmon ESU (79 FR 20802, April 14, 2014). Both natural-origin and hatchery-origin Columbia River steelhead and spring Chinook Salmon may occur in the Study Area, whereas Chum Salmon (*O. keta*) are of natural origin (NMFS 2016a):

- Middle Columbia River Steelhead DPS
    - Umatilla Walla Walla Rivers MPG
        - Includes the Touchet River Endemic Summer Steelhead Program
        - Includes the Umatilla River Summer Steelhead Program
    - Yakima River MPG
    - John Day River MPG
    - Cascades Eastern Slope Tributaries MPG
        - Includes the Round Butte Hatchery Summer Steelhead Program
- Lower Columbia River Steelhead DPS
    - Winter-run Gorge MPG
        - Includes the Hood River Winter Steelhead Program
    - Summer-run Gorge MPG
- Lower Columbia River Chinook Salmon ESU
    - Spring-run Gorge MPG
        - Does not include the Hood River Spring Chinook Salmon Program
    - Fall-run Gorge MPG
- Lower Columbia River Coho Salmon ESU
    - Gorge MPG
- Columbia River Chum Salmon ESU
    - Gorge MPG

ESA-listed salmon and steelhead from a number of ESUs and DPSs migrate through the Study Area in the Columbia River but spawn in subbasins further upstream. Upper Columbia River spring Chinook Salmon spawn from the Wenatchee River Subbasin upstream to the Okanogan River Subbasin. Snake River fall Chinook Salmon, Snake River spring/summer Chinook Salmon, Snake River steelhead, and Snake River Sockeye Salmon all migrate through the Study Area then into the Snake River Basin. Information regarding the status, limiting factors, and recovery goals for each of the ESA-listed salmon ESUs and steelhead DPSs described below was sourced from recovery plans that are incorporated herein by reference (Upper Columbia Salmon Recovery Board 2007 [Section 3, Factors for Decline]; NMFS 2009b [Section 6, Limiting Factors and Threats; Section 7, Recovery Strategy]; 2013 [Section 4, Regional Limiting Factors and Strategies; Section 5, Overall Approach to Species Recovery Analyses]; 2015 [Section 5, Threats and Limiting Factors; Section 6, Recovery Strategy]; 2017c [Section 5, Limiting Factors and threat Assessment; Section 6; Recovery Strategy, Site-Specific Management Actions, and Adaptive Management Framework]; 2017d [Section 5, Threats and Limiting Factors; Section 6, Recovery Strategy and Actions]).

3.3.3 Critical Habitat and Essential Fish Habitat

Critical habitat is designated in the Study Area, and NMFS provides critical habitat maps (NMFS 2019a) for:

- Upper Columbia River Spring Chinook Salmon ESU
- Snake River Spring/Summer Chinook Salmon ESU
- Snake River Fall Chinook Salmon ESU
- Lower Columbia River Chinook Salmon ESU
- Lower Columbia River Coho Salmon ESU
- Columbia River Chum Salmon ESU
- Snake River Sockeye Salmon ESU
- Upper Columbia River Steelhead DPS
- Snake River Steelhead DPS
- Middle Columbia River Steelhead DPS
- Lower Columbia River Steelhead DPS.

Within designated critical habitat, NMFS identifies physical and biological features such as freshwater spawning and rearing sites, as well as freshwater estuarine migration corridors. When conducting ESA consultations, NMFS must consider how limiting factors identified in recovery plans (Upper Columbia Salmon Recovery Board 2007; NMFS 2009b; 2013; 2015; 2017c; 2017d) inform analyses of the effects of proposed actions on critical habitat. Limiting factors are identified in the recovery plans and they form the basis for the current condition. The relevant sections of the recovery plans are incorporated herein by reference as noted in Section 3.3.2, ESA-Listed Salmon and Steelhead Populations.

Essential fish habitat (EFH), is defined under the Magnuson-Stevens Act as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Chinook Salmon and Coho Salmon have designated EFH throughout the Study Area (NMFS 2019b), and NMFS recognizes the need to consider EFH to minimize risks from hatchery water withdrawals, and genetic and ecological interactions of hatchery-origin fish with natural-origin fish (NMFS 2016b). NMFS (2018b; 2018c) provide an analysis of hatchery program effects on EFH in the Study Area.

3.3.4 Non-ESA-listed Salmon Populations

Similar to populations listed under the ESA, some non-listed populations spawn in and others migrate through the Study Area in the Columbia River. The Middle Columbia River Spring Chinook Salmon ESU includes both natural- and hatchery-origin populations spawning in the Klickitat River upstream to and including the Yakima River. Fish from this ESU are therefore present in the Deschutes, Umatilla, and Walla Walla River subbasins. Non-listed fall Chinook Salmon also occur in the Deschutes and Umatilla rivers. The Umatilla River also supports a run of hatchery- and natural-origin Coho Salmon existing since restoration activities were initiated in the 1980s.

Some non-listed salmon migrate through the Study Area in the Columbia River but spawn in subbasins further upstream. Upper Columbia River spring Chinook Salmon spawn from the Wenatchee River Subbasin upstream to the Okanogan River Subbasin. Okanogan River Sockeye Salmon (*O. nerka*) and Lake Wenatchee Sockeye Salmon migrate through the Study Area, as do unlisted Coho Salmon from a number of recent reintroduction efforts in the Columbia and Snake River basins.

3.3.5 Ongoing Effects of Hatchery Programs

Hatchery programs can affect natural-origin salmon and steelhead and their habitat in a variety of ways (Table 3-3). The extent of effects (adverse or beneficial) on salmon and steelhead and their habitat depends on the hatchery program design, habitat condition, and the status of the species, among other factors. The following subsections describe the past and ongoing impacts of the hatchery programs in this Project Area in detail. Impacts that would result from the proposed action are analyzed in section 4.

Table 3-3. General Effects of Hatchery Programs on Natural-origin Salmon and Steelhead Resources

Pathway	Potential Effects
Genetics	• Interbreeding with hatchery-origin fish can change the genetic character of the local populations. • Interbreeding with hatchery-origin fish may reduce the reproductive performance of local populations.
Masking	• Hatchery-origin fish can increase the difficulty in determining the status of natural-origin component of a salmon population.
Competition and Predation	• Hatchery-origin fish can increase competition for food and space. • Hatchery-origin fish can prey on natural-origin fish.
Prey Enhancement	• Hatchery-origin fish can increase the number of prey for natural-origin fish.
Disease	• Concentrating rearing salmon in a hatchery facility can lead to an increased risk of pathogens and outbreaks. When hatchery-origin fish are released from hatchery facilities, they may increase the disease risk to natural-origin salmon and steelhead through pathogen transmission.
Population Viability	• Abundance: Preserve, increase, or decrease the abundance of a natural-origin fish population • Spatial Structure: Preserve, expand, or reduce the spatial structure of a natural-origin fish population • Genetic Diversity: Retain or homogenize within-population genetic diversity of a natural-origin fish population • Productivity: Maintain, increase, or decrease the productivity of a natural-origin fish population
Nutrient Cycling	• Returning hatchery-origin adults can increase the amount of marine-derived nutrients in freshwater systems.

Pathway	Potential Effects

Facility Operations	• Hatchery facilities can reduce water quantity or quality in adjacent streams through water withdrawal and discharge.
	• Weirs for broodstock collection or to control the number of hatchery-origin fish on the spawning grounds can have the following unintentional consequences:
	  ○ Isolation of formerly connected populations
	  ○ Limiting or slowing movement of migrating fish species, which may enable poaching or increase predation or prespawn mortality
	  ○ Alteration of streamflow
	  ○ Alteration of streambed and riparian habitat
	  ○ Alteration of the distribution of spawning within a population
	  ○ Increased mortality or stress due to capture and handling
	  ○ Impingement of downstream migrating fish
	  ○ Forced downstream spawning by fish that do not pass through the weir
	• Increased straying due to either trapping adults that were not intending to spawn above the weir, or displacing adults into other tributaries

RM&E	• Surveying and sampling to assess program objectives and goals may increase the risk of injury and mortality to salmon that are the focus of the actions, or that may be incidentally encountered. • RM&E will also provide information on the status of the natural population.

3.3.5.1 Genetics

Ongoing hatchery operations currently affect the genetic character of salmon and steelhead populations in the Study Area. Genetic effects may depend on the type of hatchery program being operated. Hatchery programs included in this EA are both integrated and segregated. Segregated programs use only hatchery-origin fish for broodstock, which may result in greater domestication compared to integrated programs that use natural-origin broodstock to maintain genetic similarities with wild fish; therefore, a potential for negative effects exists if hatchery fish from segregated programs interbreed with natural fish on spawning grounds. Integrated programs are designed to supplement natural populations by using natural-origin broodstock to increase production for supplementation or harvest. NMFS considers genetic effects of hatchery programs that may alter the genetic character or reproductive performance of local populations. Descriptions of these effects and the actions to minimize these effects can be found in the biological opinions prepared for each of the hatchery programs included in this EA (Citations to be included upon completion of the biological opinions).

Typical metrics used to describe the genetic risks of hatchery-origin spawners on the natural population are called proportionate natural influence (PNI) and the pHOS. Assessment of outbreeding effects and hatchery-influenced selection occurs simultaneously using pHOS/PNI metrics. A low PNI value indicates that hatchery fish and the hatchery environment were having a greater influence (i.e., hatchery influence selection) on the naturally-spawning population than the natural environment. A PNI exceeding 0.5 indicates that natural selection outweighs hatchery-influenced selection (i.e., the use of natural-origin broodstock contributes to higher PNI). In other words, the use of more natural-origin broodstock equates to less genetic effects on natural-origin populations. The Hatchery Scientific Review Group (HSRG) developed guidelines for allowable pHOS population levels, scaled by the population's conservation importance. HSRG recommends a maximum of 5 percent in primary populations, 10 percent for contributing populations, and "at a level required" to maintain sustaining populations (HSRG 2014). NMFS has not adopted the HSRG guidelines per se; however, as the only acknowledged quantitative standards available, NMFS considers them a useful screening tool. While NMFS evaluates each hatchery program, if a program meets HSRG standards, NMFS typically considers the risk levels acceptable. Listed salmonid populations in the Study Area are classified by recovery expectation (ICTRT 2007a) rather than by the HSRG classification scheme, but viable and highly viable equate to primary and maintain equates to contributing and sustaining. Highly viable populations are those with less than 1 percent risk of

extinction over 100 years, viable populations are those with negligible (less than 5 percent) risk of extinction over 100 years, and maintained populations are those with less than 25 percent risk of extinction over 100 years (McElhany et al. 2000; NWFSC 2015).

The six existing hatchery programs included in this EA currently support artificial production of two salmonid species: spring Chinook Salmon and summer and winter steelhead. Because no Coho, fall Chinook or Sockeye Salmon are produced under any of these hatchery programs, they are not genetically affected through interbreeding. Therefore, only individuals from the Lower Columbia River Chinook ESU (ESA-threatened), Middle Columbia River Spring Chinook Salmon ESU (not listed), Lower Columbia River Steelhead DPS (ESA-threatened), and Middle Columbia River Steelhead DPS (ESA-threatened) have been subject to genetic effects from the hatchery programs covered in this EA. Though unlikely, strays from the Snake River Steelhead DPS may be subject to genetic effects; however, the impact from these programs is not measurable.

Spring Chinook Salmon Programs

Existing Spring Chinook Salmon hatchery programs have influenced the current genetic condition of salmon in the Study Area. Natural-origin salmon genetics have been affected by hatchery fish from the two spring Chinook Salmon hatchery programs presented in this section. Salmon and steelhead do not interbreed, so there is no genetic risk between spring Chinook Salmon and Middle Columbia River steelhead.

Round Butte Spring Chinook Salmon (segregated)

The Round Butte Spring Chinook Salmon Program currently uses non-listed fish for broodstock and releases fish into the domain of the unlisted Middle Columbia Spring Chinook Salmon ESU. Hatchery spring Chinook Salmon from the segregated Round Butte program have had the greatest hatchery-influenced selection over natural-origin Middle Columbia River spring Chinook Salmon in the Deschutes River Subbasin because of overlap in time and space. Because the Middle Columbia River Spring Chinook Salmon ESU is not ESA-listed, NMFS has not analyzed genetic effects of Round Butte spring Chinook Salmon hatchery fish on natural Middle Columbia River Chinook Salmon. Middle Columbia River spring Chinook Salmon populations generally exhibit limited hatchery influences, typically with less than 10 percent of hatchery-origin fish spawning naturally (NMFS 2014).

Although spring Chinook Salmon are not ESA-listed in the Middle Columbia River, they have the potential to stray into other listed Chinook Salmon ESUs (Lower Columbia River, Snake River, Upper Columbia River) or ESUs containing non-listed Upper Columbia River summer Chinook Salmon. Currently, PIT-tag and CWT data for the Round Butte Spring Chinook Salmon Program suggest that straying into listed areas is a relatively rare occurrence; an average of less than or equal to one fish per year for all terminal areas where fish were detected at either a hatchery or on spawning grounds (NMFS 2018b). This number is unlikely to have had a detectable effect on the listed populations where spring Chinook Salmon from the Round Butte Program have been recovered/detected. Relative to straying, although there is some geographic overlap of the Middle Columbia River Spring Chinook Salmon and unlisted Upper Columbia River Summer Chinook Salmon ESUs, the temporal differences in spawn timing has likely limited the potential that Round Butte spring Chinook Salmon have spawned with, and genetically affected, unlisted Upper Columbia River summer Chinook Salmon.

Hood River Spring Chinook Salmon (Integrated)

The Hood River Spring Chinook Salmon Program is a reintroduction program that uses natural- and hatchery-origin broodstock with a long-term goal of achieving 100 percent of broodstock needs using natural-origin spring Chinook Salmon returning to the subbasin. Since 2013, the program has been

successful in collecting enough hatchery- and natural-origin adults returning to the Hood River that additional production from the Deschutes River is not required. By using spring Chinook Salmon adults that have been reared, released, and returned to the Hood River Subbasin along with incorporating natural-origin adults in the broodstock, the resulting population of spring Chinook Salmon is expected to be more locally-adapted to the Hood River than the founding stock of Deschutes River spring Chinook Salmon. Because this is a reintroduction program, pHOS is not used to manage the program.

Currently, spring Chinook Salmon released from the Hood River program demonstrate low stray rates. Since return year 2013, PIT-tagging data indicates less than 1 percent of the PIT-tagged fish detected at Bonneville Dam stray into other areas (NMFS 2018c). Overall, the straying of Hood River Hatchery spring Chinook Salmon has not previously resulted in any measurable effect on ESA-listed populations under current hatchery operations.

Steelhead Programs

The Touchet River Endemic Summer Steelhead, Umatilla River Summer Steelhead, and Hood River Winter Steelhead programs are integrated, and the Deschutes (Round Butte Hatchery) Summer Steelhead Program is currently segregated (Table 1-2). Hatchery programs pose both genetic and ecological risks, which are reduced by integrated programs designed to supplement natural populations. Hatchery steelhead from all of these programs appear to exhibit low to no straying. Because the majority of the steelhead hatchery programs included in this EA have been ongoing for quite some time, and the effects of any hatchery-origin fish spawning naturally are likely reflected to some degree in the status review data for each population, NMFS (2018b) previously concluded that the low incidences of hatchery steelhead strays do not prohibit steelhead population recovery.

Touchet River Endemic Summer Steelhead

The Touchet River Endemic Summer Steelhead Program is integrated using natural-origin broodstock sourced from local populations. In the current Middle Columbia River Steelhead DPS recovery scenario, this population is not targeted for viability or high viability, but for maintained status. NMFS believes a PNI of 0.5 calculated as a 5-year running average is adequate for maintaining the population, and a PNI of < 0.5 is acceptable when natural-origin abundance is low (i.e., < 250 fish), to have enough fish to spawn regardless of fish origin. Data from 2011 to 2015 indicates PNI has ranged from 0.28 to 0.61, with an average of 0.49 based on the multi-population model tool analysis developed by Busack (2015). This indicates the ongoing program has nearly met the PNI goal of >0.5. A PNI of > 0.5 indicates that natural selection outweighs hatchery-influenced selection (HSRG 2014).

For the Touchet River Endemic Summer Steelhead Program, PIT-tag detections were highest in the Tucannon River (about four fish per year on average) and less than one per year in other areas where Touchet River fish were detected. This demonstrates very low straying of fish from this program. An exception to this is elevated straying of Touchet River fish into the Tucannon River (NMFS 2018b). However, natural-origin fish from the Touchet River appear to have a similar behavior, and stray into the Tucannon River at a similar rate (NMFS 2018b).

Umatilla River Summer Steelhead

The Umatilla River Summer Steelhead Program is integrated using natural-origin adults in the broodstock sourced from the local populations. The Umatilla program is targeted for viable status in the current recovery scenario, with a PNI goal of >0.67. As a viable program, Umatilla summer steelhead contribute to recovery of the Middle Columbia River Steelhead DPS and demographic concerns outweigh genetic risks from hatchery fish for this population. Data from 2011 to 2015 indicates that PNI ranged from 0.73 to 0.94, with an average of 0.844 (NMFS 2018b). Considering these recent PNI estimates, natural

selection outweighs hatchery-influenced selection for this program, and the potential for negative genetic effects on naturally spawning fish is low. Over 10 years of CWT recoveries, only an estimated seven fish were detected in terminal areas, which demonstrates a history of low straying of fish from this program.

Round Butte Summer Steelhead

The number of Round Butte Hatchery origin summer steelhead on natural spawning grounds is estimated to average 20 percent based on the number of RBH steelhead above Sherars Falls less those harvested and removed at in-basin traps. (ODFW 2019). The final destination for these “missing” Round Butte Hatchery origin fish is unknown, and it further unknown if Round Butte Hatchery steelhead spawn in the mainstem Deschutes River. Limited redd counts suggest that even if only “missing” Round Butte Hatchery steelhead spawned there, redd counts leave substantial numbers of fish unaccounted for. Atlhough the effect of this number of unaccounted steelhead on the wild population is unknown at this time, the potential for deleterious genetic effects may be present even though the Round Butte Hatchery stock originated from the wild stock.

Stray out-of-basin hatchery steelhead are observed in relatively large numbers each year at Sherars Falls, the Pelton Trap, and the Warm Springs National Fish Hatchery trap. Although the amount of genetic interchange between stray wild and lower Deschutes River origin wild summer steelhead is unknown, strays are believed to pose substantial adverse genetic implications for native Deschutes River steelhead (ODFW 2019).

Hood River Winter Steelhead

The Hood River Winter Steelhead Program is integrated using natural-origin adults for broodstock. In the current recovery scenario, this population is targeted as viable and has a PNI goal of > 0.67. PNI estimated for the Hood River Winter Steelhead Program has been variable over recent years and ranged from 0.32 to 0.93 (NMFS 2018c). The recent average for PNI is 0.64 which is close to the PNI goal, and indicates that genetic selection within the overall winter steelhead population has been driven by the natural environment as opposed to the hatchery environment.

PNI can be controlled by two factors: the pNOB and pHOS. If returns of natural-origin adults encountered at the weirs are sufficient to meet the broodstock goal of 50 adults then PNI can be achieved because pNOB would be at or near 100 percent. pHOS is difficult to control because not all of the returning hatchery winter steelhead are encountered at the weirs, primarily due to high flow events that make the weirs inoperable, or fish spawning below the weir. In most years, operators have not been able to collect all of the hatchery adults and thus pHOS has been high, averaging 0.52 from 2010 through 2016 (NMFS 2018c). Therefore, the winter steelhead program has posed a risk to the natural-origin population due to high pHOS levels.

Few winter steelhead released under this program have been identified as straying outside the Hood River. Since 2013, out of the 714 PIT-tagged steelhead detected crossing Bonneville Dam, only 2 (0.3 percent) were recovered as strays (NMFS 2018c). Overall, the very low incidence of straying in Hood River Hatchery winter steelhead indicates that the hatchery program has had no decernable affects other ESA-listed steelhead populations.

3.3.5.2 Masking

Masking occurs when unmarked hatchery-origin salmon and/or their offspring are included in population estimates (e.g., abundance, productivity) of natural-origin fish because hatchery-origin salmon cannot be distinguished from the natural-origin fish. Inclusion of hatchery-origin fish results in an overestimation of the count of natural-origin fish. To minimize masking effects, hatchery-origin fish are often marked (e.g.,

adipose fin clips, PIT tags, CWT). This allows hatchery-origin fish to be distinguished from natural-origin fish. Masking may have occurred in the past before hatchery programs began fully marking hatchery releases. Presently the risk of masking has been supstantially redeuce because all of the hatchery programs either externally mark or provide some other method (CWT without and adipose fin-clip) to identify hatchery produced fish. The full marking of all of the production eliminates the potential for masking effects and thus will not be considered further in this EA.

3.3.5.3 Competition and Predation

Under current operations, ecological interactions between natural- and hatchery-origin fish may occur during the adult and juvenile life-history stages. Hatchery smolts released into habitats where natural-origin juvenile salmon and steelhead rear may compete with or prey on natural-origin fish. Hatchery-origin adults may also compete with natural-origin salmon and steelhead for spawning sites and resources. The incidence of competition or predation between natural- and hatchery-origin fish under past and current operations has been influenced by a variety of factors including size of predators and prey, spatial and temporal overlap, and the number of fish released at any time.

Interactions between Hatchery-Origin Juveniles and Natural-Origin Juveniles

In the Study Area, hatchery spring Chinook Salmon and steelhead smolts are released in April or May, and outmigrate soon thereafter. During these release periods, some natural-origin salmon and steelhead juveniles are lost to competition and predation from hatchery-origin juveniles, particularly when there is overlap in time and space (NMFS 2018b; 2018c).

Predation on some species by hatchery-origin smolts is less likely than competition because of fish size. Some reports suggest that hatchery-origin fish can prey on fish one-half their length (Pearsons and Fritts 1999; HSRG 2004), but other studies concluded hatchery-origin predators prefer fish one-third or less their length (Hillman and Mullan 1989; Beauchamp 1990; Cannamela 1992). Thus, past predation by spring Chinook Salmon hatchery smolts was limited to fish less than 2.8 inches, because mean length of hatchery steelhead at release is usually less than 8.3 inches, and mean size of hatchery spring Chinook Salmon at release is even smaller, usually less than 6.7 inches (NMFS 2018b, 2018c). The average size of most natural-origin fish encountered by juvenile hatchery fish limits the effects of predation (NMFS 2018b).

NMFS (2018b, 2018c) used a risk model developed by Pearsons and Busack (2012) to evaluate predation and competition interactions between natural-origin and hatchery fish. The model is used to estimate natural-origin salmon and steelhead predation by and direct (contest) competition with released hatchery fish between the point of release and mouth of the Columbia River. Although this model provides some quantitative estimates of ecological interactions, the estimates are derived from parameters based on best available qualitative judgment. Therefore, the most appropriate way to think of these estimates is as a relative measure of the species most likely to be adversely affected by the release of hatchery fish from the programs.

Past hatchery releases are unlikely to have affected young of the year steelhead. Steelhead spawn from March to June with a peak from April to May in the Study Area (Busby et al. 1996). Thus, it is unlikely that any young of the year steelhead would have emerged in time to interact with hatchery spring Chinook Salmon or steelhead smolts during their spring migration downstream.

NMFS (2018b; 2018c), based on past program releases, estimated a maximum of 24 natural-origin Chinook Salmon adult equivalents are lost annually during the juvenile life stage from competition with and predation by juveniles from hatchery programs included in this EA. Twenty of the 24 losses would accrue to ESA-listed populations, with 16 of those being experienced by the Lower Columbia River

Chinook Salmon ESU. The estimated effect on each listed ESU is less than 0.1 percent of natural-origin adult returns to the Columbia River Basin (NMFS 2018b; 2018c).

NMFS (2018b, 2018c), based on past program releases, estimated a maximum of 84 natural-origin steelhead adult equivalents are lost annually during the juvenile life stage from competition with and predation by juveniles from hatchery programs included in this EA. Of the 84 adult losses, the Middle Columbia River Steelhead DPS (40 adult equivalents) and the Lower Columbia River Steelhead DPS (28 adult equivalents) are affected the most; however, these losses represent about 0.2 percent of the natural-origin adult returns to the Columbia River (NMFS 2018b, 2018c).

NMFS (2018b; 2018c), based on past program releases, estimated a maximum of 22 natural-origin Coho Salmon adult equivalents are lost annually during the juvenile life stage from competition with and predation by juveniles from hatchery programs included in this EA. Almost all of the competition and predation effects on Coho Salmon would accrue to the Lower Columbia River Coho Salmon ESU. The greatest likelihood of effects of interactions with fish released from the proposed programs would occur within the Hood River Subbasin where these ESA-listed fish and hatchery fish are both present; however, the loss within the Hood River Subbasin is the equivalent of only three adults (NMFS 2018c). The assumed potential loss of three adults may have been an adverse impact on the Hood River population because its current estimated population is low. The remaining potential losses do not equate to a meaningful reduction in Coho Salmon returning to the Columbia River Basin.

NMFS (2018b; 2018c), based on past program releases, estimated a maximum of nine natural-origin Sockeye Salmon adult equivalents are lost annually during the juvenile life stage from competition with and predation by juveniles from hatchery programs included in this EA. Most of the competition and predation effects on Sockeye Salmon comprise unlisted fish from the Upper Columbia River, with only about 2 percent of the effects to the ESA-listed Snake River Sockeye Salmon ESU (NMFS 2018c). If all impacts were assigned to the Snake River Sockeye Salmon ESU, losses would represent about 0.5 percent of the average annual return to the Columbia River Basin (NMFS 2018b).

NMFS (2018b, 2018c), based on past program releases, estimated a maximum of three natural-origin Chum Salmon adult equivalents are lost annually during the juvenile life stage from competition with and predation by juveniles from hatchery programs included in this EA. The impacts would be distributed among major populations of the Columbia River Chum Salmon ESU in the Columbia River below Bonneville Dam. The loss of three adults represents less than 0.001 percent of the average annual return to the Columbia River.

Residualism of Hatchery-Origin Juveniles

A proportion of the smolts released from a hatchery may not migrate to the ocean but rather reside for some time near the release point. These non-migratory smolts (residuals) may directly compete for food and space with natural-origin juvenile salmonids of similar age. They also may prey on younger, smaller-sized juvenile salmonids. Although this behavior has been studied and observed most frequently in the case of hatchery steelhead, residualism has been reported as a potential issue for hatchery Chinook Salmon as well. Johnson et al. (2012) and Temple et al. (2012) found very low rates of residualism (less than 0.1 percent) for hatchery spring Chinook Salmon in the Yakima River. Assuming, therefore, that residualism rates would be similar for hatchery programs included in this EA, few hatchery-origin spring Chinook Salmon would be expected to residualize. On-going competitive interactions between hatchery residuals and natural-origin fish have therefore likely been minimal.

Monitoring has indicated that residualism by hatchery winter steelhead juveniles may affect the production of natural-origin steelhead in the Hood River. Simpson et al. (2017) found that residual hatchery-reared steelhead (less than 141mm in length) might limit the production of natural-origin age-2

smolts the following year. However, evidence indicates that even though 3 to 4 percent of the hatchery releases may residualize (Simpson et al. 2017), this rate is less than observed for natural-origin juveniles and is representative of the life histories expressed by the natural-origin population. Residual hatchery steelhead are not currently expected to adversely affect the natural-origin population.

The hatchery programs in this EA currently implement a number of actions to reduce the potential for hatchery salmon and steelhead from residualizing including:

- releasing hatchery smolts that are physiologically ready to migrate
- rearing hatchery fish to sufficient size that smoltification occurs in nearly the entire population
- releasing hatchery smolts below areas used by natural-origin juveniles
- monitoring the incidence of non-migratory smolts (residuals) after release and adjusting rearing strategies, release location and timing if substantial competition with naturally rearing juveniles is determined likely

Interactions with Naturally-Produced Progeny

Naturally spawning spring Chinook Salmon and steelhead originating from the hatchery programs included in this EA are likely to be less efficient at reproduction than their natural-origin counterparts (Christie et al. 2014), but the progeny of these natural spawners are likely to compose a sizable portion of the juvenile fish population. If rearing habitat is limited, the added abundance of hatchery progeny may result in a density-dependent response by natural-origin juveniles of decreasing growth or survival, earlier migration due to high densities, and potential exceedance of habitat capacity. Because spring Chinook Salmon historically coexisted with steelhead in substantial numbers, with adequate passage and habitat, current densities are likely not limiting natural-origin salmon and steelhead production (NMFS 2018b).

Interactions between Hatchery-Origin Adults and Natural-Origin Adults

Negative interactions between hatchery spring Chinook Salmon on other salmonids in the Study Area have been minimal due to differences in run-timing, holding, spawn timing, and spawning habitat preferences. Competition between adult hatchery spring Chinook Salmon and ESA-listed natural-origin salmon in the Hood River Subbasin has likely been minimal due to the habitat not being fully seeded (NMFS 2018c). Because of the temporal differences in run and spawn timing, competition with listed steelhead for spawning sites is unlikely to occur. Likewise, steelhead egg incubation is largely complete by the end of June, well before spring Chinook Salmon spawn and could potentially superimpose steelhead redds (NMFS 2009a).

Because of similar run, holding, and spawn timing, hatchery steelhead that spawn naturally have an increased likelihood of competing and superimposing redds of natural-origin steelhead. The degree to which this occurs is informed by pHOS and straying levels. The pHOS for the Touchet Endemic and Umatilla steelhead programs has been less than 30 percent in recent years and out-of-basin straying has been low (NMFS 2018b). The effect of competition in the Hood River Subbasin has likely been minimal because natural-origin steelhead tend to migrate farther upstream whereas hatchery steelhead concentrate near the points of release, thus limiting their interactions (NMFS 2018c). Program goals in the, Touchet River, Umatilla River, and the Hood River Subbasin included natural spawning by some hatchery adults to increase the abundance of, and genetic integration with, the naturally spawning populations. In the Deschutes River the proportion of the mainstem spawners that consist of RB hatchery steelhead unknown, thus competitive interactions on the spawning grounds would be expected to occur. Overall impacts on the natural populations in the Deschutes River are reduced because very few RB hatchery steelhead have been observed in natural spawning ares within the tributaries to the main stem Deschutes River. Impacts on other salmonids by hatchery-origin steelhead have been minimal due to

differences in run timing, holding, spawn timing, spawning habitat preferences, and overall low abundance in some subbasins.

3.3.5.4 Prey Enhancement

Upon release into the natural environment, hatchery-origin juveniles may become prey for natural-origin salmon and steelhead and provide an additional food source. On average, about 683,000 hatchery-origin juvenile spring Chinook Salmon and summer steelhead have been released annually since 1991 into the Columbia River from hatchery programs included in this EA (Table 3-4). Any resident adult fish can prey on hatchery-origin juveniles. Similarly, larger natural-origin juvenile fish can prey on hatchery-origin juveniles. Though the occurrence of predation by some species on hatchery-origin juveniles has likely been low because of fish size (Section 3.3.5.3, Competition and Predation), prey enhancement can occur for any fish species larger than the hatchery-origin juveniles (e.g., fish that residualize).

Table 3-4. Approximate Average Juvenile Releases from Spring Chinook Salmon, Summer Steelhead, and Winter Steelhead Programs Included in this EA

Program	Release Site	Release Years	Average Juvenile Releases[1]
Touchet River Endemic Summer Steelhead	North Fork Touchet River	2000 to 2013	50,070
Umatilla River Summer Steelhead	Bonifer	1998 to 2003	45,264
	Meacham Creek	2004 to 2008	44,131
	Minthorn	1998 to 2008	43,902
	Pendleton	2002 to 2008	41,814
	Umatilla RM 48	2006	43,054
	Thornhollow	2005	50,723
	Umatilla RM 28	1999	9,878
Round Butte Hatchery Summer Steelhead	Deschutes RM 100	1991 to 2012	148,254
Round Butte Hatchery Spring Chinook Salmon	Deschutes RM 100	1986 to 2006	292,022
Hood River Winter Steelhead	East and Middle Forks Hood River	1994 to 2014	53,861
Hood River Spring Chinook Salmon	West Fork Hood River and Rogers Creek	1994 to 2012	129,815

Sources: WDFW (2015); ODFW and CTUIR (2017); ODFW and CTWSRO (2017); ODFW (2017, 2019); CTWSRO and ODFW (2017)

[1] Historical release numbers may vary from those under the Proposed Action, but are representative of conditions expected under Alternatives 1 and 2 of this EA

3.3.5.5 Diseases

Ongoing hatchery programs may introduce exotic pathogens into the natural environment. When a hatchery fish is infected in a hatchery facility, the pathogen can be amplified in the water column and among the other fish because hatchery fish are reared at higher densities and closer proximity than in the natural environment. Transmission of pathogens between infected hatchery fish and natural fish can occur indirectly through hatchery water effluent or directly if infected hatchery fish contact natural-origin fish after the hatchery fish are released into the natural environment.

Major diseases identified in salmonids from the Columbia River Basin include Bacterial Kidney Disease (BKD) and Infectious Hematopoietic Necrosis (IHN), both of which are caused by pathogens endemic to the basin (bacterium *Renibacterium salmoninarum* and *infectious hematopoietic necrosis virus* (IHNV), respectively). IHNV has no known treatment.

To minimize the potential for disease transmission within and outside of each facility, hatchery operators have closely monitored for disease during all aspects of the production programs until fish are released. Adherence to a number of state, federal, and tribal fish health policies limits the disease risks associated with hatchery programs (ODFW 2003; USFWS 2004; NWIFC and WDFW 2006). These policies govern the transfer of fish, eggs, carcasses, and water to prevent the spread of exotic and endemic reportable pathogens. For all pathogens, both reportable and non-reportable, pathogen spread and amplification have been minimized through regular monitoring, removing mortalities, and disinfecting all eggs. Vaccines may provide additional protection from certain pathogens when available. All of these actions have been implemented to prevent amplification and transmission of infectious diseases in the naturally spawning populations.

Several pathogens endemic to the Columbia River Basin have been detected at facilities used by the programs included in this EA. IHNV has been detected in Touchet River endemic summer steelhead females during virology screening of collected eggs. Because of past catastrophic losses of fish at Lyons Ferry Hatchery, female progeny testing positive for IHNV were reared in isolation and released into the Touchet River as fry rather than smolts. These protocols were followed in 2005, 2006, 2008, and 2009 (WDFW 2015).

Numerous diseases or pathogenic organisms have been detected in Umatilla River summer steelhead adults spawned at the Minthorn facility and in juveniles reared at Umatilla Hatchery (ODFW and CTUIR 2017). Diseases or pathogens detected included IHNV, *Aeromonas* (furunculosis), *Flavobacterium psychrophilum* (bacterial coldwater disease), *Gyrodactylus (*salmon fluke*)*, gill copepods, coagulated yolk disease, external and internal fungi, and *Ceratomyxa shasta.* Although pathogens were detected, in many cases no disease outbreak or fish loss resulted.

Juvenile fish have rarely been treated for external parasites at Round Butte Hatchery because of the low incidence of external parasites in the hatchery supply water. Fish being reared for Hood River programs have been examined annually for *Myxobolus cerebralis*, agent of whirling disease.

3.3.5.6 Population Viability

Salmon and steelhead population viability is determined through a combination of four parameters including abundance, productivity, spatial structure, and genetic diversity. As part of status reviews and recovery planning for threatened and endangered populations, NMFS defines population performance measures for these key parameters and then estimates the effects of hatchery programs at the population scale on the survival and recovery of an entire ESU or DPS. NMFS established population viability criteria for four federally-threatened ESUs or DPSs potentially affected by hatchery fish from programs covered in this EA: Lower Columbia River Chinook Salmon ESU, Lower Columbia River Steelhead DPS, Middle Columbia River Steelhead DPS, and Snake River Steelhead DPS. Appendix A presents a detailed summary of population viability trends for these Chinook Salmon ESUs and steelhead DPSs, including estimates of abundance, productivity, spatial structure, and genetic diversity for all MPGs.

The Middle Columbia River Spring Chinook Salmon ESU is not ESA-listed; therefore, NMFS has not developed population viability criteria. Regardless, mean adjusted productivity for the Middle Columbia River Chinook Salmon ESU has likely minimally increased because of ongoing hatchery programs.

Chinook Salmon ESUs

By using spring Chinook Salmon adults that have been reared, released, and returned to the Hood River Subbasin along with incorporating natural-origin adults in the broodstock, the resulting population of spring Chinook Salmon is more locally-adapted to the Hood River than the founding stock of Deschutes River spring Chinook Salmon. Population adaptation is expected to maximize genetic fitness to the habitat within the Hood River Subbasin helping the population become self-sustaining and viable, which would support recovery of the Lower Columbia River Chinook Salmon ESU.

The Round Butte Chinook Salmon Program has released hatchery fish into the domain of the non-listed Middle Columbia River Spring Chinook Salmon ESU. NMFS has not established population viability for non-listed populations. Regardless, Middle Columbia River Chinook Salmon populations generally exhibit limited hatchery influences, typically with less than 10 percent of hatchery-origin fish spawning naturally (NMFS 2014).

Steelhead DPSs

The effects of hatchery programs on the status of a steelhead DPS “will depend on which of the four key attributes are currently limiting the ESU, and how the hatchery fish within the ESU affect each of the attributes” (70 FR 37215, June 28, 2005). Although hatchery production for programs in this EA affect each of the four population viability parameters in different ways, overall, hatchery programs have had a minimal, negative effect on natural-origin fish from the Lower Columbia River Steelhead DPS, Middle Columbia River Steelhead DPS, and possibly the Snake River Steelhead DPS (NMFS 2018b; 2018c). Despite potential positive contributions to abundance and productivity, hatchery fish, even from integrated programs, may have negative effects on genetic diversity.

Other Salmonid ESUs

Hatchery production has had little effect on population viability for natural-origin individuals from other ESA-listed populations that may occur in the Study Area including the Lower Columbia River Coho Salmon, Columbia River Chum Salmon, Upper Columbia River Spring Chinook Salmon, and Snake River Salmon ESUs (Snake River fall Chinook Salmon, Snake River spring/summer Chinook Salmon, Snake River Sockeye Salmon), because there is limited potential for these stocks to breed with fish from subject hatchery programs. Fish from the programs included in this EA have had limited effect on productivity, abundance, diversity, or spatial structure of other ESA-listed populations as described in previous sections.

3.3.5.7 Nutrient Cycling

Salmon are important transporters of marine-derived nutrients into the freshwater and terrestrial systems through the decomposition of adult carcasses (Cederholm et al. 2000). Naturally spawning hatchery-origin fish, or carcass placement of hatchery fish, contribute to increased nutrient cycling in the natural environment.

The input of marine-derived nutrients, such as phosphorus and nitrogen, into streams is thought to enhance productivity of many nutrient-poor coastal streams and riparian vegetation communities (NMFS 2014). Phosphorous is one example of a marine-derived nutrient added to natural systems from salmonid carcasses. Estimating the quantity of phosphorous added to the natural environment from hatchery programs is one method to estimate nutrient transport. Increased phosphorus can benefit salmonids because phosphorus is typically a limiting nutrient for the growth of prey sources (e.g., *Daphnia* spp., a prey item for juvenile salmonids).

Hatchery-origin fish and eggs from the six hatchery programs included in this EA have added an unknown amount of phosphorus annually into the environment, in addition to what is typically added to the system by natural-origin fish. The amount of phosphorous is difficult to estimate accurately because hatchery-origin returns are subjected to removal from harvest, broodstock collection, and gene flow management. Regardless, hatchery-origin fish increase phosphorous concentrations, which has likely compensated for some marine-derived nutrients lost from declining numbers of natural-origin fish.

3.3.5.8 Facility Operations

Water quantity and water quality are assessed as separate resources in Sections 3.1, Water Quantity, and 3.2, Water Quality. Therefore, the discussion of current facility operations in this subsection is limited to operation of weirs and traps for adult collection, water diversions, intake structures, and facility maintenance activities relative to their direct impacts on salmon and steelhead. The facilities (or related activities) that may currently affect salmon and steelhead include:

- Dayton Adult Trap and Acclimation Pond
- Three Mile Falls Dam Collection Facility
- Minthorn Springs Acclimation Facility
- Pendleton Acclimation Facility
- Thornhollow Acclimation Facility
- Pelton Trap
- East Fork Weir and Trap
- Parkdale Hatchery
- East Fork Irrigation Acclimation Site
- Moving Falls Fish Facility

No surface water is diverted, no adults are collected at, and no juveniles are released from Lyons Ferry Hatchery, Umatilla Hatchery, or Oak Springs Hatchery. Similarly, no adults are collected at nor juveniles released from Round Butte Hatchery. The hatchery is located in non-anadromous waters and solely operates on seepage water through Round Butte Dam. Operation of these facilities therefore has not affected salmon or steelhead habitat use or decreased availability of water in rearing or spawning areas. Operation of these facilities has had no effect on salmon and steelhead in the Study Area, and they are not discussed further in this subsection. Although water for Parkdale Hatchery is withdrawn upstream from a fish passage barrier, the hatchery itself is located where operations may have affected salmon or steelhead. Operations at Parkdale Hatchery are further discussed below.

Adult Collection

The operation of adult collection facilities, particularly seasonal, channel-spanning weirs, may have delayed salmon and steelhead migration and lead to changes in spawning distribution. Operational guidelines and monitoring has minimized delays to and impacts on fish. Traps have been checked daily during peak migration periods at all collection facilities.

As presented in Chapter 2, Description of Alternatives, adult steelhead and spring Chinook Salmon have been collected for broodstock at the Dayton Adult Trap, Three Mile Falls Dam, Pelton Trap, East Fork Weir and Trap, East Fork Irrigation District, and Moving Falls Fish Facility. Natural-origin adults have been collected for broodstock as part of integrated program components but can also be encountered at traps collecting broodstock for segregated programs (Table 3-5). Such encounters may have delayed migration

and caused stress or mortality during sorting, holding, and handling. Collected non-target species have been typically returned upstream of collection sites on the day of capture. Mortality of incidentally collected species has been low, ranging from near zero to a maximum of 3 percent (NMFS 2018b, 2018c).

Table 3-5. Average Annual Number[1] of Natural-origin Steelhead and Salmon Trapped during Broodstock Collection for Programs included in this EA

Facility	Collection Period	Steelhead	Spring Chinook Salmon	Fall Chinook Salmon	Coho Salmon
Dayton Adult Trap	March-April	164	--	--	--
Three Mile Falls Dam	September-April	1,500	--	--	--
Pelton Trap	Year-round	77	--	1,065	--
East Fork Weir and Trap	February-June	129	12	0	0
East Fork Irrigation District	February-June	29	0	0	0
Moving Falls Fish Facility	May-August	34	750[2]	50[2]	25[2]

Sources: WDFW (2015); CTWSRO and ODFW (2017); ODFW and CTWSRO (2017); NMFS (2018b, 2018c); ODFW (2019)
[1]Most recent 5-year average when available unless otherwise indicated
[2]Maximum expected rather than 5-year average

Intake Screening

Each facility with intakes, pumps, or screens has the potential to impact salmon and steelhead via impingement or entrainment during water intake. Facilities have been routinely observed for any signs that screens are not effectively excluding fish from intakes. All intake facilities were designed to meet current NMFS screening criteria (NMFS 2011a).

Facility Maintenance Activities

HGMPs referenced in Section 1.3, Description of the Proposed Action, were prepared for each hatchery program and describe facility-specific maintenance activities that occur at each location, which are incorporated herein by reference (WDFW 2015; CTWSRO and ODFW 2017; ODFW 2017, 2019; ODFW and CTUIR 2017; ODFW and CTWSRO 2017). Routine preventative maintenance of hatchery facility structures is necessary for proper functionality.

For most facilities in anadromous waters, hatchery-related infrastructure (e.g., weirs and water source intakes) is located within salmon and steelhead migration and/or spawning habitat. Therefore, individual fish have been temporarily displaced from occupied habitats when personnel or heavy equipment worked in or near the river channel (e.g., clearing accumulated sediment at intakes). Hatchery maintenance activities may have displaced juvenile fish through noise and instream activity or exposed them to brief pulses of sediment as activities occur instream.

To prevent exposure of embryonic and age-0 juvenile life stages during in-water maintenance activities, all work has been completed within agency-approved summer in-water work windows unless site-specific variances are authorized by state and federal resource agencies. When maintenance activities occur

within water, they have been implemented using best management practices (BMPs) described in Section 2.1.2, Operation and Maintenance.

3.3.5.9 Research, Monitoring, and Evaluation

Although some hatchery programs have program-specific RM&E activities (Table 2-1), RM&E activities associated with other research programs are conducted independent of hatchery operations. NMFS (2018b, 2018c) determined that the effects of ongoing program RM&E on natural-origin salmon and steelhead populations have been unlikely to contribute to a decrease in the abundance, productivity, diversity, or spatial structure of the populations. RM&E activities directly related to hatchery programs are implemented using well-established methods and protocols (e.g., Galbreath et al 2008). Because the intent of RM&E for all programs is to improve the understanding of salmon and steelhead populations, the information gained outweighs the risks to the populations, based on the small proportion of fish encountered. Incidental effects may have resulted from tagging, such as injury to salmon and steelhead.

Collection of adults at traps delays individuals in their upstream migration and could alter spawning behaviors upon release. Individuals may also suffer stress or mortality during tagging or tissue sampling. Mortality from tagging is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish are released into the environment).

NMFS has developed general guidelines to reduce impacts when collecting listed adult and juvenile salmonids (NMFS 2000b, 2008c). Hatchery operators and staff must abide by these guidelines, which are incorporated as terms and conditions into current ESA Section 7 biological opinions and Section 10 permits for research and enhancement. Additional monitoring principles for supplementation programs have been developed (Galbreath et al. 2008).

Spawning ground surveys have been likely to temporarily harass salmon and steelhead in surveyed reaches of the Study Area. At times, research has involved observing adult fish, which are more sensitive to disturbance than juveniles. Salmon and steelhead exhibit avoidance behaviors likely in the range of normal predator and disturbance behaviors.

Individual salmon and steelhead are captured at rotary screw traps associated with juvenile outmigration monitoring for several hatchery programs. These ongoing collections have temporarily delayed downstream migration and stress fish during handling (if required).

Electrofishing has also been used to monitor natural- and hatchery-origin Chinook Salmon and steelhead in the Round Butte (Whychus Creek) and Umatilla programs (Iskulpa Creek). Chinook Salmon and steelhead in these streams have therefore likely been exposed to potential stress from handling and tagging. In addition, snorkel surveys have been conducted in the Hood River (West Fork Hood River) and Round Butte programs (Whychus Creek and Metolius River). In the Round Butte Program, this may have involved dip netting juvenile Chinook Salmon for growth measurements, which is less invasive than electroshocking. Overall, observational snorkel surveys have been designed to be minimally invasive and likely resulted in avoidance behaviors within the range of normal predator and disturbance behaviors.

3.3.5.10 Critical Habitat and Essential Fish Habitat

As discussed in Section 3.3.3, Critical Habitat and Essential Fish Habitat, critical habitat has been designated in the Study Area for the Columbia River Chum Salmon ESU, Lower Columbia Coho Salmon ESU, Lower Columbia Chinook Salmon ESU, the Upper Columbia Spring Chinook Salmon ESU, the Lower, Middle, and Upper Columbia River Steelhead DPSs, and all listed Snake River ESUs and DPSs. In addition, all facilities that support hatchery programs included in this EA have operated and/or released juvenile hatchery fish into Pacific Salmon EFH.

Direct effects on critical habitat and EFH have resulted from facility operation (e.g., water diversion and effluent discharge), maintenance (e.g., instream sediment removal), and the presence of hatchery program-related weirs and water withdrawal structures. Genetic and ecological interactions between hatchery-reared fish and fish in the natural environment have also contributed to minor degradation of critical habitat and EFH, particularly as related to rearing habitat.

As described in Section 3.3.5.8, Facility Operations, water withdrawals for hatchery operations can affect critical habitat and EFH by reducing streamflow, impeding migration, or limiting the amount of stream-dwelling organisms that could provide prey for juvenile salmonids. Water withdrawals can also kill or injure juvenile salmonids through impingement upon inadequately designed intake screens or by entrainment of juvenile fish into the water diversion structures. All hatchery programs have been operated to minimize each of these effects. In general, water withdrawals are small enough in scale that changes in flow are low, and measurable impacts on critical habitat and EFH do not occur. Minor modifications to channel habitat by construction and operation of weirs or maintenance actions have resulted in short-term water quality impairments. However, impacts on water quality are typically short-lived, and have not altered the function or usability of critical habitat and EFH once turbidity subsides.

Hatchery fish returning to the Lower and Middle Columbia River domains largely spawn and rear near the hatchery of origin, and generally do not enter critical habitat and/or EFH areas for other species outside of the Study Area. Some spring Chinook Salmon and steelhead from ongoing programs might stray into other rivers. However, because straying is low from these programs (NMFS 2018b, 2018c), these few strays do not exceed the carrying capacities of natural production areas, or increase disease or predation in these habitats.

3.4 Fisheries

Hatchery operations have increased the number of fish available for fisheries. Abundance of natural-origin salmon and steelhead can limit tribal and especially recreational fisheries, but hatchery production and management strategies such as selective fisheries (fisheries that target marked hatchery-origin fish) may allow fishing efforts to focus on hatchery-origin fish rather than natural-origin fish. Careful monitoring and analysis of fisheries practices can determine how specific fisheries may benefit or maintain populations.

Salmon and steelhead from the six hatchery programs included in this EA may be exposed to fisheries in the Pacific Ocean and in the Columbia River Basin; however, as described in Section 3.3.1, Study Area, effects on fisheries downstream of Bonneville Dam are not likely to be discernable. Although current ocean fisheries target Chinook Salmon and Coho Salmon (NMFS 2018b), Chinook Salmon fisheries focus primarily on fall Chinook Salmon. Few spring Chinook Salmon and steelhead are caught in ocean fisheries (NMFS 2014).

Spring Chinook Salmon and steelhead may be harvested incidentally to commercial and sport fisheries in the mainstem Columbia River and targeted in tribal fisheries above Bonneville Dam. These fisheries are limited by seasonal impacts on ESA-listed species and managed under the *U.S. v. Oregon* Management Agreement (NMFS 2018a). The likelihood of detecting specific effects of the programs included in this EA on these fisheries is low; therefore, the subsections below focus on fisheries in the Walla Walla, Umatilla, Deschutes, and Hood River subbasins.

WDFW regulates and manages recreational fisheries in the Walla Walla River Subbasin in Washington, including the Touchet River. ODFW regulates and manages recreational fisheries in the Upper Walla Walla Subbasin in Oregon, and in the Umatilla, Deschutes, and Hood River subbasins. Regulations for recreational fisheries are submitted to NMFS for approval under the limit 4 of the Section 4(d) rule.

Tribal fisheries in the Study Area are managed primarily by either the CTUIR or CTWSRO (Section 3.8. Cultural Resources). The most recent *U.S. v Oregon* Management Agreement (NMFS 2018a) provides the current framework for managing fisheries. The agreement includes a list of tribal and non-tribal salmonid fisheries in the Columbia River Basin intended to provide fair sharing of harvestable fish between tribal and non-tribal fisheries in accordance with Treaty fishing rights standards and *U.S. v. Oregon*. Harvest allocation between recreational and treaty fisheries is negotiated between WDFW or ODFW and the CTUIR or CTWSRO.

3.4.1 Spring Chinook Salmon

Because natural-origin spring Chinook Salmon from the Walla Walla, Umatilla, and Deschutes River subbasins are not ESA-listed (Section 3.3.4, Non-ESA-listed Salmon Populations), recreational fisheries are state regulated. No salmon angling is allowed in the Walla Walla Subbasin, including the Touchet River. Spring Chinook Salmon angling in the Umatilla River occurs primarily in spring, with no limit in recent years on the number of hatchery salmon that may be kept. Chinook Salmon angling in the Deschutes River is generally open from August through October with no limit on the number of hatchery fish that may be kept, but only downstream from Sherars Falls at RM 43.

Natural-origin spring Chinook Salmon in the Hood River are listed under the ESA as threatened (Section 3.3.2, ESA-Listed Salmon and Steelhead Populations). The Hood River is therefore generally closed to recreational fisheries for spring Chinook Salmon, but selective fisheries targeting hatchery spring Chinook Salmon have been permitted when hatchery abundance has allowed.

The CTUIR and CTWSRO harvest spring Chinook Salmon throughout treaty territories and at usual and accustomed locations. Harvest in the Study Area has been focused primarily in the Umatilla and Hood river subbasins. Fisheries in the Umatilla River target spring Chinook, fall Chinook, and Coho Salmon. The Hood River Spring Chinook Salmon Program provided tribal fisheries at Punchbowl Falls on the West Fork Hood River. This fishery is managed under the Warm Springs Tribal Council and occurs when hatchery adult abundance allows. Tribal fisheries may be selective or non-selective; fish with intact adipose fins may often be kept. Fisheries are open until specifically closed.

3.4.2 Steelhead

Natural-origin steelhead from all subbasins in the Study Area are listed under the ESA as threatened (Section 3.3.2, ESA-Listed Salmon and Steelhead Populations). All non-tribal recreational fisheries therefore require the release of all unmarked steelhead. Hooton (1987) concluded that catch-and-release of adult steelhead was an effective mechanism for maintaining angling opportunity without negatively affecting stock recruitment.

In the Touchet and Walla Walla rivers, angling for hatchery steelhead is allowed at various times of the year depending on location. Steelhead fishing in the Umatilla River is generally open from September through mid-April. Tribal angling permits are required on the Umatilla Indian Reservation. Fishing for hatchery steelhead is allowed all year on the Deschutes River downstream from the Warm Springs Reservation, but is closed part of the year along and upstream from the reservation. In the Hood River Subbasin, harvest of hatchery steelhead is allowed only from the river mouth upstream to the confluence with the East Fork Hood River.

The CTUIR and CTWSRO harvest steelhead throughout treaty territories and at usual and accustomed locations. Harvest in the Study Area has been focused primarily in the Umatilla River, where tribal members can retain natural-origin steelhead during fisheries targeting spring Chinook, fall Chinook, and Coho Salmon. Tribal fisheries are estimated to have harvested an average of 80 adult steelhead in the Study Area (hatchery and natural-origin combined) annually between 2001 and 2009 (Clarke et al. 2010).

3.5 Other Fish Species

Adult and juvenile fish propagated at the six hatchery programs included in this EA have the potential to interact with fish species other than salmon and steelhead in the natural environment. Approximately 100 fish species have been documented in the Columbia River Basin, many of which are introduced (Ward and Ward 2004). Many of these species are also found in the Study Area, including hatchery-origin salmon and steelhead. As described in Section 3.3.1, Study Area, effects of the hatchery programs can be detected on fish species in all waterbodies downstream of hatchery release sites to Bonneville Dam on the Columbia River. The Study Area also includes stream reaches adjacent to facilities used to rear program fish. As noted in Section 3.3.5.8, Facility Operations, operations at many facilities may potentially affect other fish species:

- Dayton Adult Trap
- Three Mile Falls Dam Trap
- Minthorn Acclimation Facility
- Pendleton Acclimation Facility
- Pelton Ladder and Trap
- East Fork Weir and Trap
- Parkdale Hatchery
- East Fork Irrigation Acclimation Site
- Moving Falls Fish Facility

No program-related broodstock collection or release of hatchery fish occurs at or near Lyons Ferry, Umatilla, Round Butte, or Oak Springs hatcheries. Because these facilities follow NPDES criteria and monitor effluent, ongoing hatchery operations, including water diversion, effluent discharge, or maintenance activities, are unlikely to affect other fish species.

3.5.1 Species Interactions

Fish from programs included in this EA have potentially interacted with other fish species during two different life phases, first as smolts upon release, and second as adults upon return. Smolts are not likely to have a discernible effect in the mainstem Columbia River (NMFS 2018b; 2018c). Adults returning to the Study Area are not likely to have had a discernible effect in the Columbia River because fish from these programs are likely to have similar density-dependent interactions (e.g., competitive or predator/prey relationships) with other fish species, comparable to that discussed in Section 3.3, Salmon and Steelhead.

Of the native and introduced fish species in the Columbia River Basin, 14 native and 3 introduced species have been identified as the most likely to have had potential interactions with fish from the current programs (Table 3-6). Bull trout, listed under the ESA as threatened (64 FR 58909, November 1, 1999), may be locally common in some of the tributary habitat occupied by anadromous fish in the Walla Walla, Umatilla, Deschutes, and Hood River subbasins. The primary interaction between bull trout and salmon and steelhead is predation of salmon and steelhead by subadult and adult bull trout. Bull trout may also occur in the Columbia River but at such low abundance that interactions with hatchery fish from the six programs included in this EA have been highly unlikely.

Pacific lamprey (*Entosphenus tridentatus*) and river lamprey (*Lampretra ayresii*) are considered culturally important to many tribes. These species have declined to a remnant of their numbers prior to human development. Anadromous lamprey are vulnerable to similar threats as salmonids, including barriers to

passage, reduced access to spawning habitat, degradation of habitat and water quality, and presence of introduced predators (Luzier et al. 2011). Hatchery fish may act as a buffer against marine mammal predation on lamprey. Hatchery-origin fish that spawn in the wild have not directly competed with lamprey because of differences in spawning and rearing habitat requirements.

Additional fish species are considered federal species of concern, or listed by individual or multiple states as endangered, sensitive, species of concern, or candidate species (Table 3-6). Hatchery fish may compete for spawning sites or have redd superimposition with other salmonid species such as resident rainbow trout and coastal cutthroat trout (*Oncorhynchus clarki clarki*). Resident redband rainbow trout are especially abundant in the Deschutes River Subbasin. Coastal cutthroat trout occur in the Hood River Subbasin and exhibits both anadromous and resident life histories. Further details about these species' life history, status and trends, limiting factors and threats, and interaction with salmon and steelhead are provided by NMFS (2014).

Table 3-6. Fish Species Other than Salmon or Steelhead that May Interact with Hatchery-origin Salmon and Steelhead in the Study Area

Species	Range	Federal/State Listing Status	Relationship		
			Prey	Competitor	Predator
Native					
Bull trout (*Salvelinus confluentus*)	Throughout the Columbia River Basin	Federal: threatened (64 FR 58909, November 1, 1999) Oregon State sensitive Washington State species of concern	✓	✓	✓
Pacific lamprey (*Entosphenus tridentatus*)	Accessible reaches of the Columbia River Basin	Federal species of concern Idaho State endangered Oregon State sensitive	✓	✓	✓
River lamprey (*Lampetra ayresii*)	Accessible reaches of the Columbia River Basin	Federal species of concern Washington State candidate	✓	✓	✓
Brook lamprey (*L. richardsoni*)	Throughout the Columbia River Basin	Oregon State sensitive	✓	✓	
Coastal cutthroat trout (*Oncorhynchus clarki clarki*)	Lower Columbia River Basin	Oregon State sensitive	✓	✓	✓
Rainbow trout (*O. mykiss*)	Throughout the Columbia River Basin	Not listed	✓	✓	✓
Leopard dace (*Rhinichthys falcatus*)	Throughout the Columbia River Basin	Washington State candidate	✓		
Umatilla dace (*R. umatilla*)	Columbia, Kootenay, Slocan, and Snake Rivers	Washington State candidate	✓	✓	
Margined sculpin (*Cottus marginatus*)	Tucannon, Walla Walla and Umatilla River subbasins	Federal species of concern Washington State sensitive	✓	✓	✓

Species	Range	Federal/State Listing Status	Relationship		
			Prey	Competitor	Predator
Mountain sucker (*Catostomus platyrhynchus*)	Middle Columbia and Upper Columbia river watersheds	Washington State candidate		✓	
Northern pikeminnow (*Ptychocheilus oregonensis*)	Throughout the Columbia River Basin	Not listed	✓	✓	✓
Three-spine stickleback (*Gasterosteus aculeatus*)	Throughout the Columbia River Basin	Not listed	✓	✓	
White sturgeon (*Acipenser transmontanus*)	Accessible reaches of the Columbia River Basin	Not listed			✓
Mountain whitefish (*Prosopium williamsoni*)	Columbia River Basin	Not listed	✓	✓	✓
Introduced					
Brook trout (*Salvelinus fontinalis*)	Upper reaches of watersheds throughout the Columbia River Basin	Not listed	✓	✓	✓
Smallmouth bass (*Micropterus dolomieu*)	Columbia River Basin	Not listed		✓	✓
Largemouth Bass (*Micropterus salmoides*)	Columbia River Basin	Not listed		✓	✓

Source: Coccoli et al. (2004); Phelps (2004); Walla Walla County and Walla Walla Basin Watershed Council (2004); Ward and Ward (2004); NMFS (2014)

Other species may prey heavily on salmonid eggs or juveniles. Hatchery fish may act as a buffer against predation on wild fish. Conversely, releases of hatchery fish may attract additional predators that prey on wild fish.

Disease and nutrient effects on salmonid species (e.g., bull trout) are likely to be similar to the effects discussed in Sections 3.3.5.5, Diseases, and 3.3.5.7, Nutrient Cycling. Diseases that pose particular risk to hatchery-origin salmonids (i.e., BKD and IHN) only affect salmonid species. Other diseases endemic to many fish species (e.g., freshwater ich, *Ichthyophthirius multifiliis*) may also be amplified in a hatchery to affect nonsalmonid species.

3.5.2 Facility Operations

Fish species other than salmon or steelhead have been affected by hatchery operations, similar to the effects discussed in Section 3.3.5.8. Facility operations effects may have included decreased water quality caused by effluent discharge, disease and pathogen transmission, injury or mortality from facility operations including dewatering, and impingement or entrainment during water withdrawl. The proportionally small volumes of effluent discharged into a larger water body has generally resulted in temporary, low, or undetectable levels of contaminants.

Species, such as bull trout and coastal cutthroat trout, may occur near existing hatchery facilities and release sites; however, disease and pathogen transmission has been unlikely. The proportion of facility surface water withdrawal and subsequent discharge at most sites has comprised only a portion of the

total streamflow (Table 3-1), which has reduced, via dilution, the likelihood for transmission of pathogens from effluent. Smolt release strategies have promoted distribution of hatchery fish throughout the system and rapid outmigration, which has reduced the concentration of hatchery-released fish in the river, and therefore, the likelihood for a diseased hatchery fish to encounter other salmonids. Fish health protocols have been in place to address pathogens also minimize the likelihood for disease and pathogen effects on salmonids.

Fish species other than salmon or steelhead may also be affected by hatchery facility operation and maintenance, similar to the effects discussed in Section 3.3.5.8, Facility Operations. Flow reductions and dewatering may affect fish species other than salmon or steelhead if migration is impeded, or if such reduction in flow leads to increased water temperatures. During low-flow periods, habitat complexity may be reduced in some areas.

Each facility with intakes, pumps, or screens has the potential to affect fish via impingement or entrainment during water intake. All intake facilities have been designed to meet current NMFS screening criteria (NMFS 2011); however, these criteria may not protect migratory lamprey.

The spatial distributions of fish species other than salmon or steelhead have not are generally been affected by weir operations because weirs are designed to allow juvenile passage, and adults are passed upstream when captured. The operation of adult collection facilities, particularly seasonal, channel-spanning weirs, can affect migratory species (e.g., Pacific lamprey and bull trout) by delaying their migration. If captured, fish may be harmed during handling at the collection facility. Although adult passage may be delayed slightly, weir operation guidelines and monitoring of weirs minimize delays and impacts on fish. All nontarget fish are generally handled and released in accordance with standard operating procedures (NMFS 2018b, 2018c).

Although many fish species may be incidentally collected during RM&E activities described in Section 3.3.5.9, Research, Monitoring, and Evaluation, general guidelines to reduce impacts on salmon and steelhead (NMFS 2000, 2008b) also reduce effects on other species. In addition, BMPs in place for ESA-listed salmon and steelhead (NMFS 2018a) further reduce effects.

3.6 Wildlife

The Study Area for wildlife is limited to the project area as described in Section 1.2, Project Area and Study Area; therefore, Orcas and other marine mammals are not considered here because marine mammals are not present within the Study Area. Effects of the Proposed Action on Orcas and other marine mammals will be evaluated in the Cumulative Effects Section. Numerous species of birds, mammals, and invertebrates occur in the Study Area and may potentially interact with salmon and steelhead associated with the hatchery programs included in this EA (Table 3-7). Hatchery facilities and hatchery-origin salmon and steelhead propagated for the six hatchery programs included in this EA may have affected wildlife by acting as either predators or prey, enhancing nutrient availability, transferring pathogens or toxic contaminants outside the hatchery environment, or impeding wildlife movement. A comprehensive list of wildlife species and potential effects is provided in Section 3.5 of the Mitchell Act FEIS (NMFS 2014).

Common salmon and steelhead predators in the Study Area include the bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), osprey (*Pandion haliaetus*), and great blue heron (*Ardea Herodias*). River otters (*Lontra canadensis*) and mink (*Neovison vison*) occur throughout the Study Area and may consume salmon and steelhead (Cederholm 2000; Melquist 1997 in NMFS 2014). Hatchery fish may act as a buffer against predation on wild fish. Conversely, releases of hatchery fish may attract additional predators increasing prey on wild fish. The presence of hatchery-origin salmon and steelhead carcasses has likely provided a benefit to local wildlife as a nutrient source.

Table 3-7. Primary Wildlife Species that May Interact with Hatchery-origin Salmon and Steelhead or be Affected by Hatchery Operations in the Study Area

Species[1]	Range in relationship to Study Area	Federal/State Listing Status	Relationship		
			Prey	Predator	Otherwise Affected by Operations
Birds					
Bald Eagle (Haliaeetus leucocephalus)	Throughout the Columbia River Basin	Federally protected under Bald Eagle and Golden Eagle Protection Act		✓	✓
Golden Eagle (Aquila chrysaetos)	Throughout the Columbia River Basin	Federally protected under Bald Eagle and Golden Eagle Protection Act Washington State candidate		✓	
Osprey (Pandion haliaetus)	Throughout the Columbia River Basin	Federally protected under Migratory Bird Treaty Act		✓	✓
Great Blue Heron (*Ardea herodias*)	Throughout the Columbia River Basin	Federally protected under Migratory Bird Treaty Act		✓	
Black Crowned Night Heron (*Nycticorax nycticorax*)	Throughout the Columbia River Basin	Not listed		✓	
Belted Kingfisher (*Megaceryle alcyon*)	Throughout the Columbia River Basin	Not listed		✓	
Mammals					
Bobcat (*Lynx rufus*)	Woodlands or remote habitat throughout the Columbia River Basin	Not listed		✓	✓
Cougar (Puma concolor)	Throughout the Columbia River Basin	Not listed		✓	✓
River Otter (Lontra canadensis)	Throughout the Columbia River Basin	Not listed		✓	✓
Mink (Neovison vison)	Throughout the Columbia River Basin	Not listed		✓	✓

[1]Additional species are provided by NMFS (2014).

Similar to Section 3.3, Salmon and Steelhead, the transfer of toxic contaminants and/or pathogens to wildlife associated with the ongoing hatchery programs is unlikely to contribute to their current presence/load in wildlife due to the regulation of hatchery operations through NPDES Aquaculture Facilities permits and the applicants' fish health policies (USFWS 2004; NWIFC and WDFW 2006; NMFS 2014).

Wildlife occurring in the Study Area may encounter hatchery operations such broodstock collection or juvenile release activities, or may avoid related noise (e.g., heavy equipment). Weirs and traps used for collection of fish may impede wildlife movement and/or benefit wildlife by restricting fish migration and subsequently enhancing predation efficiency. The six programs currently utilize passive methods of

predator control (i.e., fences around facilities, netting over holding ponds, monofilament line to deter avian predators). Some facilities and associated streams are in relatively remote areas where species such as bobcats (*Lynx rufus*) and cougars (*Puma concolor*) are expected to be more common than in developed areas.

3.7 Socioeconomics

Socioeconomics is defined as the study of the relationship between economics and social interactions with affected regions, communities, and user groups. The Study Area for socioeconomics in this EA is the Mid-Columbia River impact region analyzed in the Mitchell Act FEIS (NMFS 2014). This area includes eight counties in Washington and Oregon (Figure 1-1). Population density is relatively low in many of these counties, and per capita income is lower than statewide averages in five of the eight counties. Agriculture is the primary land use and employment sector in most of the counties, but retail and manufacturing are also important in many of the counties. The natural resource industry (forestry, fishing, and hunting) is also important throughout the area.

Hatchery programs provide fish for commercial and recreational fishing opportunities, employment, and economic opportunities through hatchery operations. Hatchery-related spending affects the economy in the community surrounding the hatchery, and those economic impacts can extend outward, having a wider regional effect. The Study Area for socioeconomics is limited to the Walla Walla River Subbasin, Umatilla River Subbasin, Deschutes River Subbasin, and the Hood River Subbasin in Washington and Oregon upstream from Bonneville Dam, with the focus on economic impacts of hatchery operations.

Both tribal and nontribal commercial and recreational fisheries may target hatchery fish. Changes in hatchery production levels have therefore influenced timing and magnitude of harvests. The hatchery programs assessed in this EA are part of the larger Mid-Columbia River impact region analyzed in the Mitchell Act FEIS (NMFS 2014). According to the Mitchell Act FEIS, the total hatchery-generated activity in the Mid-Columbia River economic impact region creates about 841 jobs, generates about $19.0 million to $38.8 million in personal income and results in about $14.7 million to $21.4 million in recreational expenditures (NMFS 2014, Table 3-23, Table 4-106, and Table 4-109).

The six hatchery programs assessed in this EA have accounted for only about 2.2 percent of the total hatchery releases from all programs in the Mid-Columbia River impact region. Therefore, the six hatchery programs have created about 17 of the 841 jobs, about $437,000 to $855,000 of the hatchery-related personal income, and about $323,000 to $471,000 of the recreational expenditures in the Mid-Columbia River economic impact region. Of note, the economic impact of hatchery spending on jobs is broader than employment just at the hatcheries because these jobs include indirect employment opportunities in the community that provide goods and services related to hatchery operations and personnel. Because the programs evaluated cover such a small proportion of all programs in the region, impacts to jobs, personal income, and recreation expenses are not broken out by individual hatchery program.

Section 3.4, Fisheries, describes salmon and steelhead fisheries in the Study Area, primarily in subbasins with the hatchery programs included in this EA. WDFW and ODFW regulate and manage recreational fisheries in these subbasins, while co-managing several programs with the CTWSRO and CTUIR. The current operating budgets of hatchery facilities associated with the six hatchery programs analyzed in this EA range from $168,000 to $1.0 million per year (Table 3-8). Operating budgets vary widely among facilities because some are used for most life stages of one or more programs, and others are used for as few as one life stage for one program. Some hatcheries are also used for programs not included in this EA.

Table 3-8. Funding Source and Operating Budgets for Programs included in this EA

Program	Operator[1]	Funding Source[2]	Hatchery Staffing Level	Annual Operating Budget	RM&E[3] Staff	RM&E Budget
Touchet River (Walla Walla River Subbasin)						
Touchet River Endemic Summer Steelhead	WDFW	LSRCP	0.3	$120,500	0.17 FTE	$215,500
Umatilla River Subbasin						
Umatilla River Summer Steelhead[4]	ODFW/CTUIR	BPA	6 FTE, 6 months seasonal staff	$1,035,731	9.5 FTE, 14.35 months seasonal staff	$1,329,499
Deschutes River Subbasin						
Round Butte Hatchery Summer Steelhead	ODFW/CTWSRO	PGE	6.1 FTE, 12 months seasonal staff	$1,037,540	--	--
Round Butte Hatchery Spring Chinook Salmon[5]	ODFW	PGE	--	--	--	--
Hood River Subbasin						
Hood River Winter Steelhead	ODFW/CTWSRO	BPA	2.36 FTE, 11 months seasonal staff	$501,038	-	-
Hood River Spring Chinook Salmon	CTWSRO/ODFW	BPA	6 FTE, 6 months seasonal staff	$1,022,362	4.5 FTE, 9 months seasonal staff	$774,405

[1]WDFW = Washington Department of Fish and Wildlife; ODFW = Oregon Department of Fish and Wildlife, CTUIR = Confederated Tribes of the Umatilla Indian Reservation, CTWSRO = Confederated Tribes of the Warm Springs Reservation of Oregon
[2]LSRCP = Lower Snake River Compensation Plan; BPA = Bonneville Power Administration; PGE = Portland General Electric
[3]RM&E = Research, Monitoring, and Evaluation
[4]Reflects current budget for all production at the hatchery (steelhead and Spring Chinook Salmon)
[5]Total operating and staffing levels covered under the Round Butte Summer Steelhead Program also cover operating and personnel costs for the Round Butte Spring Chinook Salmon Program at Round Butte Hatchery.

3.8 Cultural Resources

Salmon fishing has been central to existence of Indian tribes in the Pacific Northwest for thousands of years. Beyond the generation of jobs and income for contemporary commercial Indian tribal fishers, salmon are regularly eaten by individuals and families and served at tribal community gatherings. As with other Pacific Northwest tribes, Columbia River Basin tribes depend on salmon for subsistence purposes and attach great cultural importance to salmon for ceremonial purposes. Tribes of the Columbia River Basin share a passionate concern for the future of salmon runs in the region because of their importance to tribal culture, history, and economic subsistence. Surplus adult salmon and steelhead from many of the hatchery programs included in this EA are provided to tribes for direct consumption or for tribal fisheries (ODFW and CTWSRO 2017). Those in excess of tribes' needs are offered to local food banks or food share organizations. The Mitchell Act FEIS provides more details about the importance of salmon to Indian culture (NMFS 2014, Subsection 3.4.4.1.1, Fish Harvests and Tribal Values and Subsection 3.4.4.1.2, Ceremonial and Subsistence Harvests).

The following Indian tribes are located within or rely on salmon fisheries within the Study Area for cultural and subsistence purposes:

- Nez Perce Tribe

- Confederated Tribes and Bands of the Yakama Nation
- CTUIR
- CTWSRO

The four tribes are also members of the CRITFC, which coordinates management policy and provides fisheries technical services for the member tribes. The CRITFC tribes work together to achieve accomplishments and milestones for protection of tribal treaty fishing rights, salmon, and the watersheds where fish live.

Present day tribal reservations may encompass a fraction of a tribe's previously occupied territory; therefore, tribes have the exclusive right of taking fish at all usual and accustomed places in accordance with applicable treaties. For example, the combined amount of tribal reservation land for the Nez Perce, Umatilla, Yakama, and Warm Springs reservations consists of 2.5 million acres, but the tribes' aboriginal lands and ceded areas encompass 41 million acres (CRITFC 1994). The four Columbia River Treaty tribes enjoy fishing rights along the Columbia River from the Bonneville to McNary dams. This section of the Columbia River, also known as Zone 6 is an exclusive treaty Indian commercial fishing area. Non-commercial sport fishers may still fish in this stretch of water. Tribes are legally entitled to half the harvestable surplus of fish in the Columbia River. To meet these requirements, Oregon and Washington must set their fisheries in the lower zones (Zone 1-5) in a way that leaves enough fish to harvest in Zone 6. The tribes are committed to rebuilding salmon and steelhead populations to healthy, harvestable levels, and fairly sharing the conservation burden so they may fully exercise their right to take fish at all usual and accustomed fishing locations.

3.8.1 Nez Perce Tribe

The Nez Perce Tribe has lived in and held historical and cultural ties to the greater Columbia River Basin, although the Nez Perce Tribe Reservation is located in north-central Idaho (Figure 3-1). The Tribe has several fishing locations spread throughout most of the Columbia River and Snake River basins (CRITFC 2018a).

Under the guidance of the 1855 Treaty, the Nez Perce Tribe co-manages fisheries resources within the Study Area through the Tribe's Department of Fisheries Resources Management Program. The tribe works and coordinates with state, federal, and tribal entities while monitoring fish resources within the region. Tribal members fish throughout the Columbia River Basin, including the Study Area.

3.8.2 Confederated Tribes and Bands of the Yakama Nation

The Confederated Tribes and Bands of the Yakama Nation includes 14 tribes (CRITFC 2018b). The Yakama Indian Reservation is located at the base of Mount Adams in central Washington (Figure 3-1). The Yakama Nation has historically depended on the Columbia River and salmon for subsistence. The Yakama Nation has primarily harvested fish in the Columbia River between Bonneville and McNary dams, Columbia River tributaries including the Yakima and Klickitat rivers, and in Icicle Creek (a tributary of the Wenatchee River). Although ceded lands of the 1855 Treaty encompassed 12 million acres, tribal elders stated that historically their tribes traveled as far north as Canada and south to present day California. The Yakama Nation is responsible for restoring culturally important fish runs in the Columbia River. Yakama Nation fisheries focus primarily on culturally important fish, including Chinook Salmon, Sockeye Salmon, steelhead, Coho Salmon, pacific lamprey, and white sturgeon. The Yakama Nation has usual and accustomed places within the Study Area.

3.8.3 Confederated Tribes of Umatilla Indian Reservation

The CTUIR includes the Umatilla, Walla Walla, and Cayuse tribes (CRITFC 2018c). These tribes have long depended on the abundant fisheries in the Columbia Plateau, historically living around the confluence of the Yakima, Snake, and Walla Walla rivers (Figure 3-1). The Cayuse lived "...south of and between the Nez Perces and Wallah Wallahs, extending from the Des Chutes or Wawanui river to the eastern side of the Blue Mountains. It [their country] is almost entirely in Oregon, a small part only, upon the upper Wallah-Wallah River, lying within Washington Territory" (CTUIR 2018). The Umatilla tribes traveled over vast areas to take advantage of salmon and steelhead runs, traditionally fishing the Columbia and Snake rivers, and the Imnaha, Tucannon, Walla Walla, Grande Ronde, Umatilla, John Day, Burnt, and Powder rivers of northeastern Oregon and southeastern Washington (USBR 1986).

Tribal members typically harvest spring, summer, and fall Chinook Salmon and steelhead in the Columbia River and its tributaries located in southeastern Washington and northeastern Oregon. The confederation has co-management responsibilities of fishery activities within the Columbia, Snake, Walla Walla, Tucannon, and Grande Ronde rivers. Due to the close historical relationship and geographic proximity to the project area (), the CTUIR has usual and accustomed places within the Study Area.

3.8.4 Confederated Tribes of Warm Springs

The CTWSRO includes the Wascoes, Warm Springs, and Paiute (CRITFC 2018d). These tribes rely on fisheries resources for sustenance. Historically, the Wascoes lived along the Columbia River, while the Warm Springs Band often lived on the river tributaries, traveling between winter and summer villages. The Paiutes lived in southeastern Oregon, requiring a lifestyle with less fish and more game in their diets. The Paiute territories historically included a large area from southeastern Oregon into Nevada, Idaho and western Utah. Salmon from the nearby Columbia River was a staple for the Wasco and Warm Springs bands. Salmon were hauled out of the Columbia River with long-handled dip nets.

The CTWSRO has co-management responsibilities of fishery activities within the Columbia River Basin, including operation of hatcheries in tributaries of the Columbia River in northern Oregon. Due to the close historical relationship and geographic proximity of the CTWSRO to the project area (Figure 3-1), the CTWSRO has usual and accustomed places within the Study Area.

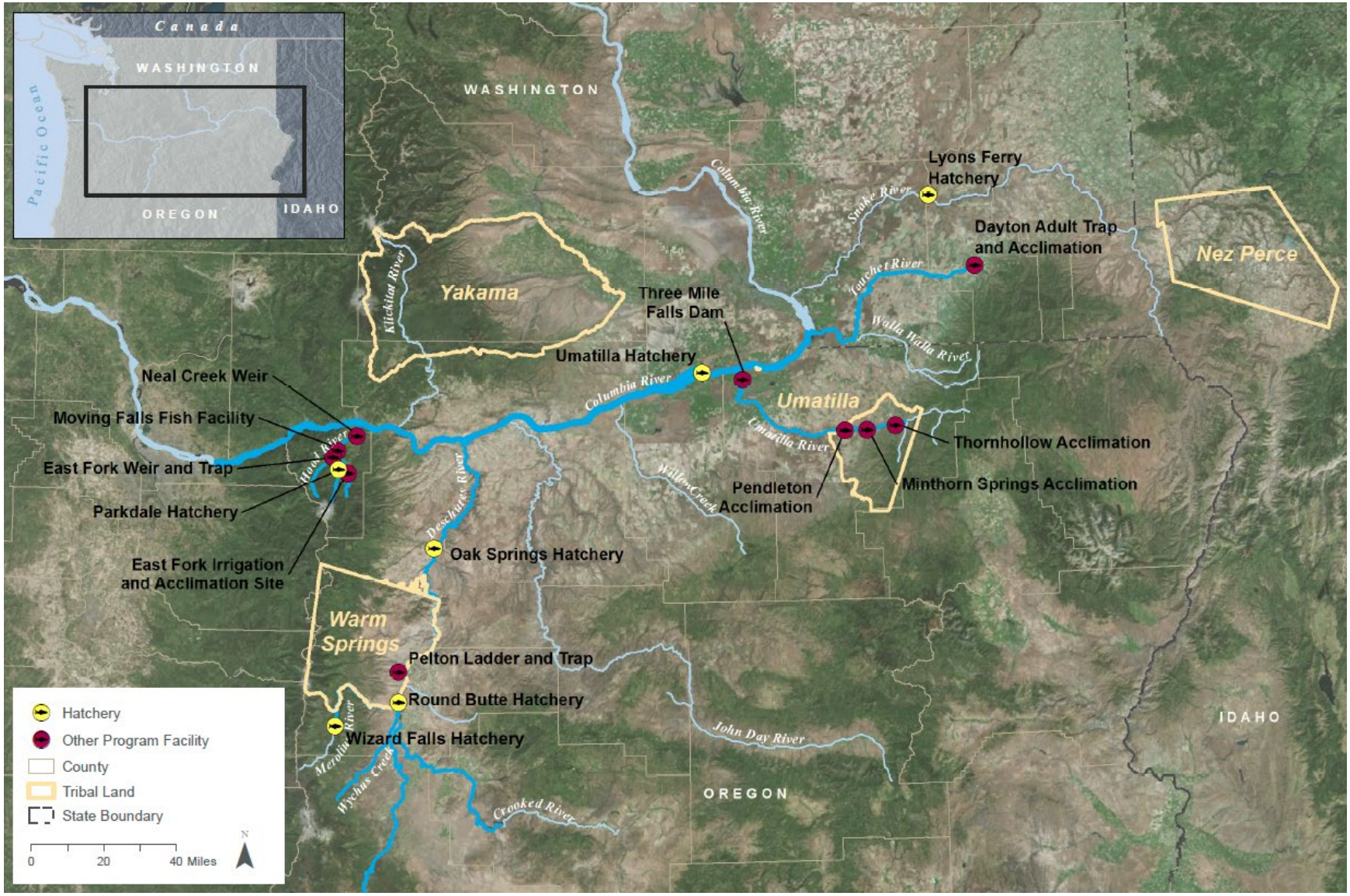

Figure 3-1. Map of Study Area for Cultural Resources Showing Tribal Reservations

3.9 Environmental Justice

In 1994, the President issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. Environmental justice is defined as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." The objectives of the Executive Order include developing federal agency implementation strategies, identifying minority and low-income populations where proposed federal actions could have disproportionately high and adverse human health and environmental effects, and encouraging the participation of minority and low-income populations in the NEPA process. Environmental justice analysis leads to a determination of whether high and adverse human health or environment effects of a program would be disproportionately borne by minority or low-income populations, often referred to as the environmental justice communities of concern. Changes in hatchery production, such as changes to the six hatchery programs in this EA, have the potential to affect the extent of fish harvest available for subsistence and economic purposes for minority or low-income populations.

For the environmental justice analysis, minority and low-income communities of concern were identified by comparing demographic data for counties in the project area are located with a statewide reference. The three environmental justice metrics used to determine if a county is considered a minority community of concern are (1) percentage of county residents that are non-white, (2) percentage that are Indian, and (3) percentage that are Hispanic. The metric for determining if a county is a low-income community of concern is based on the poverty rate and per capita income. Counties were determined to be minority or low-income communities of concern if the level in any category (percent minority, poverty rate, or income) exceeded the applicable data in the statewide reference area.

The Study Area encompasses Columbia, Franklin, and Walla Walla counties in Washington, and Umatilla, Morrow, Jefferson, Wasco, and Hood River counties in Oregon (Figure 3-2). All eight counties qualify as communities of concern based on minority population and low-income thresholds. Jefferson County also counts as a low-income community of concern (Table 3-9). The seven counties in which the six hatchery programs are located (all have program facilities except Walla Walla County) are environmental justice communities of concern.

Through treaties, the United States made commitments to protect tribes' rights to take fish. These rights are of cultural and societal importance to tribes; thus, impacts to commercial, subsistence, and recreational harvest opportunities are examined for any effect on tribal and low-income harvest. All tribes identified in Section 3.8, Cultural Resources are considered an environmental justice community of concern and, accordingly, tribal effects are a specific focus of the environmental justice analysis. Although individual tribes may not meet traditional environmental justice analysis thresholds for minority or low-income populations, they are regarded as affected communities for environmental justice purposes, as defined by USEPA guidance; guidance regarding environmental justice extends beyond statistical threshold analyses to consider explicit environmental effects on Indian tribes (USEPA 1998). The natural or physical environment of a tribe may include resources reserved and protected under the National Historic Preservation Act or the Native American Graves Protection and Repatriation Act.

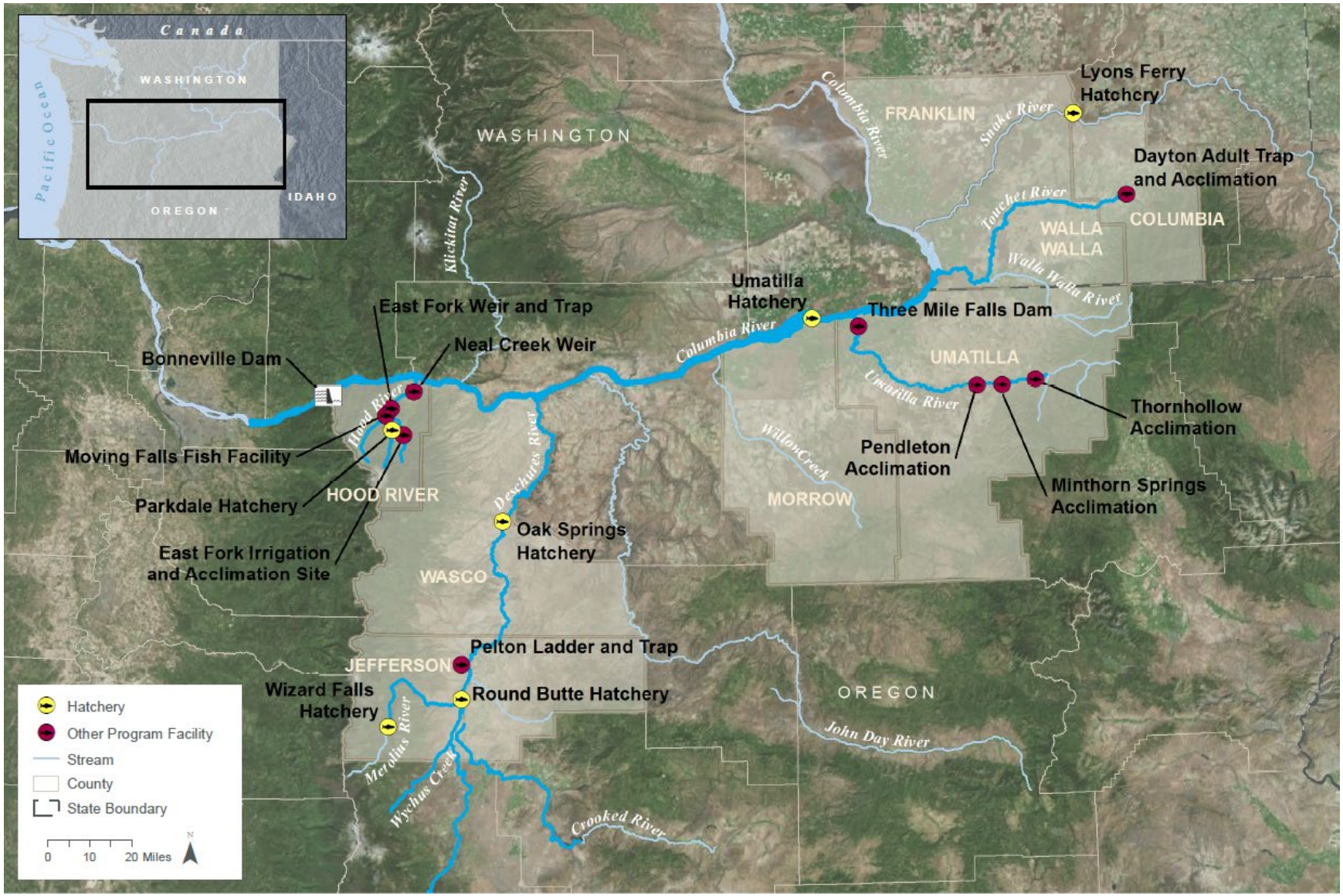

Figure 3-2. Map of Study Area for Environmental Justice Highlighting Counties Primarily Affected

Table 3-9. Summary of Environmental Justice Communities of Concern Analysis

State, County	Total Population (2016 estimates)	Percent Non White	Percent Indian	Percent Hispanic	Poverty Rate Percent	Per Capita Income $ (2016)
Washington						
Statewide Reference	1,635,483	17.2	1.1	12.0	18.0	$24,280.00
Columbia County	3,971	12.2	0.5	6.8	14.8	$26,536.00
Franklin County	87,810	58.4	0.4	52.0	16.4	$20,997.00
Walla Walla County	59,809	27.4	0.4	20.9	16.5	$24,736.00
Oregon						
Statewide Reference	3,982,267	23.1	0.9	12.4	18.66	$28,822.00
Hood River County	22,842	35.5	0.8	30.84	13.3	$28,347.00
Jefferson County	22,305	39.9	16.2	19.82	20.3	$21,630.00
Morrow County	11,207	38.8	0.4	34.7	15.2	$21,279.00
Umatilla County	76,582	32,7	2.1	25.6	18.0	$21,528.00
Wasco County	25,657	24.0	24.0	16.7	14.5	$22,931.00

Source: U.S. Census Bureau (2017), 2012-2016 American Community Survey, Table B17001: Poverty Status in the Past 12 Months by Sex and Age; Table B19301: Per Capita Income in the Past 12 Months (in 2016 Inflation Adjusted Dollars), B03002: Hispanic or Latino Origin by Race.

4 Environmental Consequences

This chapter describes the analysis of the direct and indirect environmental effects associated with the alternatives on the ten resource categories. The relative magnitude of impacts are described using the following terms:

- Undetectable – The impact would not be detectable.
- Negligible – The impact would be at the lower levels of detection.
- Low – The impact would be slight, but detectable.
- Medium – The impact would be readily apparent.
- High – The impact would be severe.

If not undetectable, then effects may be either adverse or beneficial. Adverse is defined as harmful or unfavorable relative to a benchmark condition. Beneficial is defined as favorable or advantageous relative to a benchmark condition. The benchmark condition to which Alternative 1, No Action, is being compared is a baseline, no-hatchery condition. The effects of Alternative 1, No Action, are described in terms of how current conditions (Section 3, Affected Environment) are likely to appear in the future under continued implementation of the six hatchery programs in this EA. The effects of other alternatives are described relative to Alternative 1.

Two aspects of critical habitat as defined by the ESA that may be affected include adequate water quantity and quality and freedom from excessive predation. Potential effects on critical habitat as defined by the ESA are analyzed in this EA in the broader discussion of impacts on habitat in Sections 4.1, Water Quantity; 4.2, Water Quality; 4.3, Salmon and Steelhead; 4.4, Fisheries; 4.5, Other Fish Species; and 4.6, Wildlife.

4.1 Water Quantity

The overall effect on water quantity from operation of the six hatchery programs as described in the HGMPs would be negligible-adverse under Alternative 1, Alternative 2, and Alternative 3 (Table 4-1). Relative to Alternative 1, effects would be negligible-beneficial under Alternative 4.

Table 4-1. Summary of Effects on Water Quantity

Resource	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Water Quantity	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.1.1 Alternative 1, No Action

Under Alternative 1, the hatchery programs would operate as described in the HGMPs. The six hatchery programs would continue to use surface water, spring water, and groundwater as previously described (Table 3-1). Parkdale Hatchery would continue to divert a high proportion of flow from Rogers Spring Creek; however, the value of this dewatered habitat is minimal because of low flows, high stream temperatures, or inaccessibility to anadromous fish. Other facilities would continue to withdraw relatively small proportions of available surface flow. Lyons Ferry, Umatilla, and Oak Springs hatcheries would

continue to utilize groundwater or spring water. Continued use of groundwater could potentially contribute to a decline in the groundwater aquifer and have an adverse effect. Overall, the continued operation of the hatchery programs under Alternative 1 would likely have a negligible-adverse effect on water quantity.

4.1.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program may include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program may increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). Even with these changes, any change in the quantity of water used would be minimalTherefore, this alternative would also have the same negligible-adverse effect as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.1.3 Alternative 3, Reduced Production

Under Alternative 3, the effect on water quantity would be similar to that under Alternative 1 even though the hatchery program production levels would be reduced by 50 percent. Many facilities would continue operation for other programs as described by NMFS (2014), precluding substantial reductions in surface water withdrawals. Facilities that may reduce surface water diversion because they are dedicated solely to programs considered in this EA include Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities such as acclimation in the Pelton Ladder and acclimation sites above Round Butte Dam, and Parkdale Hatchery and associated facilities including the Moving Falls Fish Facility. It is unlikely that withdrawal reductions for the Minthorn Springs acclimation facility would be substantial. Round Butte Hatchery utilizes seepage water through Round Butte Dam; this seepage would continue. The Pelton Ladder would continue operation similar to current conditions even with a reduction in the number of spring Chinook Salmon acclimated in the ladder. Outflow from both acclimation facilities associated with the reintroduction component of the Hatchery Summer Steelhead Progam would continue to be located adjacent to the inflow, thereby eliminating loss of flow in the streams. Parkdale Hatchery would continue to receive flow from an inaccessible reach of Rogers Spring Creek.

None of the hatcheries using groundwater or spring water solely or primarily are dedicated to programs considered in this EA. Reductions in production would have little effect on the amount of water used, or on the aquifer from which it is derived for Lyons Ferry, or Oak Springs hatcheries. Because of decreased water production from wells at Umatilla Hatchery, a reduction in fish production from one program may contribute to alleviating problems with water availability for other programs at the facility. Overall, Alternative 3 would have a similar negligible-adverse effect on water quantity as Alternative 1.

4.1.4 Alternative 4, Program Termination

Even with immediate termination of all six hatchery programs under Alternative 4, many facilities would remain in operation for different programs described by NMFS (2014) including Lyons Ferry, Umatilla, and Oak Springs hatcheries, plus the trap at Three Mile Falls Dam on the Umatilla River. Reduced production at these facilities may result in slightly reduced surface water and groundwater or spring water withdrawals. Reductions in production would have little effect on surface water withdrawals.

Water diversion facilities that may cease to operate because they are dedicated to programs considered in this EA include the Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities

such as acclimation in the Pelton Ladder and acclimation sites above Round Butte Dam, and Parkdale Hatchery and associated facilities including the Moving Falls Fish Facility. Termination of water diversion to Round Butte Hatchery would have little effect because seepage through Round Butte Dam would continue. The Pelton Ladder would continue to operate similarly to current conditions even if it is not used for acclimation of spring Chinook Salmon. Parkdale Hatchery would no longer withdraw water from an inaccessible reach of Rogers Spring Creek. Overall, Alternative 4 would have a negligible-beneficial effect on water quantity compared to Alternative 1.

4.2 Water Quality

The overall effect on water quality from operation of the six hatchery programs would be negligible-adverse under Alternative 1, Alternative 2, and Alternative 3 (Table 4-2). Relative to Alternative 1, effects would be negligible-beneficial under Alternative 4.

Table 4-2. Summary of Effects on Water Quality

Resource	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Water Quality	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.2.1 Alternative 1, No Action

Under Alternative 1, the six hatchery programs would operate as under current conditions. No change in the discharge water temperature, ammonia, organic nitrogen, total phosphorus, BOD, pH, and solids in receiving waters would be expected. Temporary and minor effects on sedimentation and dissolved gas supersaturation from adult collection and juvenile release activities also would be expected to remain similar to current conditions. Hatchery discharges are allowed, and most facilities are managed under NPDES permits administered by either the USEPA or the ODEQ and the WDE, through authority delegated by USEPA (Table 3-2).

The pollutant loads associated with each respective hatchery (where applicable) have been permitted with conditions and wasteload allocations that protect the water quality of receiving waters. Currently, all six hatchery programs are in compliance with their applicable NPDES discharge permits, although periodic effluence limit exceedances occur (Section 3.2, Water Quality).

Under Alternative 1, effluent discharged by hatchery facilities would be expected to continue contributing similar levels of pollutants to receiving waters, and periodic effluent permit-limit exceedances to occur at a similar frequency. However, water quality may improve in watersheds with total maximum daily loads (TMDLs) currently in place, to be developed, or to be revised in the future. As NPDES permits are renewed, hatchery facilities in these watersheds would be required to comply with effluent limits that reflect current technologies and watershed conditions, likely resulting in lower pollutant discharge limits. Overall, Alternative 1 is expected to have a negligible-adverse effect on water quality.

4.2.2 Alternative 2, Proposed Action

Under Alternative 2, the six hatchery programs would be the same as under Alternative 1, except that(1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program may include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River

Spring Chinook Salmon Program may increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). The increase in juvenile Hood River Spring Chinook Salmon production would result in a small temporary increase in the discharge water temperature, ammonia, organic nitrogen, total phosphorus, BOD, pH, and solids in receiving waters. Furthermore, the operation of Parkdale Fish Hatchery does not require a NPDES permit, and would not exceed effluent discharge thresholds to require a permit even when the production increases to 250,000 juvenile Spring Chinook Salmon (CTWSRO and ODFW 2017). Therefore, this alternative would have the same negligible-adverse effect as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.2.3 Alternative 3, Reduced Production

Under Alternative 3, the six hatchery programs would operate at half the capacity of Alternatives 1 and 2. Reducing hatchery production may improve water quality in receiving waters downstream of wastewater discharge. The effect of hatchery effluent on the water quality of receiving waters is, in part, a function of fish production levels. Decreasing fish production in the six hatchery programs would decrease the quantity of heat, nutrients, BOD, sediment, therapeutics (e.g., antibiotics), fungicides, disinfectants, steroid hormones, anesthetics, pesticides, herbicides, and pathogens discharged to receiving waters. Although pollutant loading would be less than for Alternatives 1 and 2, there would still be a pollutant load to receiving waters. For those watersheds with TMDLs in place or developed or revised in the future, compliance with the applicable NPDES permit would help improve water quality; a reduction in production level may further help improve water quality if these facilities discharge effluent at a level much lower than the limit provided in the permit.

Reduced broodstock collection may reduce in-stream disturbance, although disturbance would still occur because of broodstock collection for other programs. Fish release would also be reduced; however, fish release would occur, potentially disturbing the streambed and shoreline at release locations and temporarily affecting dissolved gas levels. Because broodstock collection, holding, incubation and rearing, and release would still occur, Alternative 3 would have a negligible-adverse effect.

4.2.4 Alternative 4, Program Termination

As described in Section 4.1, Water Quantity, even with immediate termination of all six hatchery programs under Alternative 4, many facilities would remain in operation for different programs described by NMFS (2014) and would have a reduced pollutant load to their respective receiving waters resulting in a small and incremental improvement in water quality.

Facilities that may cease to operate because they are dedicated to programs considered in this EA include the Minthorn Springs acclimation facility; Round Butte Hatchery and associated facilities such as acclimation in the Pelton Ladder and acclimation facilities above Round Butte Dam; and Parkdale Hatchery and associated facilities including the Moving Falls Fish Facility. Closing Round Butte and Parkdale hatcheries would result in a small reduction in heat, nutrients, BOD, sediment, therapeutics (e.g., antibiotics), fungicides, disinfectants, steroid hormones, anesthetics, pesticides, herbicides, and pathogens discharged to receiving waters because these hatcheries hold large numbers of fish for a longer period of time than other facilities. Therefore, closing these hatcheries would result in a small improvement in water quality, while closing other facilities is not likely to have a detectable effect.

Discontinuing broodstock collection and juvenile releases may eliminate temporary stream bottom and shoreline disturbances and effects on dissolved gas. However, the temporary and small-scale nature of sediment disturbance from broodstock collection and juvenile releases would likely result in small

differences in sediment loading and dissolved gas. Overall, Alternative 4 would have a negligible-beneficial effect on water quality compared to Alternative 1.

4.3 Salmon and Steelhead

Natural-origin salmon and steelhead populations in the Study Area could be affected by hatchery programs through various effect pathways (Table 3-3). In this subsection, the hatchery program effects on natural salmon and steelhead populations in the Study Area are described for each alternative. Effects of each alternative vary among the pathways considered, and among species for some pathways; therefore, it is difficult to postulate an overall effect of the alternatives on salmon and steelhead. In general, slightly more pathways would be adversely affected than beneficially affected under Alternative 1 and Alternative 2. Under Alternative 3 and Alternative 4, more pathways would be beneficially affected than adversely affected.

4.3.1 Genetics

As discussed in Section 3.3.5.1, Genetics, natural-origin fish from the Lower and Middle Columbia River Chinook Salmon ESUs and the Lower Columbia, Middle Columbia and Snake River Steelhead DPSs have the potential to be genetically affected by the No Action and Proposed Action alternatives (Table 4-3).

Table 4-3. Summary of Effects on Chinook Salmon and Steelhead Genetics

Species	Hatchery Program with Potential to Affect	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
			Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Lower Columbia River Chinook Salmon	Round Butte Spring Chinook	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
	Hood River Spring Chinook				
Lower Columbia River Steelhead	Hood River Summer Steelhead	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Middle Columbia River Steelhead	Touchet River Summer Steelhead	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
	Umatilla River Summer Steelhead	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
	Round Butte Summer Steelhead	Moderate-adverse	Low-adverse	Negligible-beneficial	Moderate-beneficial
Snake River Steelhead	Touchet River Summer Steelhead	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial

4.3.1.1 Chinook Salmon

Alternative 1, No Action

Under Alternative 1, both proposed hatchery programs pose genetic risks to natural-origin Chinook Salmon from the Lower and Middle Columbia River ESUs. For both Chinook Salmon hatchery programs covered in this EA, the net effect on the ESUs would be low-adverse because stray rates are low.

Round Butte Spring Chinook Salmon (Segregated)

Under Alternative 1, the segregated Round Butte Spring Chinook Salmon would continue to use non-listed fish for broodstock and release fish into the domain of the unlisted Middle Columbia River Spring Chinook Salmon ESU. Because the ESU is not ESA-listed, NMFS has not analyzed genetic effects of Round Butte spring Chinook Salmon hatchery fish on natural Chinook Salmon. However, because spring Chinook Salmon from this program have historically exhibited low stray rates, and because Middle Columbia River spring Chinook Salmon populations generally exhibit limited hatchery influences (NMFS 2014), the potential future genetic effects on other Chinook Salmon ESUs is anticipated to be low-adverse.

Hood River Spring Chinook Salmon Program (Integrated)

Under Alternative 1, this integrated reintroduction program would continue to use natural-origin adults returning to the Hood River, which is anticipated to strengthen the ongoing establishment of a locally adapted stock. Using an in-basin broodstock collection approach has resulted in low stray rates (NMFS 2018c) and should continue to do so. Interactions with natural-origin Lower Columbia River Chinook Salmon outside of the Hood River Subbasin should therefore remain limited. Because the native Hood River population of spring Chinook Salmon was determined to be extirpated (Myers et al. 2006), the pHOS is not a factor used to manage the program.

Alternative 2, Proposed Action

Under Alternative 2, the operation of hatchery programs would be the same as under Alternative 1, except that the Hood River Spring Chinook Salmon Program may increase juvenile releases from 150,000 to 250,000 smolts (Section 2.2, Alternative 2, Proposed Action). Even with the increased production of the Hood River program, low stray rates would continue to limit interactions and effects on natural Chinook Salmon genetics. Therefore, this alternative would also have the same, low-adverse effect on other out-of-basin populations as Alternative 1. The proposed increase in production may increase the number of adult spring Chinook salmon returning to the Hood River and available to spawn naturally. The increase may have a beneficial effect to abundance if it is assumed that returning hatchery adults are necessary for maintaining the naturally spawning population in the basin. Furthermore, the increase in naturally spawning adults would increase the number of natural-origin adults available for incorporation into the broodstock and thus support the development of a locally adapted population. Relative to how current conditions are likely to appear in the future, the effect would be slightly benficial as compared to Alternative 1.

Alternative 3, Reduced Production

Reduction of hatchery programs by 50 percent under Alternative 3 would reduce the hatchery-influenced selection from both programs, resulting in no more than a negligible-beneficial effect compared to Alternative 1. The integrated Hood River program is not part of the Lower Columbia River Chinook Salmon ESU (Appendix A); however, it may contribute to genetic diversity of natural-origin fish. The 50% reduction in releases would be expected to reduce the number of returning adults that could spawn

naturally which may have a negative effect if it assumed that the returning hatchery adults are necessary to maintain the naturally spawning population in the basin. Furthermore, the reduction in the number of natural-origin adults produced, would reduce those available for incorpation into the broodstock which may adversely affect the development of a locally adapted population. However, the reduction in releases might be a beneficial effect on abundance if naturally spawning hatchery fish are adversely impacting natural production in the basin. The expected long-term benefit of this re-established Hood River population, primarily formed of locally-adapted broodstock, is to increase species-wide abundance, productivity, and Lower Columbia River Chinook Salmon spatial structure. Although this integrated program would contribute to genetic diversity, hatchery-origin production in the natural environment is generally considered adverse.

Alternative 4, Program Termination

With immediate termination of the hatchery programs under Alternative 4, hatchery-origin fish that have already been released would return to the Hood River and Deschutes River subbasins for 4 or 5 years and continue to be removed if encountered through another program, but removal would not take place at the levels described in the HGMPs. Therefore, hatchery-influenced selection may temporarily increase, but would decrease as the hatchery-origin adults cease to return.

Elimination of all hatchery programs would have a low-beneficial effect on Middle Columbia River Spring Chinook Salmon ESU and Lower Columbia River Chinook Salmon ESU genetics compared to Alternative 1. As stated for Alternative 3, the integrated Hood River program is not part of the Lower Columbia River Chinook Salmon ESU, but the program would contribute to genetic diversity by re-establishing a locally-adapted population. In the Deschutes River Basin, the termination of the program would eliminate a source of spring Chinook salmon that could be used to support reintroduction efforts in the upper basin above the dams. The termination of the program in the Hood River may have a negative effect when assuming hatchery-origin fish would be required to support the natural spawning population in the Hood River such that, without the input from the hatchery program, the naturally produced population would not be sustainable. Alternatively, because hatchery-origin production in the natural environment is considered adverse, elimination of these hatchery programs may have a low-beneficial effect on natural origin Chinook Salmon genetics.

4.3.1.2 Steelhead

Alternative 1, No Action

Under Alternative 1, the proposed hatchery programs pose genetic risks to natural-origin steelhead from the Lower Columbia River, Middle Columbia River, and Snake River steelhead DPSs, although there is some benefit to the species from the integrated programs designed to supplement the Touchet River and Umatilla River populations. With the exception of elevated straying of Touchet River program fish into the Tucannon River, steelhead from these programs appear to exhibit low to no straying; however, as described in Section 3.3.5.1, Genetics, the program does pose a risk to the natural-origin population due to high pHOS levels observed within the basins where the steelhead are released. Therefore, the overall effects would be low-adverse.

Touchet River Endemic Summer Steelhead

Under Alternative 1, the integrated Touchet River Endemic Summer Steelhead Program is expected to continue observed increasing trends in PNI. A PNI greater than 0.5 indicates that natural selection outweighs hatchery-influenced selection (HSRG 2014). Considering this, and low straying rates, the genetic risk to natural-origin steelhead is low within the Touchet River. Straying of program steelhead into

the Tucannon River, even at current low rates, would be expected to continue to have adverse genetic effects on that population because of its current low abundance and productivity.

Umatilla River Summer Steelhead

Future production of the integrated Umatilla River Summer Steelhead Program is likely to obtain a PNI greater than 0.67. As described in Section 3.3.5.1, Genetics, this program is intended to augment and supplement the natural population and is considered a viable program for recovery of the Middle Columbia River Steelhead DPS. Considering this, combined with high PNI estimates and low stray rates, the potential for negative effects on naturally spawning fish is low. NMFS believes maintaining a pNOB of 70 percent and a pHOS at current levels enables the program to meet PNI goals and is within acceptable gene flow recommendations. The low stray rates for this program would limit genetic effects on natural-origin steelhead to the Umatilla River population of MCR steelhead.

Round Butte Summer Steelhead

Considering currently high stray rates of both out-of-basin steelhead and program fish within the Deschutes River Basin, future production of this program is likely to perpetuate on-going moderate-adverse genetic interactions with native Deschutes River summer steelhead. The low stray rates for this program would limit genetic effects on natural-origin steelhead to the Deschutes River populations of the MCR Steelhead DPS.

Hood River Winter Steelhead

Under Alternative 1, all hatchery winter steelhead encountered at the weirs would be removed from the spawning populations. The integrated Hood River Winter Steelhead Program would continue to use natural-origin broodstock, and be operated to obtain a PNI goal of exceeding 0.67 (although the recent PNI average has been 0.64). In addition, all hatchery winter steelhead encountered at facility weirs would be removed from the spawning populations when flow conditions permit. These removals, combined with low stray rates and average PNI rates of 0.64 indicates that natural selection would be equal to or dominant over hatchery selection in most years, and the net genetic effect on natural populations would be low. Although this program produces steelhead that are genetically similar enough to the natural population to be listed within the Lower Columbia River Steelhead DPS, hatchery-production is believed by NMFS to have adverse effects on natural populations. The low stray rates for this program would limit genetic effects on natural-origin steelhead to the Hood River population of the Lower Columbia DPS.Thus, although a PNI of 0.64 would support the recovery of ESA-listed winter steelhead in the subbasin, the overall genetic effect would be low-adverse.

Alternative 2, Proposed Action

Under Alternative 2, the operation of hatchery programs would be the same as under Alternative 1, except that the Round Butte Hatchery Summer Steelhead Program will complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program (Section 2.2, Alternative 2, Proposed Action). Overall, this alternative would have the same, low-adverse effect as Alternative 1. The integration of wild adult into the broodstock for the Round Butte Hatchery program and the proposal to reduce the proportion of hatchery adults spawning naturally is expected to result in a low-adverse effect, which is a reduction relative to Alternative 1. However, for the other three steelhead programs that will continue to operate under current conditions that are likely to appear in the future, the genetic effects would be the same as that of Alternative 1.

Alternative 3, Reduced Production

Reduction of hatchery programs by 50 percent under Alternative 3 would reduce the hatchery-influenced selection from all steelhead programs and may increase PNI for the programs. A modest increase in PNI would be dependent on the abundance and productivity of the respective natural-origin populations and an increase in PNI would be expected to have a low-beneficial effect compared to Alternative 1. The integrated Hood River program is part of the Lower Columbia River Steelhead DPS, and the Touchet, Umatilla, and Round Butte programs are part of the Middle Columbia River Steelhead DPS. Therefore, each program is intended to contribute to genetic diversity of natural-origin fish. Regardless, although these programs would contribute to genetic diversity, and may increase PNI, hatchery-origin production in the natural environment is generally considered adverse and reduction of hatchery programs would have a low-beneficial effect on the genetics of natural-origin steelhead in the Study Area compared to Alternative 1.

Alternative 4, Program Termination

With immediate termination of the hatchery programs under Alternative 4, hatchery-origin fish that have already been released would return to the Touchet, Umatilla, Deschutes, and Hood River subbasins for 4 or 5 years and continue to be removed if encountered through another program, but removal would not take place at levels described in the HGMPs. Therefore, hatchery-influenced selection may temporarily increase, but would decrease as the hatchery-origin adults cease to return.

Elimination of all hatchery programs would have a low-beneficial to moderate-beneficial effect on Lower and Middle Columbia River and Snake River steelhead genetics compared to Alternative 1. As stated for Alternative 3, several integrated programs are part of the Lower Columbia River and Middle Columbia River Steelhead DPSs. Although these programs are intended to contribute to genetic diversity, hatchery-origin production in the natural environment is generally considered adverse and elimination of hatchery programs would have a low-beneficial effect on the genetics of natural-origin steelhead from the Lower and Middle Columbia River DPS in the Study Area compared to Alternative 1. Effects would be negligible-beneficial for the Snake River Steelhead DPS because straying into the domain of the Snake River DPS is low and limited to the Tucannon River.

4.3.2 Competition and Predation

The overall competition and predation effects from hatchery-origin Chinook Salmon and steelhead on natural-origin salmon and steelhead would be negligible-adverse or undetectable under Alternative 1, Alternative 2, and Alternative 3 (Table 4-4). Relative to Alternative 1, effects would be negligible-beneficial or undectable under Alternative 4.

Table 4-4. Summary of Effects on Natural-origin Salmon and Steelhead from Competition and Predation with Hatchery-origin Fish

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Chinook Salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Steelhead	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Coho Salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Sockeye Salmon	Undetctable	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Chum Salmon	Undetectable	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

4.3.2.1 Alternative 1, No Action

Competition and predation effects from all programs would be negligible-adverse for natural-origin populations of all salmon and steelhead in the Columbia River Basin. As noted in Section 3.3.5.3, Competition and Predation, most effects would be on the Lower Columbia River Chinook Salmon ESU, Middle Columbia River Steelhead DPS, Lower Columbia River Steelhead DPS, and Lower Columbia River Coho ESU. Sockeye and Chum Salmon are unlikely to encounter released hatchery juveniles included in this EA; and are therefore unlikely to be affected in any detectable manner. Overall, smolts released for the programs included in this EA may outcompete or prey on the equivalent of less than 0.2 percent of the natural-origin adult returns to the Columbia River Basin of each species (NMFS 2018b, 2018c). Hatchery Chinook Salmon smolts migrate out of the Study Area soon after release, with median travel times to Bonneville Dam of 7 days for Round Butte Hatchery spring Chinook Salmon (NMFS 2018b) and 15 days for Hood River spring Chinook Salmon (NMFS 2018c). Hatchery steelhead smolts also migrate out of the Study Area soon after release, with median travel times to Bonneville Dam ranging from a high of 49 days for Touchet River endemic summer steelhead (NMFS 2018b) to a low of 12 days for Hood River winter steelhead (NMFS 2018c).

Adults from the spring Chinook Salmon hatchery programs may compete for spawning sites and potentially superimpose natural-origin spring Chinook Salmon redds in the Study Area. The likelihood is low; however, because habitat is not fully seeded. Impacts of spring Chinook Salmon on steelhead and other salmonids in the Study Area would continue to be minimal due to differences in run-timing, holding, spawn timing, and spawning habitat preferences.

Because of similar run, holding, and spawn timing, hatchery steelhead that spawn naturally have an increased likelihood of competing and superimposing redds of natural-origin steelhead. However, the effect is likely to continue being negligible-adverse because natural-origin steelhead migrate farther upstream whereas hatchery steelhead tend to concentrate near the points of release, thus limiting their interactions; and, it is anticipated that pHOS would remain less than 30 percent, out-of-basin straying would remain low, and the effect of competition in the Hood River Subbasin would remain minimal NMFS 2018c). Impacts on other salmonids by hatchery-origin steelhead would remain negligible due to differences in run-timing, holding, spawn timing, spawning habitat preferences, and overall low abundance in some subbasins.

4.3.2.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). The increase in both steelhead and Chinook Salmon smolts could increase the possibility of competition and predation on natural-origin salmon and steelhead; however, the overall effect would be the same, negligible-adverse or undectable effect as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.3.2.3 Alternative 3, Reduced Production

The 50 percent reduction in hatchery production under Alternative 3 would theoretically result in similar reductions to competition and predation effects on natural-origin salmon and steelhead. However, effects

are currently considered negligible or undectable (NMFS 2018b, 2018c), and production from the programs included in this EA constitute only about 2.2 percent of the total hatchery releases from all programs in the Mid-Columbia River impact region (Section 3.7, Socioeconomics). Therefore, any meaningful changes in the effects of competition and predation from reducing production by 50 percent would most likely be undetectable but my have a negligible-benefiticial on populations within the basins where the hatchery fish are released. The competitive and predatory effects of hatchery-origin smolts and returning adults would therefore be negligible-benefiticial compared to Alternative 1.

4.3.2.4 Alternative 4, Program Termination

With the complete termination of hatchery programs under Alternative 4, facilities would not be used for these programs, but many would continue to operate for other salmon or steelhead programs described by NMFS (2014). Because there would be a reduction in the overall spring Chinook Salmon and steelhead hatchery production, and a subsequent reduction in juveniles released and returning adults in the Study Area over time, the hatchery programs' competitive and predatory effects would eventually subside. Because the production from the programs included in this EA constitute such a small percentage of the total hatchery releases from all programs in the Mid-Columbia River impact region, the effects would be negligible-beneficial to all natural-origin salmon and steelhead relative to Alternative 1. Ecological effects of program termination may be most substantial in the Deschutes River Subbasin where all steelhead hatchery programs would be terminated, and in the Hood River Subbasin because all hatchery programs would be terminated.

4.3.3 Prey Enhancement

Because adult Chinook Salmon do not typically eat after entering freshwater (Quinn 2005) and steelhead are the only species likely to be present and feeding as adults when hatchery subyearlings and yearlings are released from all programs in the spring (Section 3.3.5.4, Prey Enhancement), the effects of prey enhancement are analyzed only for steelhead (Table 4-5).

Table 4-5. Summary of Prey Enhancement Effect on Steelhead

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Steelhead	Negligible-beneficial	Same as Alternative 1	Negligible-adverse	Negligible-adverse

4.3.3.1 Alternative 1, No Action

Under Alternative 1, all hatchery programs would be operated as under current conditions and have a negligible-beneficial effect. No change would therefore be expected in the prey enhancement effects from Chinook Salmon and steelhead smolts released from the programs compared to those described in Section 3.3.5.4, Prey Enhancement.

4.3.3.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000

to 250,000 (Section 2.2, Alternative 2, Proposed Action). Therefore, the steelhead programs would have the same, negligible-beneficial effect as Alternative 1. Under the Alternative 2, the Round Butte Hatchery Summer Steelhead program would eliminate the release of fry above Round Butte Dam as part of the reintroduction program and replace these with a smaller number of hatchery smolts. The reduction in the total number of prey would decrease the prey enhancement effect, but effect of this reduction may be offset by the increase in the number of larger smolts released. The proposed increase in Hood River Spring Chinook production from 150,000 to 250,000 would result in a minor increase in prey availability but would not result in a change to the overall negligible-beneficial effect. Relative to how current conditions are likely to appear in the future, and the production changes under Alternative 2, the effect would be the same as that of Alternative 1.

4.3.3.3 Alternative 3, Reduced Production

Under Alternative 3, the total number of smolts released would be reduced compared to Alternative 1 and Alternative 2 to about 280,000 spring Chinook Salmon smolts, 215,000 spring Chinook Salmon fry, and 256,000 steelhead smolts, not counting post-smolts released into Lake Simtustus from the Round Butte Hatchery program. Steelhead would have a smaller number of smolts to prey on compared to Alternative 1, and the difference in effects would likely be negligible-adverse, especially because steelhead do not rely on smolts from the programs and would find other sources of food.

4.3.3.4 Alternative 4, Program Termination

Under Alternative 4, no program-related smolts would be available as a prey source for adult steelhead, though these fish are likely to find other sources of food. Therefore, this alternative would have a negligible-adverse effect compared to Alternative 1. A reduction in prey enhancement would be most substantial in reaches adjacent to and downstream of facilities that would cease to operate completely under Alternative 4, as described in Section 4.1, Water Quantity.

4.3.4 Diseases

The overall disease effects from hatchery-origin Chinook Salmon and steelhead on natural-origin salmon and steelhead would be negligible-adverse or undetectable under Alternative 1 and Alternative 2. Relative to Alternative 1, effects would be negligible-beneficial or undetectable under Alternative 3 and Alternative 4 (Table 4-6). NMFS (2018b, 2018c) determined that current practices minimize the risk of pathogen transmission to natural-origin salmon and steelhead for programs under the Proposed Action.

Table 4-6. Summary of Disease Effects on Salmon and Steelhead

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Chinook Salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Steelhead	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Coho Salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Chum Salmon	Undetectable	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

4.3.4.1 Alternative 1, No Action

Under Alternative 1, the hatchery programs would be operated with the same disease management protocols as current conditions, so no change in disease effects on other salmon and steelhead species would be expected. Although pathogens can be passed to and from natural-origin salmon and steelhead

that occupy rivers near hatchery facilities, several factors reduce the likelihood of disease and pathogen transmission between hatchery and natural fish. First, the proportion of facility surface water withdrawal and subsequent discharge at most sites represents only a portion of the total streamflow (Section 3.1, Water Quantity). This reduces, via dilution, the potential for transmission of pathogens from effluent (Section 3.2, Water Quality). Second, smolt release strategies typically promote distribution of hatchery fish throughout the system and rapid outmigration, which reduces the concentration of hatchery-released fish, and therefore, the potential for a diseased hatchery fish to encounter natural-origin salmon or steelhead. Chum Salmon are unlikely to encounter facilities included in this EA; and are therefore unlikely to encounter concentrations of hatchery-released fish. Finally, standard fish health protocols minimize the potential for disease and pathogen effects on natural-origin salmon and steelhead (NMFS 2018b, 2018c). Because few major outbreaks have occurred for any of the programs and management protocols have limited the extent and duration of any outbreaks, production of all salmon and steelhead discussed here would have a negligible-adverse effect.

4.3.4.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). The increase in juvenile Chinook Salmon releases increases the number of fish that could potentially transfer diseases to natural-orgin fish; however, the effect is likely to remain negligible, with no change in disease effects on other salmon and steelhead. Therefore, this alternative would have the same, negligible-adverse or undetectable effect as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.3.4.3 Alternative 3, Reduced Production

The 50 percent reduction in total quantity of smolts under Alternative 3 would result in a negligible-beneficial or undetectable effect on the potential for pathogen transmission to natural-origin fish associated with the hatchery programs compared to Alternative 1 because it would reduce the number of hatchery fish that can potentially transfer diseases to natural-origin fish. Although a slight beneficial effect might be realized, many facilities that propagate fish from these programs would continue to operate for other nonproject programs that would have similar disease effects on natural salmon and steelhead. This minimizes any beneficial effect compared to Alternative 1.

4.3.4.4 Alternative 4, Program Termination

Similar to Alternative 3, given the quantity of smolts that would be eliminated from the Study Area, terminated production under Alternative 4 would result in a negligible-beneficial or undetectable effect on the potential for pathogen transmission to natural-origin fish associated with the hatchery programs compared to Alternative 1. Although a slight beneficial effect might be realized, as discussed in Section 2.4, Alternative 4, with the exception of the Minthorn Springsacclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities, facilities that propagate fish from these programs would continue to operate for other nonproject programs that have similar disease effects on natural salmon and steelhead. This minimizes any beneficial effect compared to Alternative 1. Relative disease effects of program termination may be most substantial in the Deschutes River

Subbasin, where hatchery steelhead production would cease, and in the Hood River Subbasin where all hatchery production would cease.

4.3.5 Threatened Salmonid Population Viability

As discussed in Section 3.3.5.6, Population Viability, and in Appendix A, this discussion is limited to the ESA-listed Lower Columbia River Chinook Salmon ESU, and the Lower Columbia River, Middle Columbia River, and Snake River Steelhead DPSs because these are the only populations in the Study Area that have established population viability criteria. Chinook Salmon hatchery programs considered in this EA would have no effect on population viability for any of the steelhead DPSs and vice versa. Effects on population viability consider abundance, productivity, spatial structure, and diversity. Effects from same-species hatchery programs (i.e., conspecifics) on the ESA-listed Chinook Salmon ESU and steelhead DPSs are summarized below (Table 4-7).

Table 4-7. Summary of Population Viability Effects of Chinook Salmon Hatchery Programs on Natural-origin Chinook Salmon and Steelhead Hatchery Programs on Natural-origin Steelhead

ESU or DPS	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Lower Columbia River Chinook Salmon	Negligible adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Lower Columbia River Steelhead	Low adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Middle Columbia River Steelhead	Low adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Snake River Steelhead	Negligible adverse	Same as Alternative 1	Undetectable	Negligible-beneficial

4.3.5.1 Chinook Salmon

Alternative 1, No Action

Under Alternative 1, hatchery programs would release the number of smolts and/or fry as proposed in the HGMPs (Table 1-2). The integrated Hood River Spring Chinook Salmon Program would continue to use natural-origin adults returning to the Hood River, which is anticipated to build upon establishing a locally adapted stock (Hood River spring Chinook Salmon are considered extirpated) that would support the recovery of the Lower Columbia River Chinook Salmon ESU. Adaptation of the population to the subbasin would be expected to maximize diversity (genetic fitness), abundance and productivity, and spatial distribiution within the Hood River Subbasin supporting the population becoming self-sustaining, which would support recovery of the Lower Columbia River Chinook Salmon ESU. Although this integrated reintroduction program would be expected to contribute to the viability of the population, there is still the potential that the naturally spawning hatchery fish would have a negligible effect on population viability.

Fish from the segregated Round Butte Hatchery program are intended to: 1) increase harvest opportunity, and 2) contribute to natural population recovery via reintroduction above Round Butte Dam. The reintroduction component of this program is designed to allow hatchery-origin fish to spawn naturally. Although this would increase abundance and provide a benefit to population viability, stray fish from reintroduction hatchery programs would slightly increase genetic risks to natural-origin fish via hatchery-

influenced selection from hatchery fish spawning in the wild. These genetic risks are necessary when using hatchery fish for reintroduction if natural-origin adults are not available.

Genetic risks are present for both Chinook Salmon programs. Although the benefit of increased abundance exists for the Hood River integrated program and the reintroduction component of the Round Butte program, the overall effect of hatchery programs on natural-origin population viability in non-listed MCR Chinook Salmon ESU and the ESA-listed Lower River Spring Chinook Salmon ESU would be negligible-adverse.

Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except that the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). The increase in releases would be expected to increase the number of returning adults that could potentially contribute to the naturally spawning population thus increasing abundance and productivity as well as increasing spatial distribution, all of which would be expected to provide a slight benefitical effect on population viability compared to Alternative 1. Therefore, this alternative would have low-beneficial effect compared to Alternative 1 assuming that the naturally-spawning hatchery fish do not have a negative effect on the viability of the naturally-origin population.

Alternative 3, Reduced Production

Although the 50 percent reduction in hatchery production under Alternative 3 would reduce the small benefits to the Lower Columbia River Chinook Salmon ESU abundance relative to Alternative 1, it would decrease risks to genetics and productivity from hatchery-influenced selection. The Hood River Spring Chinook Salmon Program is not part of the Lower Columbia River Chinook Salmon ESU; however, it may provide benefits to abundance. Therefore, a reduction in program production may be a slight negative effect relative to Alternative 1. Overall, however, effects on population viability under Alternative 3 would be negligible-beneficial for the Lower Columbia River Chinook Salmon ESU relative to Alternative 1 because genetic risks are reduced for all programs by the reduction in production.

Alternative 4, Program Termination

With immediate termination of all hatchery programs under Alternative 4, hatchery-origin fish that have already been released would continue to be removed if encountered through another program, but removal would not take place at the levels described in the HGMPs because adult removal would not occur as described in the HGMP. Returning adults from previous releases for the integrated program would contribute to abundance for a short period, but the integrated program would not contribute to abundance thereafter. Hatchery productions would not contribute to genetic risks for all programs. Relative to Alternative 1, effects on population viability would be negligble-beneficial for the Lower Columbia River Chinook Salmon ESU. Although genetic risks would be eliminated by the termination of all hatchery programs, cessation of hatchery programs would also terminate the reintroduction program above Round Butte. This program may not yet be sustainable without the reintroduction hatchery program.

4.3.5.2 Steelhead

Alternative 1, No Action

Under Alternative 1, steelhead hatchery programs included in this EA would release the same number of smolts and/or fry as under current conditions. Effects on population viability would be low-adverse for the

Lower Columbia River Steelhead and Middle Columbia River Steelhead DPSs, and negligible-adverse for the Snake River Steelhead DPS because straying into the domain of the Snake River DPS is low. Steelhead hatchery programs covered in this EA would continue to produce a portion of hatchery fish intended to spawn naturally, which could contribute to increased future abundance. The increases in abundance from these programs, all of which are included in the Lower Columbia River or Middle Columbia River Steelhead DPSs, may provide a benefit to population viability by not only increasing abundance but also productivity and spatial distribution, while maintaining genetic diversity. Under future production scenarios under Alternative 1, NMFS expects that the integrated steelhead programs will obtain a minimum PNI exceeding 0.5 (or higher for some programs; NMFS 2018b, 2018c). Low straying and hatchery fish removal would minimize genetic risks from programs that are not intended for natural population supplementation because fish that have some hatchery influence may be less fit than natural-origin fish and could reduce the productivity of natural-origin fish if they spawn in the wild. In addition, spatial structure would be maintained or enhanced using various acclimation sites that encourage hatchery-origin adults to return to rivers where they were released. Over time, other viability factors, such as genetic diversity and spatial structure, would increase as natural-origin returns increase.

As discussed for Chinook Salmon (Section 4.3.5.1, Chinook Salmon), hatchery-origin fish that may spawn naturally pose genetic risks to natural-origin fish of the same species. Although the benefit of increased abundance exists for all of the integrated programs and the reintroduction component of the Round Butte program, the overall effect of hatchery programs on natural-origin population viability in the Lower Columbia River and Middle Columbia River Steelhead DPSs would be low-adverse. Because few steelhead from these hatchery programs stray into the Snake River Steelhead DPS domain, the overall effect would be negligible-adverse.

Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except that the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program (Section 2.2, Alternative 2, Proposed Action) with no change in the effects on population viability of all ESA-listed steelhead DPSs compared to Alternative 1 for the Touchet River Endemic, Umatilla River, and Hood River steelhead programs. The integration of wild adults into the broodstock for the Round Butte steelhead program and the proposal to reduce the proportion of hatchery adults spawning naturally is expected to further reduce effects to low-adverse and a slight reduction relative to Alternative 1. For the other three steelhead programs that will continue to operate under current conditions and which are likely to appear in the future, the effect would be the same as that of Alternative 1.

Alternative 3, Reduced Production

Although the 50 percent reduction in hatchery production under Alternative 3 would reduce the small benefits to the abundance of the Lower Columbia River Middle Columbia River Steelhead DPSs relative to Alternative 1, it would decrease risks to genetics and productivity from hatchery-influenced selection. All of the steelhead hatchery programs in this EA are part of the listed Lower Columbia River Steelhead DPS or Middle Columbia River Steelhead DPS and contribute to DPS abundance. Therefore, a reduction in production may be a slight negative effect relative to Alternative 1. Overall, however, effects on population viability under Alternative 3 would be negligible-beneficial for the Lower Columbia River and Middle Columbia River Steelhead DPSs relative to Alternative 1 because genetic risks are reduced for all programs by the reduction in production. Because few steelhead from these hatchery programs stray into the Snake River steelhead DPS domain, any change in effect on population viability compared to Alternative 1 would not be detectable.

Alternative 4, Program Termination

With immediate termination of all steelhead hatchery programs under Alternative 4, hatchery-origin fish that have already been released would continue to be removed if encountered through another program. However, removal would not take place at the levels described in the HGMPs because adult removal would not occur as described in the HGMP. Returning adults from previous releases for the integrated programs and the reintroduction component of the Round Butte program would contribute to abundance for a short period, but programs will not contribute to abundance thereafter. The terminated hatchery programs would reduce the number of naturally-spawning adults under Alternative 4, and any adverse effects from the naturally spawning hatchery fish would no longer affect natural-origin steelhead populations relative to Alternative 1. The hatchery programs and their potentially adverse effects on productivity of natural fish would not be expected to occur under Alternative 4, and the associated effects on population viability would be low-beneficial for the Lower Columbia River DPS. Effects would be negligible-beneficial for the Middle Columbia River Steelhead DPS because, although genetic-based effects on productivity would cease, so too would the reintroduction program, which would reduce abundance and spatial distribution in the Deschutes River. Because few steelhead from these hatchery programs stray into the Snake River steelhead DPS domain, any change in effect on population viability compared to Alternative 1 would be negligible-beneficial.

4.3.6 Nutrient Cycling

The overall effects of nutrient contribution in the form of marine-derived nutrients on natural-origin salmon and steelhead would be negligible-beneficial or undetectable for Alternative 1 and Alternative 2 (Table 4-8). Relative to Alternative 1, effects would be negligible-adverse or undetectable under Alternative 3 and under Alternative 4.

Table 4-8. Summary of Nutrient Cycling Effects on Salmon and Steelhead

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Chinook Salmon	Negligible-beneficial	Same as Alternative 1	Negligible-adverse	Negligible -adverse
Steelhead	Negligible -beneficial	Same as Alternative 1	Negligible-adverse	Negligible -adverse
Coho Salmon	Negligible -beneficial	Same as Alternative 1	Negligible-adverse	Negligible -adverse
Chum Salmon	Undetectable	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

4.3.6.1 Alternative 1, No Action

Under Alternative 1, NMFS expects nutrient cycling effects to remain the same as current conditions. Salmon and steelhead species discussed here benefit equally from additional nutrients provided by hatchery fish carcasses. Because hatchery-origin fish may compose from 0 percent to 50 percent of natural spwaners, depending on the program (Table 1-2), the programs would provide a negligible-beneficial effect on salmon and steelhead species that exist in the Study Area through nutrient cycling. The actual number of hatchery-origin fish allowed to spawn naturally is undetermined because the number would depend on how many natural-origin fish are on the spawning ground. However, a portion of hatchery-origin adult returns would be expected to spawn naturally and thereby contribute nutrients to the environment. Over time, returning hatchery fish that spawn naturally would contribute to marine-derived nutrients in the Study Area, increasing the overall benefit to the system. The overall effect would be negligible-beneficial.

4.3.6.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Summer Steelhead Hatchery Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). The increased release of hatchery spring Chinook salmon in the Hood River would be expected to increase the number of returning hatchery adults that could be used for nutrient enhancement and thus would have low-beneficial effect relative to Alternative 1. For the other hatchey programs this alternative would also have the same negligible-beneficial or undetectable effect as Alternative 1.

4.3.6.3 Alternative 3, Reduced Production

With the 50 percent reduction in hatchery programs under Alternative 3, hatchery releases would be reduced to about 280,000 spring Chinook Salmon smolts, 215,000 spring Chinook Salmon fry, 230,000 steelhead smolts, and 240,000 steelhead fry, not counting those released into Haystack Reservoir and the Jefferson County Fishing Pond from the Round Butte Hatchery programs. Program hatchery-origin adults would still return to the Study Area, with a portion spawning in the natural environment and carcasses subsequently contributing to nutrient cycling. Therefore, with regard to nutrient cycling, this alternative would have no more than a negligible-adverse effect compared to Alternative 1.

4.3.6.4 Alternative 4, Program Termination

Cessation of all program smolt releases (currently 560,000 summer Chinook Salmon smolts, 430,000 spring Chinook Salmon fry, 460,000 steelhead smolts, and 475,000 steelhead fry) under Alternative 4 would reduce the quantity of adult returns. Hatchery-origin smolts released prior to program termination would return to the Study Area for 4 or 5 years, and continue to contribute to nutrient cycling at reduced levels. Over time, hatchery-origin adults from the project programs would no longer return to the Study Area, and marine-based nutrient contribution attributed to program adults would cease. However, the overall small size of the programs relative to all programs in the Study Area would result in this alternative have a negligible-adverse effect compared to Alternative 1.

4.3.7 Facility Operations

The overall effects of facility operations on natural-origin salmon and steelhead would range from negligible-adverse to undetectable under Alternative 1 and Alternative 2. Relative to Alternative 1, effects would range from negligible-beneficial to undectable under Alternative 3 and Alternative 4 (Table 4-9).

Table 4-9. Summary of Facility Effects on Salmon and Steelhead

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Chinook Salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Steelhead	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Coho Salmon	Negligible-adverse	Same as Alternative 1	Negligible-beneficial	Negligible-beneficial
Chum Salmon	Undetectable	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

4.3.7.1 Alternative 1, No Action

Under Alternative 1, hatchery programs would be operated the same as under current conditions with no change in effects on salmon and steelhead from facility operations expected, including adult collection, surface water diversion, effluent discharge, and routine instream maintenance activities.

The effects of intake facilities on Chinook Salmon, steelhead, and Coho Salmon would be negligible-adverse. Chum Salmon are unlikely to encounter facilities included in this EA; therefore, effects on Chum Salmon would be undetectable. Effects on salmon and steelhead in the Study Area are negligible because the program facilities minimize any impediment of fish movement as discussed in Section 3.3.5.8, Facility Operations. Further, all facilities comply with current anadromous salmonid passage facility design criteria and guidelines (NMFS 2011). These criteria require the mesh or slot size in the screening material and the approach velocity of water toward the intake screening, meet standards that reduce the risk of both entrainment and impingement of listed juvenile salmonids. Moreover, facilities are routinely observed for any sign that screens are not effectively excluding fish from intakes.

Surface water withdrawals would not change from current operations; therefore, effects of water withdrawals and associated habitat degradation in diversion reaches assessed in Section 3.3.5.8, Facility Operations, are assumed into the future under Alternative 1. Note that because future climate change trends (Section 5.1, Past, Present, and Reasonably Foreseeable Actions) indicate juveniles may outmigrate earlier, the risk of dewatering juvenile rearing habitat when flows are at their lowest would be reduced even further (Dittmer 2013).

Weirs, ladders, and traps operated for Chinook Salmon and steelhead broodstock collection would continue to operate as they currently do, and potentially capture both natural- and hatchery-origin salmon and steelhead. Broodstock collection timing would be the same under Alternative 1 as under current operations, and broodstock collection for each facility would have the greatest effect on species that overlap in run timing (primarily spring Chinook Salmon and steelhead). Effects would range from migratory delay to mortality through stress from handling. Mortality would remain minimal, such as the annual average mortality rate of 0.07 percent of adult steelhead collected for the Umatilla River Summer Steelhead Program (ODFW and CTUIR 2017).

The spatial distribution of juvenile and adult salmon and steelhead likely would not be affected by weir operation because weirs are designed to allow juvenile passage, and natural-origin adults are passed upstream when not required for broodstock. Traps are checked daily and nontarget fish are removed and passed upstream.

Broodstock collection currently has a negligible-adverse effect on Chinook Salmon and steelhead. Similar effects would occur under Alternative 1. Coho Salmon are separated spatially and/or temporally from spring Chinook Salmon and steelhead collection periods, and are encountered at few of the collection facilities (NMFS 2018b, 2018c). Chum Salmon are unlikely to encounter facilities included in this EA; therefore, effects on Chum Salmon would be undetectable.

Operations would continue to include BMPs that limit the type, timing, and magnitude of allowable instream activities. In general, BMPs would limit effects to short-term, sublethal effects such as fish displacement, and/or startling of fish, and would not result in any deviation beyond normal fish behavioral responses to environmental disturbances. Therefore, routine maintenance activities would not result in harm, harassment, or mortality of salmon and steelhead. The overall effect would be negligible-adverse.

4.3.7.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to

incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Summer Steelhead Hatchery Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). Although the number of juvenile Spring Chinook Salmon produced would increase, no substantive changes in facility operations would be expected. Withdrawals from the East Fork Hood River would continue to be non-consumptive and would not exceed the existing water right of 5 cfs Therefore, this alternative would also have the same, negligible-adverse effect as Alternative 1 for Chinook Salmon, steelhead, and Coho Salmon, and an undetectable effect on Chum Salmon. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.3.7.3 Alternative 3, Reduced Production

The 50 percent reduction in hatchery production under Alternative 3 would reduce the required broodstock for collection and perhaps the collection period duration; however, many facilities would continue to operate to produce hatchery fish for other programs that are not included in this EA. Similarly, although lower program production would likely require less surface water for operations, nonproject operations would likely continue to divert surface water from adjacent waterbodies at most facilities. Therefore, this alternative would have no more than a negligible-beneficial effect compared to Alternative 1.

4.3.7.4 Alternative 4, Program Termination

With the complete termination of hatchery programs under Alternative 4, existing facilities would no longer be used to support these programs. As described in Section 4.1, Water Quantity, with the exception of the Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities, facilities would continue to operate to produce hatchery fish for other programs that are not included in this EA.that would have similar operational effects on natural salmon and steelhead. This minimizes any beneficial effect compared to Alternative 1 because, although the frequency at which salmon and steelhead are encountered would be less and the likelihood of migratory delay or mortality would be reduced, ongoing facility operations would continue at many sites, resulting in a negligible-beneficial effect on most salmon and steelhead compared to Alternative 1.

4.3.8 Research, Monitoring, and Evaluation

The overall effects of facility operations on natural-origin salmon and steelhead would range from negligible-adverse to undetectable under Alternative 1, Alternative 2, and Alternative 3. Relative to Alternative 1, effects would range from negligible-beneficial to undetectable under Alternative 4, depending on the species considered (Table 4-10).

Table 4-10. Summary of RM&E Effects on Salmon and Steelhead

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Chinook Salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Steelhead	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Coho Salmon	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Chum Salmon	Undetectable	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

4.3.8.1 Alternative 1, No Action

Under Alternative 1, RM&E activities currently part of the hatchery programs would be operated the same as under current conditions, so no change in effects on salmon and steelhead would be expected. Spawning ground surveys would continue to be performed during salmon and steelhead surveys, screw traps would continue to be operated the same as under current conditions, and juvenile fish sampling, tagging, and monitoring (e.g. electrofishing, snorkel surveys) would be performed the same way as under current conditions (Section 3.3.5.9, Research, Monitoring, and Evaluation). The effects of juvenile fish sampling would be minimized because smolt traps would have a negligible effect on migration. Angling in the Hood River would be performed following sport fishing equipment rules for selective fisheries and methods of electrofishing would be performed to minimize fish injury (Snow et al. 2014). All salmon and steelhead species are likely to be affected in a similar fashion, with the effects ranging from migratory delay to stress from handling (Section 3.3.5.9, Research, Monitoring, and Evaluation), leading to a negligible-adverse effect. Because smolt traps are checked daily, non-target fish can be removed on a daily basis, though handling may cause stress or injury to the fish. Considering the low number of Chum Salmon, and limited occurrence in the Study Area, the potential for effects on Chum Salmon would be undetectable.

4.3.8.2 Alternative 2, Proposed Action

Under Alternative 2, hatchery program operations would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Summer Steelhead Hatchery Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). No substantive changes in RM&E activities would be expected. Therefore, this alternative would also have the same, negligible-adverse effect as Alternative 1 for Chinook Salmon, steelhead, and Coho Salmon, and an undetectable effect on Chum Salmon. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.3.8.3 Alternative 3, Reduced Production

Under Alternative 3, the RM&E for both hatchery programs would be the same as under Alternative 1; however, lower production would reduce the level of effort required for RM&E, and therefore, reduce the presence of researchers in the natural environment. Regardless, Alternative 3 would result in no detectable change in effects on salmon and steelhead compared to Alternative 1. Therefore, this alternative would also have the same, negligible adverse effect as Alternative 1 for Chinook Salmon, steelhead, and Coho Salmon, and an undetectable effect on Chum Salmon.

4.3.8.4 Alternative 4, Program Termination

With the termination of hatchery programs under Alternative 4, surveys would presumably continue until all adults from terminated programs have returned. Future surveys and smolt trapping would be reduced in duration and frequency until all program-related RM&E is discontinued. RM&E used to inform non-project hatchery and natural monitoring objectives would continue to operate. Effects on salmon and steelhead related to such RM&E would continue as under Alternative 1. Thus, in those waterbodies, RM&E effects would be negligible beneficial for Chinook Salmon, steelhead, and Coho Salmon, and undetectable for Chum Salmon in the Study Area because of reduced effort associated with program-related RM&E.

As described in Section 4.1, Water Quantity, facilities that may cease operations because they are dedicated to programs considered in this EA include Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities. If these facilities cease to operate entirely, hatchery-related RM&E effects on salmon and steelhead would be reduced, especially in the Deschutes River Subbasin (steelhead only) and in the Hood River Subbasin where hatchery programs would be terminated.

4.3.9 Critical Habitat and Essential Fish Habitat

The overall effects of the alternatives on critical habitat and EFH for Chinook and Coho Salmon in the Study Area would be low-adverse for Alternative 1 and Alternative 2 (Table 4-11). Relative to Alternative 1, effects would be negligible-beneficial under Alternative 3, and low-beneficial under Alternative 4.

Table 4-11. Summary of Program Effects on Critical Habitat and EFH for Chinook and Coho Salmon

Species	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Chinook Salmon	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Coho Salmon	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial

4.3.9.1 Alternative 1, No Action

Under Alternative 1, all hatchery programs would be operated the same as under current conditions, with no change in water use or juvenile release strategies. Therefore, NMFS expects no change in effects on critical habitat or Chinook or Coho Salmon EFH compared to current conditions. Alternative 1 would result in a low-adverse effect on critical habitat and EFH for Chinook Salmon and Coho Salmon because production of hatchery fish may provide forage, through operation and existence of associated structures (e.g., weirs, water withdrawal structures, effluent, and maintenance and construction). Genetic and ecological interactions of hatchery-origin fish with natural-origin fish in the natural environment also affect complex channels and floodplain habitat, thermal refugia, and spawning habitat.

4.3.9.2 Alternative 2, Proposed Action

Under Alternative 2, hatchery program operation would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation component of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). Increased production of Hood River Spring Chinook Salmon may require additional withdrawals but existing water rights would not be exceeded. No change is expected regarding the effects on critical habitat and EFH for Chinook or Coho Salmon. Therefore, this alternative would have the same low-adverse effect as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.3.9.3 Alternative 3, Reduced Production

The 50 percent reduction in hatchery production under Alternative 3 would reduce the required broodstock for collection; however, many facilities would continue to operate for other nonproject programs. Similarly, although lower program production would likely require less surface water for operations, nonprogram operations would likely continue to divert surface water from adjacent waterbodies at most facilities. Therefore, this alternative would have no more than a negligible-beneficial effect on critical habitat and EFH compared to Alternative 1.

4.3.9.4 Alternative 4, Program Termination

With the complete termination of hatchery programs under Alternative 4, existing facilities would no longer be used to support these programs. As described in Section 4.1, Water Quantity, with the exception of the Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities, facilities would continue to operate for other programs with similar operational effects on critical habitat and EFH for Chinook and Coho Salmon. This would minimize any beneficial effect compared to Alternative 1 because, although the frequency at which salmon and steelhead are encountered would be less and the likelihood of migratory delay or mortality reduced, ongoing facility operations would continue at many sites, resulting in a low-beneficial effect on critical habitat and EFH compared to Alternative 1.

4.4 Fisheries

The overall effects of the hatchery programs on salmon and steelhead fisheries in the Study Area would be low-beneficial or medium-beneficial, depending on species, for Alternative 1 and Alternative 2 (Table 4-12). Relative to Alternative 1, effects would be negligible-adverse or low-adverse under Alternative 3 and low-adverse or medium-adverse under Alternative 4.

Table 4-12. Summary of Effects on Fisheries for Spring/Summer Chinook Salmon, Coho Salmon, and Steelhead

Fishery	Alternative 1 - No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 – Program Termination
Chinook Salmon	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Steelhead	Medium-beneficial	Same as Alternative 1	Low-adverse	Medium-adverse

4.4.1 Alternative 1, No Action

Returning hatchery-origin adult salmon and steelhead provide both recreational and tribal fisheries opportunities. Selective fisheries, in which only hatchery-origin salmon and steelhead with clipped adipose fins may be kept, are intended to increase fishing opportunities while also protecting natural-origin fish. Because hatchery programs play an important role in the implementation and management of fisheries, they would provide a continuing low-beneficial effect on recreational and tribal fisheries for Chinook Salmon and a medium-beneficial effect for fisheries on steelhead. Because steelhead that return to tributaries in the Study Area are part of the either the Middle Columbia River Steelhead DPS or the Lower Columbia River Steelhead DPS, both of which are listed as threatened under the ESA, hatchery-origin fish with their adipose-fin clipped are the only steelhead that may be harvested by recreational anglers. Hatchery-origin spring Chinook Salmon provide a recreational fishery in the Deschutes River, and are the only spring Chinook Salmon that may be harvested in the Hood River, where, natural-origin

fish are part of the Lower Columbia River Chinook Salmon ESU, which is listed as threatened under the ESA. Alternative 1 would therefore result in a low-beneficial effect to fisheries.

4.4.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation component of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). With the proposed increase in juvenile releases the average annual return of adult Spring Chinook Salmon to the Hood River would increase from 971 to about 1,000 (CTWERO 2017 and ODFW 2017). This would be a slight increase with no overall change in effects on fisheries. Therefore, this alternative would also have the same low-beneficial or medium-beneficial effects on Chinook Salmon and steelhead fisheries as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.4.3 Alternative 3, Reduced Production

The 50 percent reduction in hatchery production under Alternative 3 would reduce abundance relative to Alternative 1, and therefore reduce both recreational and tribal fishing opportunities. Although fishing opportunities from the programs included in this EA would be reduced, other programs would continue operating and provide fishing opportunities in the Columbia River and tributaries in the Study Area. Further reductions in harvest to protect natural-origin fish would therefore not be needed. The effect of reductions in production of Chinook Salmon and steelhead would therefore be negligible-adverse or low-adverse, because the fisheries have a large geographic scope.

4.4.4 Alternative 4, Program Termination

Termination of hatchery programs would decrease recreational and tribal fishing opportunities in the Study Area because the number of hatchery-origin fish would decrease substantially. Recreational fisheries would likely be further reduced to protect natural-origin steelhead and to a lesser extent natural-origin Chinook Salmon. Production resulting from operation of the Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities would cease entirely. Recreational fishing for steelhead in the Umatilla River, Deschutes River, and Hood River, and for Chinook Salmon in the Hood River, therefore, may cease entirely. Tribal fisheries may continue because those fisheries are non-selective, though opportunities would also be reduced because hatchery-origin adults would no longer contribute to the fisheries. Therefore, this alternative would have low-adverse effects for Chinook Salmon, and medium-adverse effects for steelhead compared to Alternative 1.

4.5 Other Fish Species

The overall effect on fish species other than salmon and steelhead would range from negligible-adverse to low-beneficial under Alternative 1 and Alternative 2 (Table 4-13). Relative to Alternative 1, effects would be generally negligible-beneficial or negligible-adverse under Alternative 3, and would range from low-beneficial to low-adverse under Alternative 4.

Table 4-13. Summary of Effects on Fish Species other than Salmon or Steelhead

Metric	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Competition and Predation	Low-adverse	Same as Alternative 1	Negligible-beneficial	Low-beneficial
Prey Enhancement	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Diseases	Negligible-adverse	Same as Alternative 1	Undetectable	Negligible-beneficial
Nutrient Cycling	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse
Facility Operations	Negligible-adverse	Same as Alternative 1	Undetectable	Negligible-beneficial
Research Monitoring and Evaluation	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.5.1 Alternative 1, No Action

Because production of salmon and steelhead smolts and fry and the estimated number of adult recruits under Alternative 1 would not change compared to current conditions, competition and predation effects would continue to be low-adverse for many fish species in the Study Area, especially for salmonid species such as bull trout, redband trout, and cutthroat trout that may compete for spawning grounds or experience redd superimposition with hatchery-origin salmonids. Effects on other fish species would likely be less than effects on natural-origin salmon and steelhead (Section 4.3.2, Competition and Predation) because of differences in spawn timing, location, and habitat preference. Predation by hatchery fish on native species, such as leopard dace and Umatilla dace, would also remain similar to current levels.

Prey enhancement related to hatchery production of salmon and steelhead would continue to have a low-beneficial effect on fish species in the Study Area that could prey on smolts or fry from the hatchery programs, though no fish species relies solely on salmonid smolts or fry. Available juvenile salmon and steelhead prey would remain similar to current numbers and predation on hatchery-origin juvenile salmon and steelhead by bull trout would remain similar to current levels. Predation on hatchery-origin salmon and steelhead by Pacific lamprey and river lamprey would also likely be similar to current conditions, as would the potential for hatchery salmon and steelhead to buffer Pacific lamprey from predation by marine mammals.

Diseases that are endemic to many fish species would continue to have a negligible-adverse effect on fish species in the Study Area, though such incidences are not likely to occur with current ongoing hatchery programs. Diseases that pose particular risk to hatchery-origin salmonids (i.e., BKD and IHN) only affect salmonid species. Although other salmonid species such as bull trout, redband trout, and cutthroat trout have the potential to occur near existing hatchery facilities and release sites, several factors such as the relatively low volume of discharge, smolt release strategies, and fish health protocols would continue to reduce the likelihood of disease and pathogen transmission between hatchery fish and other salmonids.

Most fish species in the Study Area would continue to indirectly benefit from nutrient cycling of carcasses from hatchery-origin fish through having enhanced nutrients available to their prey sources. Naturally spawning fish of hatchery origin or nutrient enhancement derived from fish spawned in hatcheries would continue to contribute to increased nutrient cycling in the natural environment.

Facility operations would continue to have negligible-adverse effects because program facilities minimize any impediment to fish movement as discussed in Section 3.5, Other Fish Species. Upstream migration

may be delayed slightly for fish trapped at collection facilities. Handling levels and potential for injury would remain unchanged from current conditions. Weirs may act as barriers that cause population subdivision if other fish species (e.g., small, non-game fish) are consistently not passed upstream. Effects of water diversions, intakes, effluent discharge, and maintenance activities would also remain unchanged.

RM&E activities would continue to have a negligible-adverse effect on fish species other than salmon and steelhead. Individuals would continue to be incidentally collected in traps and during surveys, and may suffer increased stress and minimal mortality. However, guidelines to reduce impacts on salmon and steelhead (NMFS 2008b) would continue to reduce effects on other species.

4.5.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). The reduction in summer steelhead fry would reduce the total number of prey available to Bull Trout and would decrease the beneficial effect, but this reduction may be offset by the increase in the number of larger smolts released. The increase in spring Chinook salmon smolts released by the the Hood River program may increase both competition and prey enhancement; however, overall, this alternative would have the same effects as Alternative 1 (Table 4-13). Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.5.3 Alternative 3, Reduced Production

Under Alternative 3, the 50 percent decrease in hatchery-origin salmon and steelhead smolt production would reduce competition and predation effects relative to Alternative 1. The change would be negligible-beneficial under Alternative 3 (Table 4-13) because fewer juvenile salmon and steelhead would compete with juvenile Coastal Cutthroat Trout and other fish species for prey and habitat space.

The decrease in hatchery-origin salmon and steelhead smolt production would also reduce the availability of an important prey resource of bull trout, and to a lesser extent of Pacific lamprey and river lamprey. Other food sources would remain available (e.g., insects, other fish species, frogs, snake, mice, waterfowl), because hatchery production and activities would not affect these resources. Therefore, the effect on prey enhancement on fish species other than salmon and steelhead would be negligible-adverse relative to Alternative 1.

Current rearing and release strategies and fish health protocols reduce the likelihood of disease and pathogen transmission between hatchery fish and other salmonids; however, reduction of hatchery production may further reduce the risk of disease amplification to salmonids other than salmon and steelhead. Reduction of hatchery production under Alternative 3 may result in a beneficial effect on other fish species relative to Alternative 1; however, this effect would likely be undetectable.

The 50 percent reduction in hatchery production under Alternative 3 would result in fewer hatchery-origin salmon and steelhead contributing to nutrient cycling in the Study Area. The corresponding reduced nutrient intake through prey sources would contribute to a negligible-adverse effect on other fish species relative to Alternative 1.

The 50 percent reduction in hatchery production under Alternative 3 would reduce the effort required to collect hatchery broodstock, which would reduce the number of nontarget fish collected; however, all facilities would continue to operate for the six programs and other programs described by NMFS (2014). Because most facilities would continue to operate similar to current conditions, though likely for shorter durations to meet reduced broodstock collection goals, any beneficial effect on fish species relative to Alternative 1 would be undectable.

RM&E activities would also continue even with the 50 percent reduction in production under Alternative 3. Because all RM&E activities would be similar to current conditions, the effect on fish species would be similar to Alternative 1.

4.5.4 Alternative 4, Program Termination

With the complete termination of hatchery programs under Alternative 4, facilities would not be used for these programs, but many would continue to operate for other salmon or steelhead programs described by NMFS (2014). As described in Section 4.1, Water Quantity, facilities that cease operations because they are dedicated to programs considered in this EA include Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities. Relative effects of program termination, such as reduced incidental handling and migration delays at the traps, may be most substantial in the Hood River.

Termination of the hatchery programs would reduce competition with and predation on other fish species, leading to an overall low-beneficial effect on other fish species relative to Alternative 1. Relative reductions would be negligible for many of the six programs, but would be more substantial in the Deschutes River Subbasin where all steelhead production would be terminated, and in the Hood River Subbasin, where all hatchery production would be terminated.

The programs would not release smolts or fry, eliminating one source of prey for some fish (especially bull trout) in the Study Area. This could result in a low-adverse effect on other fish species relative to Alternative 1. Relative effects would be negligible primarily because the majority of hatchery facilities and release sites are located downstream from areas likely to be inhabited by bull trout during most of the year.

Termination of hatchery programs would eliminate the risk of hatchery-related disease amplification to salmonids other than salmon and steelhead. Complete cessation of hatchery production in some watersheds would contribute to a negligible-beneficial effect on other fish species relative to Alternative 1.

Over time, as salmon and steelhead from terminated programs no longer return to the Study Area, hatchery-origin adults from the six programs would no longer contribute to nutrient cycling. Some hatchery-origin fish would successfully spawn in the natural environment, and therefore, add to future generations that would contribute to nutrient cycling. However, complete cessation of hatchery production in some watersheds, and corresponding reduced intake of nutrients through prey sources, would contribute to a low-adverse effect on other fish species relative to Alternative 1.

As previously noted, facilities would not be used for the six programs considered in this EA, but many would continue to operate for other salmon or steelhead programs. These facilities may operate with reduced intake and effluent discharge because of reduced production. Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities would cease operations. Reduced operation of some hatcheries and complete cessation of operations at other facilities would contribute to a negligible-beneficial effect on other fish species relative to Alternative 1.

RM&E would eventually terminate for these programs, but would likely continue to operate for other programs. The exception would be for programs in the Hood River Subbasin, where all hatchery production facility operations cease. Complete cessation of hatchery-related RM&E activities in these watersheds would contribute to a negligible-beneficial effect on other fish species relative to Alternative 1.

4.6 Wildlife

The overall effect on wildlife would range from negligible-adverse to negligible-beneficial under Alternative 1, Alternative 2, and Alternative 3 (Table 4-14). Relative to Alternative 1, effects would be negligible-beneficial or negligible-adverse under Alternative 4.

Table 4-14. Summary of Effects on Wildlife

Metric	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Prey Enhancement	Negligible-beneficial	Same as Alternative 1	Same as Alternative 1	Negligible-adverse
Diseases	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial
Nutrient Cycling	Negligible-beneficial	Same as Alternative 1	Same as Alternative 1	Negligible-adverse
Facility Operations	Negligible-adverse	Same as Alternative 1	Same as Alternative 1	Negligible-beneficial

4.6.1 Alternative 1, No Action

Because production of salmon and steelhead smolts and/or eggs, and the estimated number of adult recruits under Alternative 1 would not change compared to current conditions, undetectable change in effects on wildlife would be expected. Prey enhancement related to hatchery production of salmon and steelhead would continue to have a negligible-beneficial effect on wildlife species in the Study Area that could prey on smolts or fry from the hatchery programs, though no wildlife species relies solely on hatchery-origin salmon smolts, fry, or adults. Toxic contaminants and/or diseases found in hatchery-origin salmon and steelhead are unlikely to affect other wildlife species and would continue to have a negligible-adverse effect on wildlife species in the Study Area.

Most wildlife species in the Study Area (e.g., stream invertebrates, mammals, and birds) would continue to benefit from nutrient cycling of carcasses from hatchery-origin fish, either directly or indirectly. Naturally spawning fish of hatchery origin, or carcass placement of fish spawned in hatcheries, would continue to contribute to increased nutrient cycling in the natural environment.

Program facilities would continue to have negligible-adverse effects from handling, impedement of movements, etc., because only passive methods (i.e., netting and fencing around facilities) are used to deter predators such as great blue herons and river otters at facilities. Program facilities minimize impediments to wildlife movement, and staff members who can remove nontarget species would be present at weirs and traps during trapping operations and routine maintenance activities. Handling levels and potential for injury would remain unchanged from current conditions.

O&M at the hatcheries, weirs, and release locations may cause temporary effects on wildlife, including various species of birds, because of human presence and temporary elevated noise. Noise-sensitive wildlife are anticipated to temporarily relocate to adjacent habitats, which are abundant near program facilities. Effects from temporarily elevated noises are anticipated to remain unchanged from current conditions because no change in operation is proposed that would change the level of noise.

4.6.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). Increased production of Chinook Salmon may increase both competition and prey enhancement; however, overall, this alternative would have the same effects on wildlife as Alternative 1. Therefore, this alternative would have the same effects as Alternative 1 (Table 4-14). Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.6.3 Alternative 3, Reduced Production

Under Alternative 3, the geographic extent of effects of the hatchery programs on wildlife would be the same compared to Alternative 1. The 50 percent decrease in hatchery-origin salmon and steelhead smolt production would reduce the availability of prey compared to Alternative 1, though no wildlife species relies solely on salmon smolts, eggs, or adults. The overall effect on prey enhancement on wildlife would be the same as under Alternative 1.

Current rearing and release strategies and fish health protocols reduce the likelihood of toxic contaminants and pathogen transmission between hatchery fish and wildlife, and reduction of production under Alternative 3 would be minimal relative to overall production in the Study Area. Effects under Alternative 3 would therefore be similar to those under Alternative 1.

The 50 percent reduction in hatchery production under Alternative 3 would result in fewer hatchery-origin and natural-origin salmon and steelhead contributing to nutrient cycling in the Study Area, but the change would be minimal relative to overall production in the Study Area. Effects under Alternative 3 would therefore be similar to those under Alternative 1.

The 50 percent reduction in hatchery production under Alternative 3 may reduce the number of nontarget wildlife species incidentally captured, and potentially, the duration of the collection period; however, all facilities would continue to operate for the six programs and other programs described by NMFS (2014). Because all facilities would continue to operate similar to current conditions, effects under Alternative 3 would be similar to those under Alternative 1.

4.6.4 Alternative 4, Program Termination

With the complete termination of hatchery programs under Alternative 4, facilities would not be used for these programs, but many would continue to operate for other salmon or steelhead programs described by NMFS (2014). As described in Section 4.1, Water Quantity, facilities that may cease operations because they are dedicated to programs considered in this EA include Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities. Relative effects of program termination may be most substantial in the Hood River Subbasin.

Termination of hatchery programs would further reduce the availability of prey, which could increase competition among wildlife species with shared food preferences (e.g., among piscivorous avian species). This may shift predation pressure to other wildlife species to compensate for the loss in salmon, leading to a negligible-adverse effect on prey enhancement relative to Alternative 1. Relative reductions would be negligible for some of the six programs, but would be more substantial in the Deschutes River Subbasin

where all steelhead production would be terminated, and in the Hood River Subbasin, where all hatchery production would be terminated.

The programs would not release smolts or fry, eliminating one source of prey for some wildlife species in the Study Area. This could result in a negligible-adverse effect to wildlife species relative to Alternative 1. Relative effects would again be undetectable for some of the six programs, but more substantial in the Deschutes River Subbasin (steelhead only) and Hood River Subbasin where hatchery production would be terminated.

Termination of hatchery programs would eliminate the risk of limited types of hatchery-related toxins and pathogens transferrable to wildlife species. Complete cessation of hatchery production in some watersheds would contribute to a negligible-beneficial effect on wildlife relative to Alternative 1.

Over time, as salmon and steelhead from terminated programs no longer return to the Study Area, hatchery-origin adults from the six programs would no longer contribute to nutrient cycling. Some hatchery-origin fish would successfully spawn in the natural environment, and therefore, contribute to future generations that would contribute to nutrient cycling. However, complete cessation of hatchery production in some watersheds, and corresponding reduced intake of nutrients through prey sources would contribute to a negligible-adverse effect on wildlife species relative to Alternative 1.

As previously noted, facilities would not be used for the six programs considered in this EA, but many would continue to operate for other salmon or steelhead programs. Some facilities may cease operations because they are dedicated to programs considered in this EA. Complete cessation of these facility operations, including the elimination of some weirs and traps that may impede wildlife movement, would contribute to a negligible-beneficial effect on wildlife species relative to Alternative 1.

4.7 Socioeconomics

The overall effect on socioeconomics would be low-beneficial under Alternative 1 and Alternative 2 (Table 4-15). Relative to Alternative 1, effects would be negligible-adverse under Alternative 3 and low-adverse for Alternative 4.

Table 4-15. Summary of Effects on Socioeconomics

Resource	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Socioeconomics	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse

4.7.1 Alternative 1, No Action

Under Alternative 1, hatchery programs would operate in a similar manner as under current conditions. Recreational expenditures, employment opportunities, and the local procurement of goods and services related to hatchery operations would remain the same. Thus, the maximum potential contribution of over $471,000 in recreational expenditures, $855,000 in hatchery-related personal income, and 17 jobs to the regional economy would lead to a low-beneficial effect of these hatchery programs, as seen under current conditions.

4.7.2 Alternative 2, Proposed Action

Under Alternative 2, hatchery program operations would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating

approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). Although increased production of Hood River spring Chinook Salmon may result in approximately 30 additional returning adults, no overall change in recreational expenditures, employment opportunities, or the local procurement of goods and services related to hatchery operations is expected. Therefore, this alternative would have the same low-beneficial effect as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.7.3 Alternative 3, Reduced Production

Decreasing hatchery production by 50 percent under Alternative 3 could result in a reduction of harvest and associated recreational expenditures within the Study Area, though recreational fisheries targeting fish from other programs would continue. However, most facilities would continue to operate at essentially the same levels because of other programs. Although possible, it is unclear whether staff reduction and impacts on personal income would occur. Therefore, this alternative would have no more than a negligible-adverse effect compared to Alternative 1.

4.7.4 Alternative 4, Program Termination

Under Alternative 4, operations of hatchery programs described would no longer contribute to recreational expenditures, jobs, or operational expenses for the regional economy, though recreational fisheries targeting fish from other programs would continue. As described in Section 4.1, Water Quantity, facilities that would cease operations include Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities. At these facilities, hatchery-related expenditures, jobs, and operational expenses will be eliminated. Other facilities such as Lyons Ferry, Umatilla, and Oak Springs hatcheries would continue to operate at essentially current staffing levels because of other programs. This alternative would have a low-adverse effect compared to Alternative 1 because of reduced expenditures, jobs, and operational expenses.

4.8 Cultural Resources

The overall effect on cultural resources would be low-beneficial under Alternative 1 and Alternative 2 (Table 4-16). Relative to Alternative 1, effects would be negligible-adverse under Alternative 3 and low-adverse under Alternative 4.

Table 4-16. Summary of Effects on Cultural Resources

Resource	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Cultural Resources	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse

4.8.1 Alternative 1, No Action

Under Alternative 1, the hatchery programs would be operated as under current conditions, and the health and survival of fish would be the same relative to current conditions. Because conservation programs currently in place would be expected to increase Chinook Salmon and steelhead abundance and productivity, the tribes would continue to receive the surplus of adult fish collected. In addition, the

tribes would continue to harvest hatchery-origin fish, as well as benefit from increased natural production through the non-selective fisheries. The tribes would benefit through the long-term potential for salmon and steelhead to continue existing and for their populations to increase in size in the Columbia River Basin, resulting in a low-beneficial effect.

4.8.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of both hatchery programs would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Hatchery Summer Steelhead Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). Increased production of Hood River spring Chinook Salmon may result in approximately 30 additional returning adults. Therefore, this alternative would have the same low-beneficial effect as Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.8.3 Alternative 3, Reduced Production

Under Alternative 3, the effects of the hatchery programs on cultural resources would be similar to those under Alternative 1, but harvests would be reduced in the Study Area (Section 4.7, Socioeconomics). Reduced returns of hatchery fish could reduce harvest opportunities and surplus fish received by tribes, though some opportunities would remain through the reduced hatchery production relative to Alternative 1. Therefore, this alternative would have a negligible-adverse effect compared to Alternative 1.

4.8.4 Alternative 4, Program Termination

Under Alternative 4, hatchery programs would no longer contribute to tribal fisheries, the tribes receiving surplus fish, or to the abundance and productivity of salmon and steelhead in the Study Area. The tribes would be able to continue their non-selective fisheries, although a portion of their harvest would be reduced because hatchery production would no longer contribute to returning fishable adults. As described in Section 4.1, Water Quantity, facilities that cease operations because they are dedicated specifically to the programs considered in the Proposed Action include Minthorn Springs acclimation facility, Round Butte Hatchery and associated facilities, and Parkdale Hatchery and associated facilities. All hatchery production in the Deschutes River (steelhead only) and Hood River would cease. Hatchery programs would no longer contribute to tribes receiving surplus fish or to tribal fisheries. However, other facilities such as Lyons Ferry, Umatilla, and Oak Springs, hatcheries would likely continue to operate at essentially current levels because of other hatchery programs. Because the tribes would lose a portion of harvest and surplus fish, this alternative would have a low-adverse effect compared to Alternative 1.

4.9 Environmental Justice

The overall effect on environmental justice would be low-beneficial under Alternative 1 and Alternative 2 (Table 4-17). Relative to Alternative 1, effects would be negligible-adverse under Alternative 3 and low-adverse under Alternative 4.

Table 4-17. Summary of Effects on Environmental Justice

Resource	Alternative 1 – No Action	Effects of Alternative Relative to Alternative 1		
		Alternative 2 – Proposed Action	Alternative 3 – Reduced Production	Alternative 4 - Program Termination
Environmental Justice	Low-beneficial	Same as Alternative 1	Negligible-adverse	Low-adverse

4.9.1 Alternative 1, No Action

Under Alternative 1, the hatchery programs would continue to distribute fish collected for adult management to public entities (e.g., local food banks or food share organizations) and local tribes for ceremonial and subsistence purposes. The environmental justice communities of concern (Section 3.9, Environmental Justice) would benefit from the distribution of fish to local food banks to the extent these communities rely on these food banks. The programs would also continue to provide economic opportunities (Section 4.7, Socioeconomics) and fish of cultural importance to the tribes (Section 4.8, Cultural Resources). Therefore, this alternative would have a low-beneficial effect.

4.9.2 Alternative 2, Proposed Action

Under Alternative 2, the operation of all hatchery programs would be the same as under Alternative 1, except that (1) the Round Butte Hatchery Summer Steelhead Program would complete a transition to incorporating approximately 92 NOR adults into the broodstock for the reintroduction and mitigation components of the program, (2) the reintroduction component of the Round Butte Summer Steelhead Hatchery Program would include the release 100,000 smolts rather than 430,000 fry beginning in 2020, and (3) the Hood River Spring Chinook Salmon Program would increase juvenile releases from 150,000 to 250,000 (Section 2.2, Alternative 2, Proposed Action). No change in socioeconomics, tribal cultural resources, or fish distribution affecting the environmental justice communities of concern is expected as a result of these potential program changes. Therefore, this alternative would have the same low-beneficial effect as under Alternative 1. Relative to how current conditions are likely to appear in the future, the effect would be the same as that of Alternative 1.

4.9.3 Alternative 3, Reduced Production

Decreasing hatchery production under Alternative 3 could result in a reduction of charitable harvest donations. However, tribes, food banks and food share organizations would continue to benefit from receiving surplus fish for consumption and ceremonial purposes. It is likely that the 50 percent reduction in production of these programs under Alternative 3 would result in a negligible-adverse effect compared to Alternative 1.

4.9.4 Alternative 4, Program Termination

As previously described, termination of the hatchery programs under Alternative 4 would have a socioeconomic and cultural resources effect of low-adverse (Section 4.7, Socioeconomics and Section 4.8, Cultural Resources). Fishing for subsistence purposes may be affected in the Deschutes River (steelhead only) and the Hood River, where hatchery production would be terminated. Lyons Ferry, Umatilla, and Oak Springs hatcheries are used for programs beyond those analyzed in this EA. These hatchery facilities would continue to operate and provide charitable harvest donations to tribes, food bank, and nontribal organizations for consumption, ceremonial, or subsistence purposes. Therefore, this alternative would have a low-adverse effect compared to Alternative 1.

5 Cumulative Impacts

Cumulative impacts were assessed by combining the effects of each alternative with the effects of other past, present, and reasonably foreseeable future actions that are affecting or will affect the same resources potentially affected by each alternative. Actions are included only if they are tangible and specific, and if effects overlap temporally and geographically with the Proposed Action.

5.1 Past, Present, and Reasonably Foreseeable Actions

The impacts of past and present actions on resources potentially affected by the Proposed Action are recognized as current conditions described in Chapter 3, Affected Environment. Historical development of the Columbia Basin for electrical power, flood control, navigation, and agricultural needs influenced the existing condition of resources in the Study Area. This development, along with other factors such as historic harvest, has led to implementation of management and recovery actions, including numerous hatchery programs.

The expected impacts of the alternatives on all of the resources are described in Chapter 4, Environmental Consequences. Reasonably foreseeable future actions with the potential to have cumulative effects with the alternatives described in this EA include operation of hatchery programs as described in the Mitchell Act FEIS (NMFS 2014).

However, Chapter 4 does not take into account future foreseeable actions, especially in the context of future climate change. Climate change may also contribute to effects of the alternatives and is considered a reasonably foreseeable future condition[2] for purposes of this cumulative effects analysis.

5.1.1 Geographic and Temporal Scales

The geographic area included in the cumulative effects analysis for this EA includes the portion of the Columbia River Basin defined in Section 1.2, Project Area and Study Area. The project area includes locations immediately adjacent to hatchery facilities, acclimation sites, and weir locations. The scope of the action considered in this EA includes the rearing and release of hatchery steelhead and Chinook Salmon in the Walla Walla, Umatilla, Deschutes, and Hood River subbasins, as well as the Columbia River from the Walla Walla River downstream to Bonneville Dam. Adult collection, rearing, and release activities would occur in localized areas only; the associated direct and indirect effects of these activities would occur to varying degrees in the project area and larger study areas, depending on the affected resource, as analyzed in Chapter 4.

NMFS considered whether the mainstem Columbia River downstream from Bonneville Dam, estuary, and ocean should be included in the broad Study Area in this EA. Because NMFS was unable to detect or measure effects of the Proposed Action beyond the Study Area, it determined that the Proposed Action and alternatives would not contribute to cumulative effects beyond that same Study Area.

Available knowledge and research abilities are insufficient to discern the role and contribution of the Proposed Action to density dependent interactions affecting salmon and steelhead growth and survival in the mainstem Columbia River downstream from Bonneville Dam, Columbia River estuary, or Pacific Ocean. NMFS' generally concluded the influence of density-dependent interactions on growth and survival is likely small enough compared with the effects of large scale and regional environmental conditions that effects of the Proposed Action in the Study Area may contribute to effects outside the

[2] Climate change is not an "action" but a condition which affects both the proposed action and the past, present, and future actions discussed here.

Study Area, but this contribution would not be meaningful or discernible outside the Study Area. Although hatchery production on a scale many times larger than the Proposed Action may affect salmon survival at sea, the degree of impact or level of influence is not yet understood or predictable, nor is there evidence that hatchery programs of the size being evaluated in this EA, have effects in the ocean. Thus, neither direct nor indirect impacts of the programs on the human environment outside the Study Area are expected.

Although direct and indirect effects of the Proposed Action are not expected to be measurable outside the Study Area, it is important to consider how effects of certain activities outside the Study Area may or may not interact with the Proposed Action to exacerbate impacts on resources. Potential cumulative effects are analyzed below, as is how these effects might correspond with the cumulative effects of hatchery programs in the Columbia River Basin as evaluated in the Mitchell Act FEIS (NMFS 2014). The analysis of cumulative effects within the Study Area presented in this EA represents a local, specific evaluation of effects than is provided in the larger scale of the Mitchell Act FEIS, with the goal of determining if the cumulative effects within the Study Area are substantially different from or reveal effects not considered in the Mitchell Act FEIS.

The ESA Section 4(d) authorizations do not have a specified time limit. NMFS reviews annual reports provided by applicants, and authorizations may be modified when warranted by NMFS.

5.1.2 Climate Change

The project area is in the Pacific Northwest where the effects of climate change are affecting hydrologic patterns and water temperatures. Climate change impacts to the regional hydrologic cycle and ESA-listed salmon and steelhead populations, as well as their habitats, have been evaluated extensively across the Columbia River Basin (ISAB 2007; Karl et al. 2009; USBR 2016). Evidence of climate change includes increased average annual air and water temperatures over the past century.

According to the Independent Scientific Advisory Board (ISAB), average annual temperatures in the Northwest increased by approximately 1.8°F since 1900, or about 50 percent more than the global average evaluated over the same period of time (ISAB 2007). Earlier climate investigations estimated that the mean annual temperature in the Columbia River Basin increased by approximately 3.6°F since the late 1800s (USBR 2016). The latest climate models project a warming of 0.2°F to 1.1°F per decade over the next century (NMFS 2018b, 2018c).

In general, warming air temperature in winter and spring will lead to more precipitation falling as rain, rather than snow. At elevations along the transient snow zone, even a small amount of warming in winter may cause substantial shifts in the accumulated rainfall versus snowfall during the cool months (October through March); alternatively, locations at higher elevations typically experience winter temperatures far below freezing, so a slight increase in temperature may not initiate a shift from snow to rain (ISAB 2007). In watersheds that historically develop a seasonal snow pack, warmer temperatures will likely reduce snowpack depth and cause a temporal shift in snowmelt runoff.

Reduction in snowpack depth is attributed to both warming surface air temperatures and reduction of precipitation falling as snow (ISAB 2007). Annual snowpack measurements taken throughout the region on April 1 are considered a prime indicator of natural water storage available as runoff during the warmer months of the year. These measurements indicate a substantial snowpack reduction across the Pacific Northwest (Karl et al. 2009). For example, the average snowpack decline in the Cascade Mountains was about 25 percent over the past 40 to 70 years, and is projected to decline by as much as 40 percent by the 2040s (Karl et al. 2009). In general, declines in the Pacific Northwest snowpack are projected to continue over this century, varying with latitude, elevation, and proximity to the coastal regions.

Flow timing has shifted over the past 50 years, with the peak spring runoff shifting from a few days earlier in some places to as much as 25 to 30 days earlier in others (Karl et al. 2009). Throughout the region, shifts in timing and magnitude of snowmelt runoff increase the winter flood risk and summer drought risk in more sensitive watersheds. Increased winter temperatures and reduced snowpack would likely increase winter runoff, causing peak flows along rivers and large streams to increase and diminished runoff earlier in the season (ISAB 2007). Reductions in warm season (April through September) runoff in the region are expected to reach approximately 10 percent by mid-century (Karl et al. 2009). Impacts caused by shifts in flow timing range from lower streamflows to drought in the warmer months (June through September; ISAB 2007).

5.2 Harvest Management

Changes in fisheries harvest management may also have cumulative effects with the alternatives. The most recent *U.S. v Oregon* Management Agreement (NMFS 2018a) provides the framework for managing fisheries in the Columbia River Basin through 2027 to provide fair sharing of harvestable fish between tribal and non-tribal fisheries. Any changes in harvest management agreements may affect hatchery production in the Columbia River Basin, including production by programs included in this EA.

5.3 Development

Human population growth and resource needs will continue into the future. These needs may result in changes to existing land uses because of increases in residential and commercial development and roads, increases in impervious surfaces, conversions of private agricultural and forested lands to developed uses, increased potential for invasive species, and further development of alternative energy sources such as wind power. Development will continue to affect the natural resources in the Study Area.

Federal, state, and local laws, regulations, and policies will be applied with the intent to better enforce environmental protection for proposed future project developments. These laws, regulations, and policies include processes for public input, agency reviews, mitigation measures, permitting, and monitoring. The intent of these processes is to help ensure that development projects will occur in a manner that protects sensitive natural resources. The environmental goals and objectives of these processes are aimed at protecting ecosystems from activities that are regulated; however, not all activities are regulated to the same extent (e.g., large developments tend to be regulated more than smaller developments). Further, it is uncertain if all environmental goals and objectives can be successfully met by such processes. Unregulated or minimally regulated activities may lead to cumulative effects on sensitive natural resources over time. Thus, although Federal, state, and local laws, regulations, policies, and guidelines are in place to protect environmental resources from future development effects, there will continue to be some cumulative environmental degradation in the future from development, albeit likely to a lesser extent than has occurred historically when environmental regulatory protections did not exist or were not comprehensive and collaborative.

5.4 Impacts Analysis

This subsection will discuss the cumulative impacts for resources analyzed in Chapter 4. Of note, analysis from the Mitchell Act FEIS (NMFS 2014) is incorporated, where relevant, because the effects of the six programs included in this EA were included in the Mitchell Act FEIS as part of a broader analysis of 166 hatchery programs in the Columbia and Snake River basins. Cumulative impacts of these programs with other hatchery programs in the Columbia River Basin were analyzed in the Mitchell Act FEIS. The cumulative effects of the alternatives evaluated in this EA are presented relative to the selected alternative (Alternative 6) in the Mitchell Act FEIS (NMFS 2014). Additional discussion focuses primarily

on the cumulative effects on each resource beyond that considered in Chapter 4, Environmental Consequences, because of climate change, harvest management, and development.

5.4.1 Water Quantity

Successful operation of hatcheries depends on reliable supplies of surface water, spring water, or groundwater subsequently discharged to receiving waterbodies (Section 3.1, Water Quantity). Changes in production levels have the potential to affect water quantity by changing the amount of water withdrawn from a surface water body or groundwater for hatchery operations.

NMFS (2014, Section 4.6.4, Water Quantity) determined that reduced production could result in slightly decreased water use for Mitchell Act FEIS Alternative 6, the preferred alternative[1]. The total number of juvenile steelhead released would be similar to releases for all Mitchell Act FEIS alternatives for the hatchery programs; however, releases of Chinook Salmon would be higher than all Mitchell Act FEIS alternatives for the hatchery programs. Water use may therefore be slightly higher than analyzed in the Mitchell Act FEIS.

Climate change may affect water quantity by changing seasonal river flows. Some areas may experience reduced flows, increased flows, or a change in flow timing. Shifts in the timing and magnitude of snowmelt runoff may increase winter flows and the risk of summer drought. Increased winter temperatures and reduced snowpack could cause peak flows to increase and result in diminished runoff earlier in the season than under current conditions (ISAB 2007).

Under Alternatives 1 and 2 of this EA, the six hatchery programs are expected to have measurable negligible-adverse effects on water quantity. The effects on water quantity are due primarily to a small number of facilities diverting a relatively large proportion of streamflow over relatively short diversion reaches for a limited time during low-flow periods (Section 4.1, Water Quantity). Hatchery needs are likely to remain somewhat stable; therefore, any reductions in water quantity because of climate change would have greater effects than considered in Section 4.1, Water Quantity. Increases in production to meet increased harvest management goals could further exacerbate the adverse effects of the hatchery programs on water quantity. Increased needs for domestic water because of population growth, or decreased availability of water because of increased resource extraction would also amplify potential adverse affects. Effects under Alternative 3 would be similar to those under Alternative 1 and Alternative 2 because even with reduced production, all facilities would continue operating. Under Alternative 4, a number of the hatcheries would cease operations entirely; therefore, cumulative impacts would be similar to the effects considered in Section 4.1, Water Quantity.

5.4.2 Water Quality

Successful operation of hatcheries requires consistent supply of high quality water. NMFS (2014, Section 4.6.3, Water Quality) determined that reductions in hatchery production for Mitchell Act FEIS Alternative 6 could improve water quality minimally compared to current conditions through reductions in temperature, ammonia, nutrients (e.g., nitrogen), BOD, pH, sediment levels, antibiotics, fungicides, disinfectants, steroid hormones, and pathogens. For the Chinook Salmon programs that have higher production numbers than what was analyzed in the Mitchell Act FEIS alternatives, water quality effects may be slightly greater than analyzed in the Mitchell Act FEIS. However, the programs analyzed in this EA are likely to continue improving water quality, along with the other hatchery programs in the Columbia River Basin.

Continued discharge of effluent through other development, such as agriculture, is likely to continue affecting water quality. For those watersheds with established TMDLs, the water quality is expected to improve because the effluent should meet federal standards designed to improve water quality.

Given the close correspondence between surface air temperature and surface water temperature for many streams, climate change may affect water quality by increasing water temperatures and changing seasonal river flows. As a result, water quality may be degraded further relative to current conditions.

Under Alternatives 1 and 2 of this EA, the six hatchery programs are expected to have measurable, but negligible-adverse effects on water quality. The effects on water quality are due primarily to minor changes in water temperature, BOD, pH, and various nutrients and pollutants in receiving waters (Section 4.1, Water Quantity). Hatchery needs are likely to remain somewhat stable; therefore, any reductions in water quality because of climate change would have greater effects than considered in Section 4.2, Water Quality. Increases in production to meet increased harvest management goals could further exacerbate the adverse effects of the hatchery programs on water quality. Increased needs for domestic water because of population growth, or decreased availability of water because of increased resource extraction would also amplify potential adverse affects. Although decreased fish production in the six hatchery programs would slightly decrease the pollutant load discharged to receiving waters, all facilities would remain in operation. Pollutants would still be discharged to receiving waters; therefore, effects under Alternative 3 would be similar to those under Alternative 1 and Alternative 2. Under Alternative 4, a number of the hatcheries would cease operations entirely; therefore, cumulative impacts would be similar to the effects considered in Section 4.2, Water Quality.

5.4.3 Salmon and Steelhead

Cumulative impacts of hatchery production in the Columbia River Basin may benefit salmon and steelhead but also pose risks (Section 4.3, Salmon and Steelhead).

In the Mitchell Act FEIS, NMFS (2014) concluded that hatchery programs would:

- Affect natural-origin abundance where hatchery broodstock is collected from the natural-origin population
- Pose genetic risks to salmon and steelhead, affecting productivity and diversity at numerous hatcheries across the basin
- Employ weirs, which can impede spatial structure
- Pose risks of effects related to operation of hatchery facilities, such as blocked passage, reduced habitat, entrainment, and diminished water quality
- Pose competition and predation risks to natural-origin salmon and steelhead
- Pose a risk of masking hatchery effects without adequate marking and sampling
- Pose a risk of disease transfer to natural-origin populations

NMFS (2014, Section 4.2.3, Effects on Salmon and Steelhead) determined that natural-origin abundance of Columbia River salmon and steelhead would generally increase under all Mitchell Act FEIS alternatives relative to current conditions (Alternative 1). Genetic diversity would also likely increase under all alternatives relative to current conditions, with changes being similar under all alternatives compared to current conditions. Hatchery facility risks would be decreased from current conditions under Alternative 6. Competition with and predation on natural-origin juvenile salmonids would be reduced with decreases in hatchery production; however, decreases would be small under Alternative 6. Risks of masking and disease transfer may also be reduced through reduced hatchery production; therefore, relative effects would be similar to those for competition and predation. For the Chinook Salmon programs that have higher production numbers than analyzed in the Mitchell Act FEIS, effects on salmon and steelhead may be slightly greater than described in the Mitchell Act FEIS.

Climate change, particularly changes in streamflow and water temperatures, would likely impact natural-origin salmon and steelhead life stages in various ways. The effects of climate change on salmon and steelhead would vary among species and life history stages (ISAB 2007). Effects of climate change may affect every species and life history in every type of salmon and steelhead in the cumulative impacts Study Area (Glick et al. 2007; Mantua et al. 2009).

It is likely that, as climate change affects ocean conditions, abundances of salmon and steelhead would change accordingly, resulting in changes in abundance of adults returning to freshwater to spawn. Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, whereas cooler ocean periods have coincided with relatively high abundances (Karl et al. 2009).

If climate change reduces water volumes and increases water temperatures in the Study Area, it will likely reduce the suitable habitat for spring Chinook Salmon and steelhead rearing, potentially decreasing their abundance. Effects would likely be less on fish that migrate as subyearlings, and therefore do not rear during summer low flows. Lower summer flows and increased water temperatures may lead to an increase in the abundance of nonnative warm water species that can compete and prey on listed salmon and steelhead. Warmer water temperatures may also increase the incidence of disease outbreaks and pathogen virulence in both the natural population and hatchery-produced juveniles. On the other hand, warmer water temperature may also shift pathogen composition by increasing pathogens that thrive in warmer waters and decreasing pathogens susceptible to warmer waters.

Although climate change may well impact the abundance and/or distribution of salmon and steelhead populations being considered under all of the alternatives in this EA, the proposed hatchery management described in the HGMPs and the associated monitoring provides the ability to evaluate hatchery program impacts as abundances change, making appropriate adjustments feasible and timely. Increases in production to meet increased harvest management goals could also be accommodated as needed. Increased resource extraction could reduce the amount of habitat available for natural-origin fish, further increasing the needs for increased hatchery production. Therefore, the cumulative impacts on salmon and steelhead under Alternative 1 and Alternative 2 of this EA may extend beyond that considered in Section 4.3, Salmon and Steelhead, because of the potential changes in natural production and distribution, and changes in hatchery production and operations that may be required.

Under Alternative 3 and Alternative 4 of this EA, the number of smolts released would decrease; effects on salmon and steelhead would range from low-beneficial to low-adverse (Section 4.3, Salmon and Steelhead). However, similar to Alternative 1 and Alternative 2 of this EA, the cumulative impacts on salmon and steelhead when including climate change, harvest management, and development may extend beyond that considered in Section 4.3, Salmon and Steelhead.

5.4.4 Fisheries

As described above, climate change, harvest management requirements, and development will likely affect the abundance and/or distribution of salmon and steelhead. These impacts would likely result in changes to management actions such as regulation of fisheries to make appropriate adjustments. The cumulative impacts on fisheries under all alternatives of this EA may extend beyond that considered in Section 4.4, Fisheries, because of the potential changes in natural production and distribution, and changes in hatchery production and operations.

5.4.5 Other Fish Species

NMFS (2014, Section 4.2.4, Effects on Other Fish Species that Have a Relationship to Salmon and Steelhead) determined that reductions in hatchery production for Mitchell Act FEIS Alternative 6 would

likely result in reduced competition and predation for Bull Trout, Pacific Lamprey, and other fish species, and prey resources compared to current conditions; however, the change under Alternative 6 would be minor. For the Chinook Salmon programs that have higher production numbers than analyzed in the Mitchell Act FEIS, effects on other fish species may be slightly greater than described in the Mitchell Act FEIS.

Other fish species would likely respond to climate change and development in similar ways as salmon and steelhead. Habitat may be affected by future changes in land development, water temperatures, precipitation, and extreme events. Fish that are more adaptable to degraded or warmer aquatic conditions could ultimately replace native cold water fish as the dominant species, but the mitigated benefits from habitat restoration actions are difficult to predict.

Under Alternative 1 and Alternative 2 of this EA, hatchery juveniles and adults would continue to either be prey for other fish species, prey upon other fish species, and/or compete for resources with other fish species. However, because climate change and development may favor introduced warmer water fish over native cold water fish, the cumulative impacts on other fish species may be greater than those described in Section 4.5, Other Fish Species.

Under Alternative 3 and Alternative 4 of this EA, the number of smolts released would decrease; effects on other fish species would range from low-beneficial to low-adverse (Section 4.5, Other Fish Species). However, because climate change and development may favor introduced warmer water fish over native cold water fish, the cumulative impacts on other fish species may be greater than those described in Section 4.5, Other Fish Species.

5.4.6 Wildlife

NMFS (2014, Section 4.5.4, Wildlife Species Effects) determined that wildlife populations would be expected to increase under Alternative 6[1] of the Mitchell Act FEIS (Section 1.4.7, Mitchell Act). For the Chinook Salmon programs that have higher production numbers than what was analyzed in the Mitchell Act FEIS alternatives, effects on wildlife may be slightly greater than described in the Mitchell Act FEIS.

The effects of climate change and development on wildlife could include decreased distribution because of warmer summer temperatures and loss of insulating snow cover for mammals in winter, habitat degradation, or reductions in food availability through effects on prey species such as salmon and steelhead. Reduction in salmon and steelhead carcasses would decrease nutrients available to wildlife. A reduction in the number of live fish could affect predators such as bald eagles and golden eagles.

Under Alternative 1 and Alternative 2 of this EA, hatchery juveniles and adults would continue to be either prey for wildlife or provide nutrients both inside and outside the Study Area. Although climate change and development may negatively affect salmon and steelhead, hatchery production would continue; therefore, the cumulative impacts on wildlife would likely be similar to those described in Section 4.6, Wildlife.

Under Alternative 3 and Alternative 4 of this EA, the cumulative impacts on wildlife may differ from those under Alternatives 1 and 2 because the number of smolts released would decrease; however, effects on wildlife would range from negligible-beneficial to negligible-adverse (Section 4.6, Wildlife). The cumulative impacts on wildlife would likely be similar to those described in Section 4.6, Wildlife. Although no marine mammals occur within the study area, the reduction and/or termination of the hatchery programs under these alternatives would reduce the abundance of prey for marine mammals, however, the contribution from the proposed production to the prey base for pinnipeds would be undetectable relative the overall abundance of salmon and steelhead and other prey available. Pinnipeds are opportunistic predators that are not food limited in the region. Southern resident killer whales may have small but meaningful benefit from individual hatchery programs when considered with other programs as generally increasing

availability of prey for this food limited species, so reduction or termination may have negligible adverse effect on Southern resident killer whales.

5.4.7 Socioeconomics

Socioeconomic conditions represent effects from many years of development and attempts to mitigate for that development through hatchery programs and other restoration actions. NMFS (2014, Section 4.3.4, Harvest and Economic Values) determined that under Alternative 6 economic benefits would be increased relative to current conditions. Climate change, harvest management, and development could possibly have indirect effects through potential changes in hatchery operations in response to changes in water quantity, wate quality, and harvest goals.

Under Alternative 1 and Alternative 2 of this EA, the total number of juvenile steelhead released would be similar to releases for Mitchell Act FEIS Alternative 6 for the hatchery programs. Alternative 1 and Alternative 2 also would have similar contributions to total harvest, total economic benefit to income, jobs, and recreational expenditures. Releases of Chinook Salmon would be higher than all Mitchell Act FEIS alternatives for the hatchery programs; therefore, contributions to total harvest, total economic benefit to income, jobs, and recreational expenditures may be slightly higher than those described by NMFS (2014). The cumulative impacts on socioeconomics would likely be similar to those described in Section 4.7, Socioeconomics.

Under Alternative 3 and Alternative 4 of this EA, the cumulative impacts on socioeconomics may differ than those under Alternatives 1 and 2 because the number of smolts released and returning adults would decrease; however, any decreases in total harvest, total economic benefit to income, jobs, and recreational expenditures would be negligible to low (Section 4.7, Socioeconomics). The cumulative impacts under Alternative 3 and Alternative 4 would not be measurable beyond that analyzed in the Mitchell Act FEIS. The cumulative impacts on socioeconomics would likely be similar to those described in Section 4.7, Socioeconomics.

5.4.8 Cultural Resources

Tribal harvest conditions also represent effects from many years of development and attempts to mitigate for that development through hatchery programs and other restoration actions. However, future climate change and development could reduce the number of salmon and steelhead available for harvest.

Under Alternative 1 and Alternative 2 of this EA, the total number of juvenile steelhead released would be similar to releases for all Mitchell Act FEIS alternatives, but releases of Chinook Salmon would be higher than all Mitchell Act FEIS alternatives. The number of adult Chinook Salmon available for tribal harvest may be higher than described by NMFS (2014). However, cumulative impacts are unlikely to change substantially from those considered in Section 4.8, Cultural Resources.

Under Alternative 3 and Alternative 4 of this EA, the number of juvenile salmon released, and therefore the number of adult salmon available for tribal harvest or as surplus (Section 4.7, Socioeconomics) could be less than under Alternative 1 and Alternative 2. However, cumulative impacts under Alternative 3 and Alternative 4 would not be measurable beyond that analyzed in the Mitchel Act FEIS. The cumulative impacts on cultural resources would likely be similar to those described in Section 4.8, Cultural Resources.

5.4.9 Environmental Justice

Distribution of surplus fish from hatchery programs is dependent on fish availability and at least indirectly affected by levels of hatchery production and harvest policies. NMFS (2014, Section 4.4.4, Analysis of

Environmental Justice Effects) determined that tribal harvests would increase under Mitchell Act FEIS Alternative 6. As previously noted, the total number of juvenile steelhead released would be similar to releases for all Mitchell Act FEIS alternatives for the hatchery programs, but releases of Chinook Salmon would be higher than all Mitchell Act FEIS alternatives. For the Chinook Salmon programs that have higher production numbers than what was analyzed in the Mitchell Act FEIS alternatives, environmental justice effects may be slightly greater than analyzed in the Mitchell Act FEIS. Future climate change and development could possibly reduce the number of hatchery-origin salmon and steelhead available for harvest and distribution. Reductions in the number of fish available because of climate change and development may result in greater cumulative impacts than considered in Section 4.9, Environmental Justice.

Under Alternative 3 and Alternative 4 of this EA, the number of adult salmon available for harvest or distribution may be less than under Alternative 1 or Alternative 2 (Section 4.9, Environmental Justice). Further reductions in the number of fish available because of climate change and development may result in cumulative impacts being greater than those considered in Section 4.9, Environmental Justice.

6 Agencies Consulted

Bonneville Power Administration

US. Fish and Wildlife Service

Oregon Department of Fish and Wildlife

Washington Department of Fish and Wildlife

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Appendix A. Population Viability of Salmon and Steelhead in the Study Area

Steelhead from the Lower Columbia River, Middle Columbia River, and Snake River DPSs, and Chinook Salmon from the Lower Columbia River Chinook Salmon ESU may be impacted under the alternatives presented in this EA during broodstock collection activities and from ecological interactions within tributaries in the Study Area, including the mainstem Columbia River from the Walla Walla River confluence downstream to Bonneville Dam. Population viability information for these ESA-listed populations of steelhead and Chinook Salmon are presented in this appendix.

Lower Columbia River Chinook Salmon

The Hood River Spring Chinook Salmon Program is a reintroduction program that currently uses both natural- and hatchery-origin broodstock with a long term goal of achieving 100 percent of broodstock needs using natural-origin spring Chinook Salmon returning to the subbasin.

On March 24, 1999, NMFS listed the Lower Columbia River Chinook Salmon ESU as a threatened species (64 FR 14308). The threatened status was reaffirmed on April 14, 2014. Thirty-two historical populations within six MPGs compose the LCR Chinook Salmon ESU (Table A-7-1). The run-timing distributions across the 32 historical populations are: 9 spring populations, 21 early-fall populations, and 2 late-fall populations (Table A-2). Within the geographic range of this ESU, 27 hatchery Chinook Salmon programs are currently operational. Fourteen of these hatchery programs are included in the ESU but the remaining 13 programs are excluded (Jones Jr. 2015). Willamette River Chinook Salmon are listed within the Willamette River Chinook Salmon ESU, but they are not listed within the Lower Columbia River Chinook Salmon ESU.

Table A-7-1. Lower Columbia River Chinook Salmon ESU Components

ESU Components	
Natural Production	
Major Population Group	**Populations**
Cascade Spring	Upper Cowlitz, Cispus, Tilton, Toutle, Kalama, North Fork Lewis, Sandy
Gorge Spring	White Salmon, Hood River
Coast Fall	Grays/Chinook, Elochoman, Mill Creek, Youngs Bay, Big Creek, Clatskanie, Scappoose
Cascade Fall	Lower Cowlitz, Upper Cowlitz, Toutle, Coweeman, Kalama, East Fork Lewis, Salmon Creek, Washougal, Clackamas, Sandy River early
Gorge Fall	Lower Gorge, Upper Gorge, White Salmon, Hood River
Cascade Late Fall	North Fork Lewis, Sandy
Artificial Production	
Hatchery programs included in ESU (14)	Big Creek Tule Fall Chinook, Astoria High School (STEP), Tule Fall Chinook, Warrenton High School (STEP), Tule Fall Chinook, Cowlitz Tule Fall Chinook Salmon Program, North Fork Toutle Tule Fall Chinook, Kalama Tule Fall Chinook, Washougal River Tule Fall Chinook, Spring Creek National Fish Hatchery (NFH) Tule Chinook, Cowlitz spring Chinook Salmon (2 programs), Friends of Cowlitz spring Chinook, Kalama River Spring Chinook, Lewis River Spring Chinook, Fish First Spring Chinook, Sandy River Hatchery Spring Chinook Salmon (ODFW stock #11)
Hatchery programs not included in ESU (13)	Deep River Net-Pens Spring Chinook, Clatsop County Fisheries (CCF) Select Area Brights Program Fall Chinook, CCF Spring Chinook Salmon Program, Carson NFH Spring Chinook Salmon Program, Little White Salmon NFH Tule Fall Chinook Salmon Program, Bonneville Hatchery Tule Fall Chinook Salmon Program, Hood River Spring Chinook Salmon Program, Deep River Net Pens Tule Fall Chinook, Klaskanine Hatchery Tule Fall Chinook, Bonneville Hatchery Fall Chinook, Little

ESU Components	
Natural Production	
	White Salmon NFH Tule Fall Chinook, Cathlamet Channel Net Pens Spring Chinook, Little White Salmon NFH Spring Chinook

Sources: Jones Jr. (2015); NWFSC (2015); NMFS (2018c);

Table A-7-2. Current Status for Lower Columbia River Chinook Salmon Populations and Recommended Status under the Recovery Scenario

Major Population Group	Population (State)	Status Assessment		Recovery Scenario	
		Baseline Persistence Probability[1]	Contribution[2]	Target Persistence Probability	Abundance Target[3]
Cascade Spring	Upper Cowlitz (WA)	VL	Primary	H+	1,800
	Cispus (WA)	VL	Primary	H+	1,800
	Tilton (WA)	VL	Stabilizing	VL	100
	Toutle (WA)	VL	Contributing	M	1,100
	Kalama (WA)	VL	Contributing	L	300
	North Fork Lewis (WA)	VL	Primary	H	1,500
	Sandy (OR)	M	Primary	H	1,230
Gorge Spring	White Salmon (WA)	VL	Contributing	L+	500
	Hood (OR)	VL	Primary[4]	VH[4]	1,493
Coast Fall	Youngs Bay (OR)	L	Stabilizing	L	505
	Grays/Chinook (WA)	VL	Contributing	M+	1,000
	Big Creek (OR)	VL	Contributing	L	577
	Elochoman/Skamokawa (WA)	VL	Primary	H	1,500
	Clatskanie (OR)	VL	Primary	H	1,277
	Mill/Aber/Germ (WA)	VL	Primary	H	900
	Scappoose (OR)	L	Primary	H	1,222
Cascade Fall	Lower Cowlitz (WA)	VL	Contributing	M+	3,000
	Upper Cowlitz (WA)	VL	Stabilizing	VL	--
	Toutle (WA)	VL	Primary	H+	4,000
	Coweeman (WA)	VL	Primary	H+	900
	Kalama (WA)	VL	Contributing	M	500
	Lewis (WA)	VL	Primary	H+	1,500
	Salmon (WA)	VL	Stabilizing	VL	--
	Clackamas (OR)	VL	Contributing	M	1,551
	Sandy (OR)	VL	Contributing	M	1,031
	Washougal (WA)	VL	Primary	H+	1,200
Gorge Fall	Lower Gorge (WA/OR)	VL	Contributing	M	1,200
	Upper Gorge (WA/OR)	VL	Contributing	M	1,200

Major Population Group	Population (State)	Status Assessment		Recovery Scenario	
		Baseline Persistence Probability[1]	Contribution[2]	Target Persistence Probability	Abundance Target[3]
	White Salmon (WA)	VL	Contributing	M	500
	Hood (OR)	VL	Primary[4]	H[4]	1,245
Cascade Late Fall	North Fork Lewis (WA)	VH	Primary	VH	7,300
	Sandy (OR)	H	Primary	VH	3,561

Sources: Jones Jr. (2015); NWFSC (2015); NMFS (2018c)

[1] LCFRB (2010) used the late 1990s as a baseline period for evaluating status; ODFW (2010) assume average environmental conditions of the period 1974-2004. VL = very low, L = low, M = moderate, H = high, VH = very high. These are adopted in the recovery plan NMFS (2013).

[2] Primary, contributing, and stabilizing designations reflect the relative contribution of a population to recovery goals and delisting criteria. Primary populations are targeted for restoration to a high or very high persistence probability. Contributing populations are targeted for medium or medium-plus viability. Stabilizing populations are those that will be maintained at current levels (generally low to very low viability), which is likely to require substantive recovery actions to avoid further degradation.

[3] Abundance objectives account for related goals for productivity (NMFS 2013).

[4] Oregon's analysis indicates a low probability of meeting the delisting objective of high persistence probability for this population.

Lower Columbia River Steelhead DPS

On March 19, 1998, NMFS listed the Lower Columbia River Steelhead DPS as a threatened species (63 FR 13347). The threatened status was reaffirmed on January 5, 2006 (71 FR 834) and most recently on April 14, 2014 (79 FR 20802). The DPS includes all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers, Washington (inclusive), and the Willamette and Hood Rivers, Oregon (inclusive), as well as multiple artificial propagation programs (NWFSC 2015).

The Lower Columbia River Steelhead DPS is composed of 23 historical populations, distributed through two ecological zones, split by summer or winter life history resulting in four MPGs (Table A-7-3). The DPS includes six summer-run populations and seventeen winter-run populations (Jones Jr. 2015; NWFSC 2015). Inside the geographic range of the DPS, 29 hatchery programs are currently operational, of which only seven are considered part of the ESA-listed DPS Excluded are steelhead in the upper Willamette River Basin above Willamette Falls, Oregon, and from the Little White Salmon and White Salmon Rivers, Washington.

Table A-7-3. Lower Columbia River Steelhead DPS Components

DPS Components	
Natural Production	
Major Population Group	**Populations**
Cascade summer	Kalama, North Fork Lewis, East Fork Lewis, Washougal
Gorge summer	Wind, Hood
Cascade winter	Lower Cowlitz, Upper Cowlitz, Cispus, Tilton, South Fork Toutle, North Fork Toutle, Coweeman, Kalama, North Fork Lewis, East Fork Lewis, Salmon Creek, Washougal, Clackamas, Sandy
Gorge winter	Lower Gorge, Upper Gorge, Hood

DPS Components	
Natural Production	
Major Population Group	**Populations**
Artificial Production	
Hatchery programs included in DPS (7)	Kalama River Wild Winter, Kalama River Wild Summer, Hood River Winter (ODFW stock # 50), Cowlitz Trout Hatchery Late Winter, Clackamas Hatchery Late Winter (ODFW stock # 122), Sandy Hatchery Late Winter (ODFW stock # 11), Lewis River Wild Late Winter.
Hatchery programs not included in ESU (22)	Upper Cowlitz River Wild Late Winter, Tilton River Wild Late Winter, Cowlitz Summer, Friends of the Cowlitz Summer, Cowlitz Game and Anglers Summer, North Toutle Summer, Kalama River Summer, Merwin Summer, Fish First Summer, Speelyai Bay Net-Pen Summer, EF Lewis Summer, Skamania Summer, Kalama River Winter, Cowlitz Early Winter, Merwin Winter, Coweeman Ponds Winter, EF Lewis Winter, Skamania Winter, Klineline Ponds Winter, Eagle Creek NFH Winter, Clackamas Summer, Sandy River Summer.

Sources: Jones Jr. (2015); NWFSC (2015); NMFS (2018c)

Best available information indicates that the Lower Columbia River Steelhead DPS is at moderate risk and remains at threatened status. Each natural population's baseline and target persistence probabilities are summarized in **Table A-7-4**, along with target abundance for each population that would be consistent with delisting. Persistence probability is measured over a 100-year time period and ranges from very low (probability < 40 percent) to very high (probability >99 percent).

Table A-7-4. Current Status for Lower Columbia River Steelhead Populations and Recovery Scenario Targets

Major Population Group	Population (State)	Status Assessment		Recovery Scenario	
		Baseline Persistence Probability[1]	Contribution[2]	Target Persistence Probability	Abundance Target[3]
Cascade summer	Kalama (WA)	M	Primary	H	500
	North Fork Lewis (WA)	VL	Stabilizing	VL	--
	EF Lewis (WA)	VL	Primary	H	500
	Washougal (WA)	M	Primary	H	500
Gorge summer	Wind (WA)	H	Primary	VH	1,000
	Hood (OR)	VL	Primary	H[4]	2,008

Major Population Group	Population (State)	Status Assessment		Recovery Scenario	
		Baseline Persistence Probability[1]	Contribution[2]	Target Persistence Probability	Abundance Target[3]
Cascade winter	Lower Cowlitz (WA)	L	Contributing	M	400
	Upper Cowlitz (WA)	VL	Primary	H	500
	Cispus (WA)	VL	Primary	H	500
	Tilton (WA)	VL	Contributing	L	200
	South Fork Toutle (WA)	M	Primary	H+	600
	North Fork Toutle (WA)	VL	Primary	H	600
	Coweeman (WA)	L	Primary	H	500
	Kalama (WA)	L	Primary	H+	600
	North Fork Lewis (WA)	VL	Contributing	M	400
	East Fork Lewis (WA)	M	Primary	H	500
	Salmon Creek (WA)	VL	Stabilizing	VL	--
	Washougal (WA)	L	Contributing	M	350
	Clackamas (OR)	M	Primary	H*	10,671
	Sandy (OR)	L	Primary	VH	1,519
Gorge winter	Lower Gorge (WA/OR)	L	Primary	H	300
	Upper Gorge (WA/OR)	L	Stabilizing	L	--
	Hood (OR)	M	Primary	H	2,079

Sources: Jones Jr. (2015); NWFSC (2015); NMFS (2018c)

[1] LCFRB (2010) used the late 1990s as a baseline period for evaluating status; ODFW (2010) assume average environmental conditions of the period 1974-2004. VL = very low, L = low, M = moderate, H = high, VH = very high. These are adopted in the recovery plan NMFS (2013).

[2] Primary, contributing, and stabilizing designations reflect the relative contribution of a population to recovery goals and delisting criteria. Primary populations are targeted for restoration to a high or very high persistence probability. Contributing populations are targeted for medium or medium-plus viability. Stabilizing populations are those that will be maintained at current levels (generally low to very low viability), which is likely to require substantive recovery actions to avoid further degradation.

[3] Abundance objectives account for related goals for productivity (NMFS 2013).

[4] Oregon's analysis indicates a low probability of meeting the delisting objective of high persistence probability for this population.

Middle Columbia River Steelhead DPS

The Middle Columbia River steelhead distinct population segment (DPS) includes all naturally spawning populations of steelhead using tributaries upstream and exclusive of the Wind River (Washington) and the Hood River (Oregon), excluding the Upper Columbia River tributaries (upstream of Priest Rapids Dam) and the Snake River (NWFSC 2015). The Middle Columbia River Steelhead DPS was listed as

threatened by NMFS in 1999, with that listing designation being affirmed in 2006 and 2012. Four MPGs, composed of 19 historical populations (2 extirpated), make up the Middle Columbia River Steelhead DPS (Table A-7-5). Inside the geographic range of the DPS, 11 hatchery steelhead programs are currently operational. Seven of these artificial programs are included in the DPS.

Table A-7-5. Middle Columbia River Steelhead DPS Components

DPS Components	
Natural Production	
Major Population Group	**Populations**
Cascades Eastern Slope Tributaries	Fifteen Mile Creek[1], Deschutes (Westside), Deschutes (Eastside), Klickitat River[1], Rock Creek[1], Crooked River (ext), White Salmon R (ext)
Yakima River	Satus Creek, Toppenish Creek, Naches River, Upper Yakima River
John Day River	Lower John Day Tribs, Middle Fork John Day, North Fork John Day, South Fork John Day, Upper John Day
Umatilla and Walla Walla River	Umatilla River, Walla Walla River, Touchet River
Artificial Production	
Hatchery programs included in DPS (7)	Touchet River Endemic summer, Yakima River Kelt Reconditioning summer (in Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River), Umatilla River summer, Deschutes River summer
Hatchery programs not included in DPS (2)	Wallowa Stock release into the Touchet River. Skamania Stock summer, released into the Klickitat River.

Sources: Jones Jr. (2015); NWFSC (2015); NMFS (2018b)
[1]Winter steelhead populations (all others are summer steelhead).

Middle Columbia River Basin populations include summer and winter steelhead. The two life history types differ in degree of sexual maturity at freshwater entry, spawning time, and frequency of repeat spawning. Best available information indicates that the Middle Columbia River Steelhead DPS is at moderate risk and remains at threatened status. The most recent status update (NWFSC 2015) used updated abundance and hatchery contribution estimates provided by regional fishery managers to inform the analysis on this DPS. However, this DPS has been noted as difficult to evaluate in several of the reviews for reasons such as: the wide variation in abundance for individual natural populations across the DPS, chronically high levels of hatchery strays into the Deschutes River, and a lack of consistent information on annual spawning escapements in some tributaries (NWFSC 2015).

The Middle Columbia River Steelhead Recovery Plan (NMFS 2009b) identified hatchery practices and the effects of spawning stray hatchery fish as a key limiting factor and threat to the viability of the Deschutes River Eastside, Deschutes River Westside, John Day River, Umatilla River, and Walla Walla River populations. Within the Study Area, hatchery programs included in this EA directly affect the Touchet and Umatilla populations in the Umatilla/Walla Walla MPG and the Deschutes Eastside and Deschutes Westide in the Deschutes populations in the Cascade Eastern Slope Tributaries MPG (Table A-7-6). Other populations in the DPS may be subject to ecological (predation/competition) effects along migratory corridors, or genetically via straying.

Table A-7-6. Measures of Viability and Overall Viability Rating for the Middle Columbia River Steelhead DPS Major Population Groups

Major Population Group, Population	Abundance and Productivity[1]				Spatial Structure and Diversity			Overall Viability Rating[2]
	ICTRT Minimum Spawner Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk	
Eastern Cascades MPG								
Fifteen Mile Creek	500	↓356 (.16)	↑1.84 (.19)	Moderate	Very Low	Low	Low	Maintained
Deschutes (Westside)	1,500 (1,000)	↑634 (.13)	↑1.16 (.15)	High	Low	Moderate	Moderate	High Risk
Deschutes (Eastside)	1,000	↓1,749 (.05)	↑2.52 (.24)	Low	Low	Moderate	Moderate	Viable
Klickitat River	1,000			Moderate (?)	Low	Moderate	Moderate	Maintained (?)
Rock Creek	500				Moderate	Moderate	Moderate	High Risk (?)
Crooked River (ext)	2,000							Extirpated
White Salmon R (ext)	500							Extirpated
Yakima River MPG								
Satus Creek	1,000 (500)	↑1127 (.17)	↑1.93 (.12)	Low	Low	Moderate	Moderate	Viable
Toppenish Creek	500	↓516 (.14)	↓2.52 (.19)	Low	Low	Moderate	Moderate	Viable
Naches River	1,500	↑1,244 (.16)	↑1.83 (.10)	Moderate	Low	Moderate	Moderate	Moderate
Upper Yakima River	1,500	↑246 (.18)	↑1.87 (.10)	Moderate	Moderate	High	High	High Risk
John Day River MPG								
Lower John Day Tribs	2,250	↓1,270 (.22)	↓2.67 (.19)	Moderate	Very Low	Moderate	Moderate	Maintained
Middle Fork John Day	1,000	↑1,736 (.41)	↑3.66 (.26)	Low	Low	Moderate	Moderate	Viable

Major Population Group, Population	Abundance and Productivity[1]				Spatial Structure and Diversity			Overall Viability Rating[2]
	ICTRT Minimum Spawner Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk	
North Fork John Day	1,000	↑1,896 (.19)	↓2.48 (.23)	Very Low	Very Low	Low	Low	Highly Viable
South Fork John Day	500	↑697 (.27)	↑2.01 (.21)	Low	Very Low	Moderate	Moderate	Viable
Upper John Day	1,000	↑641 (.21)	1.32 (.18)	Moderate	Very Low	Moderate	Moderate	Maintained
Umatilla/Walla Walla MPG								
Umatilla River	1,500	↑2,379 (.11)	○1.20 (.32)	Moderate	Moderate	Moderate	Moderate	Maintained
Walla Walla River	1,000	↓877 (.13)	↑1.65 (.11)	Moderate	Moderate	Moderate	Moderate	Maintained
Touchet River	1,000	↓382 (.12)	↑1.25 (.11)	High	Low	Moderate	Moderate	High Risk

Source: NWFSC (2015)

[1] Current abundance and productivity estimates are expressed as geometric means with (standard error) for abundance.

[2] Highly viable/Very Low risk = less than 1 percent risk of extinction over 100 years; Viable/Low risk = less than 5 percent risk of extinction over 100 years; ratings with (?) are based on imitated or provisional data.

Snake River Steelhead DPS

The Snake River Basin Steelhead DPS includes all naturally spawned anadromous *O. mykiss* originating below natural and man-made impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho (NWFSC 2015). The Interior Columbia Technical Recovery Team (ICTRT) identified six MPGs in the Snake River Steelhead DPS: Clearwater River, Salmon River, Grande Ronde River, Imnaha River, Lower Snake River, and Hells Canyon Tributaries (ICTRT 2007b). The Hells Canyon Tributaries MPG is extirpated, leaving five extant MPGs. Nine hatchery steelhead programs are included in the DPS (Table A-7-7).

The Snake River Steelhead DPS has a moderate to high risk of extinction and remains threatened. Four of the five extant MPGs are not meeting recovery objectives in the draft recovery plan, and the status of many individual populations remains uncertain. Still, the most recent status review suggests that populations in the Salmon and Clearwater subbasins are doing relatively well (Table A-7-8).

Although the potential is low, all populations in the DPS may be subject to ecological (predation/competition) effects along migratory corridors, or genetically via straying. Because the Study Area does not overlap with the domain of the Snake River Steelhead DPS, it is difficult to speculate which MPGs may be most affected by hatchery programs included in this EA.

Table A-7-7. Snake River Basin Steelhead DPS Components

DPS Components[1]	
Natural Production	
Major Population Group	**Populations**
Grande Ronde River	Joseph Creek, Upper Mainstem, Lower Mainstem, Wallowa River
Imnaha River	Imnaha River
Clearwater River	Lower Mainstem River, North Fork Clearwater, Lolo Creek, Lochsa River, Selway River, South Fork Clearwater
Salmon River	Little Salmon/Rapid, Chamberlain Creek, Secesh River, South Fork Salmon, Panther Creek, Lower MF, Upper MF, North Fork, Lemhi River, Pahsimeroi River, East Fork Salmon, Upper Mainstem
Lower Snake	Tucannon River, Asotin Creek
Hells Canyon Tributaries	Extirpated
Artificial Production	
Hatchery programs included in DPS (7)	Tucannon River summer, Little Sheep Creek summer, EF Salmon River A, Dworshak NFH B, Lolo Creek B, Clearwater Hatchery B, SF Clearwater (localized) B

Source: 79 FR 20802; NMFS (2012); Jones Jr. (2015); NWFSC (2015)

[1] The DPS listing is updated in the Federal Register every five years and the last update was on April 14, 2014. NMFS is currently developing an updated DPS listing.

Table A-7-8. Measures of Viability and Overall Viability Rating for Snake River Steelhead DPS Major Population Groups (MPG)

Major Population Group, Population	Abundance and Productivity[1]				Spatial Structure and Diversity			Overall Viability Rating[2]	Proposed Recovery Status[3]
	ICTRT Minimum Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk		
Lower Snake River MPG									
Tucannon River	1,000	NA	NA	High (?)	Low	Moderate	Moderate	High Risk	Viable or Highly Viable
Asotin Creek	500		NA	Moderate (?)	Low	Moderate	Moderate	Maintained (?)	Viable or Highly Viable
Grande Ronde River MPG									
Lower Grande Ronde	1,000	NA	NA		Low	Moderate	Moderate	Maintained	Viable or highly Viable
Joseph Creek	500	1,839	1.86	Very low	Very low	Low	Low	Highly Viable	Highly Viable
Upper Grande Ronde	1,500	1,649 (.21)	3.15	Viable (moderate)	Very low	Moderate	Moderate	Viable	Viable or Highly Viable
Wallowa River	1,000	NA	NA	High	Very low	Low	Low	Moderate (?)	Viable or Highly Viable
Imnaha River MPG									
Imnaha River	1,000	NA	NA	Moderate	Very low	Moderate	Moderate	Moderate	Highly Viable
Clearwater River MPG									
Lower Mainstem Clearwater River	1,500	2,099 (.15)	2.36	Moderate	Very low	Low	Low	Maintained (?)	Viable
South Fork Clearwater River4	1,000	NA	NA	High	Low	Moderate	Moderate	Maintained or High Risk (?)	Maintained
Lolo Creek	500	NA	NA	High	Low	Moderate	Moderate	Maintained (?)	Maintained
Selway River	1,000	1,650 (.17)	2.33	Moderate (?)	Very low	Low	Low	Maintained (?)	Viable
Lochsa River	1,000			Moderate (?)	Very low	Low	Low	Maintained (?)	Highly Viable

Major Population Group, Population	Abundance and Productivity[1]				Spatial Structure and Diversity			Overall Viability Rating[2]	Proposed Recovery Status[3]
	ICTRT Minimum Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk		
North Fork Clearwater River	--	--	--	--	--	--	--	Extirpated	
Salmon River MPG									
Little Salmon River	500	NA	NA	Moderate (?)	Low	Moderate	Moderate	Maintained (?)	Maintained
South Fork Salmon River.	1,000	1,028 (.17)	1.80	Moderate (?)	Very low	Low	Low	Maintained (?)	Viable
Secesh River	500			Moderate (?)	Low	Low	Low	Maintained (?)	Maintained
Chamberlain Creek	500	2,213 (.16)	2.38	Moderate (?)	Low	Low	Low	Maintained (?)	Viable
Lower Middle Fork Salmon River	1,000			Moderate (?)	Very low	Low	Low	Maintained (?)	Highly Viable
Upper Middle Fork Salmon River	1,000			Moderate (?)	Very low	Low	Low	Maintained (?)	Viable
Panther Creek	500	NA	NA	Moderate	High	Moderate	High	High Risk	Viable
North Fork Salmon River	500	NA	NA	Moderate	Low	Moderate	Moderate	Maintained (?)	Maintained
Lemhi River	1,000	Insufficient data	Insufficient data	Moderate	Insufficient data	Insufficient data	Moderate	Maintained (?)	Viable
Pahsimeroi River	1,000	NA	NA	Moderate	Moderate	Moderate	Moderate	Maintained (?)	Maintained
East Fork Salmon River	1,000	NA	NA	Moderate	Very low	Moderate	Moderate	Maintained (?)	Maintained
Upper Salmon River	1,000	NA	NA	Moderate	Very low	Moderate	Moderate	Maintained (?)	Maintained

Major Population Group, Population	Abundance and Productivity[1]				Spatial Structure and Diversity			Overall Viability Rating[2]	Proposed Recovery Status[3]
	ICTRT Minimum Threshold	Natural Spawning Abundance	ICTRT Productivity	Integrated Risk	Natural Processes Risk	Diversity Risk	Integrated Risk		
Hells Canyon Tributaries MPG									
Lower Hells Canyon Tributaries	--	--	--	--	--	--	--	Extirpated	--

Source: NWFSC (2015); NMFS (2017)

[1] Current abundance and productivity estimates are expressed as geometric means with (standard error) for abundance.

[2] Highly viable/Very Low risk = less than 1 percent risk of extinction over 100 years; Viable/Low risk = less than 5 percent risk of extinction over 100 years; ratings with (?) are based on imitated or provisional data.

[3] Maintained/Moderate = 6 to 25 percent risk of extinction over 100 years; High Risk = does not meet viability criteria, greater than 25 percent risk of extinction over 100 years.

[4] Bolded cells indicate populations whose viability may be affected by hatchery programs.

Mid-Columbia Spring Chinook Salmon ESU

Included in the Middle Columbia River Spring Chinook Salmon ESU are spring-run Chinook Salmon spawning in the Klickitat, Deschutes, John Day, and Yakima Rivers. No fall-run Chinook Salmon are included in this ESU. Historically, spring run populations from the Walla Walla and Umatilla rivers may have also belonged in this ESU, but these populations are now considered extinct. However, there are ongoing efforts to reintroduce spring Chinook Salmon into the Walla Walla River and Umatilla River subbasins. In 1998, NMFS concluded that Chinook Salmon in this ESU were not in danger of extinction, nor were they likely to become endangered in the foreseeable future (63 FR 11497). As a result, this ESU was not listed. Because they are not ESA-listed, no viability criteria have been established.

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