B O N N E V I L L E   P O W E R   A D M I N I S T R A T I O N

Mid-Columbia
Coho Restoration Program

Final Environmental Impact Statement

March 2012



DOE/EIS-0425

Mid-Columbia Coho Restoration Program

Final

Environmental Impact Statement

DOE/EIS-0425

Bonneville Power Administration

Okanogan County

The Confederated Tribes and Bands of the Yakama Nation

March 2012

Abstract

Mid-Columbia Coho Restoration Program Environmental Impact Statement

Responsible Agency: U.S. Department of Energy - Bonneville Power Administration (BPA)

Title of Proposed Project: Mid-Columbia Coho Restoration Program

Cooperating Tribe: The Confederated Tribes and Bands of the Yakama Nation

State Involved: Washington

Lead State Agency: Okanogan County

Abstract: The Environmental Impact Statement (EIS) describes a coho salmon restoration program sponsored by the Confederated Tribes and Bands of the Yakama Nation (YN). BPA proposes to fund the construction, operation and maintenance of the program to help mitigate for anadromous fish affected by the Federal Columbia River Power System dams on the Columbia River. The YN wants to restore naturally spawning populations of coho salmon in harvestable numbers to the Methow and Wenatchee river basins in north central Washington State. The EIS discloses the environmental effects expected from facility construction and program operations and a No Action alternative.

The Proposed Action is to implement the remaining phases of the restoration program as outlined in the Mid-Columbia Coho Restoration Master Plan (YN 2010). This would involve building a new, small, in-basin adult holding/spawning, incubation and rearing facility on the Wenatchee River at one of two potential sites; and constructing and improving several sites in both the Wenatchee and Methow river basins for acclimating coho in key habitats in the upper portions of the basins.

Public review of and comment on the Draft EIS closed August 22, 2011. Comments received and BPA responses to them are in Appendix 12 of this Final EIS. BPA expects to issue a Record of Decision whether to implement the project in April 2012.

For more information about the Final EIS, please contact:

Nancy Weintraub, Senior Environmental Protection Specialist
Bonneville Power Administration
P. O. Box 3621, KEC-4
Portland, OR 97208-3621
Telephone: (503) 230-5373
Email: nhweintraub@bpa.gov

For additional copies of this document, please call 1-800-622-4520 and ask for the document by name. You may also request additional copies by writing to:

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208
ATT: Public Information Center – CHDL-1

The EIS is also on the Internet at: http://efw.bpa.gov/environmental_services/Document_Library/Mid-Columbia_Coho_Restoration_Project/.

For additional information on DOE NEPA activities, please contact Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, GC-54, U.S. Department of Energy, 1000 Independence Avenue S.W., Washington D.C. 20585-0103, phone: 1-800-472-2756 or visit the DOE NEPA Web site at www.eh.doe.gov/nepa.

Table of Contents

Appendices [1]

Appendix 5. Monitoring and Evaluation Plan

Appendix 12. Public Comments on the Draft EIS and BPA Responses

Appendix 13. Icicle Creek Water Quality Evaluation

List of Figures

List of Tables

[1] Eleven appendices were issued with the Draft EIS. Of these, only Appendix 5 is being reissued, in order to make minor corrections and to include the list of references that was inadvertently left out of the DEIS version. For the Final EIS, two additional appendices are included.

Executive Summary

Bonneville Power Administration (BPA), in partnership with the Yakama Nation (YN), proposes to fund transition of the Mid-Columbia Coho Restoration Program from its feasibility phase to a comprehensive program to restore naturally spawning populations of coho salmon in harvestable numbers to the Wenatchee and Methow river basins in north central Washington State. Construction of a new hatchery on the Wenatchee River in Chelan County, and construction and use of small acclimation facilities in natural settings in Chelan and Okanogan counties, are included in this proposal. Figure ES-1 shows the general project area.

BPA is a federal power marketing agency within the United States Department of Energy (USDOE). BPA's operations are governed by several statutes, such as the Pacific Northwest Power Planning and Conservation Act of 1980 (Northwest Power Act) (16 U.S.C. § 839b(h)(10)(A)). Under the Act, BPA must protect, mitigate, and enhance fish and wildlife affected by the development and operation of federal hydroelectric facilities on the Columbia River and its tributaries. BPA must fulfill this duty in a manner consistent with the Columbia River Basin Fish and Wildlife Program developed by the Northwest Power and Conservation Council (Council). The Council in turn gives deference to project proposals made by Indian tribes.

Since 1996, BPA has funded the Yakama Nation to study the feasibility of reintroducing coho in north central Washington. The studies show a reasonable likelihood of success for full-scale coho reintroduction, so the YN prepared a Master Plan (YN 2010[2]) for a program to increase local adaptation and self-sustainability of the newly developed Mid-Columbia coho broodstock and to increase their abundance in the upper tributaries of the two basins. After review of the Master Plan, the Council recommended to BPA to proceed with Step 2 of the Council's three-step review process for the Mid-Columbia Coho Restoration Program proposed by the Yakama Nation. The tribe proposed the project because naturally spawning populations of coho were extirpated from the Wenatchee and Methow river basins, and currently insufficient facilities exist in the upper basin tributaries to restore coho populations to those basins.

This Environmental Impact Statement (EIS) analyzes the effects of the Proposed Action as described in the Master Plan and the No Action Alternative required by the National Environmental Policy Act (NEPA).

Underlying Need for Action

BPA needs to respond to the Northwest Power and Conservation Council's recommendation and decide whether to provide funding to the YN for its proposal to move to the next phase of the Mid-Columbia Coho Restoration Program in the Wenatchee and Methow river basins.

---

[2] http://www.yakamafish-nsn.gov/Production/Coho/MC%20coho%20web/Mid-C%20Coho%20MP%208-17-10%20FINAL.pdf

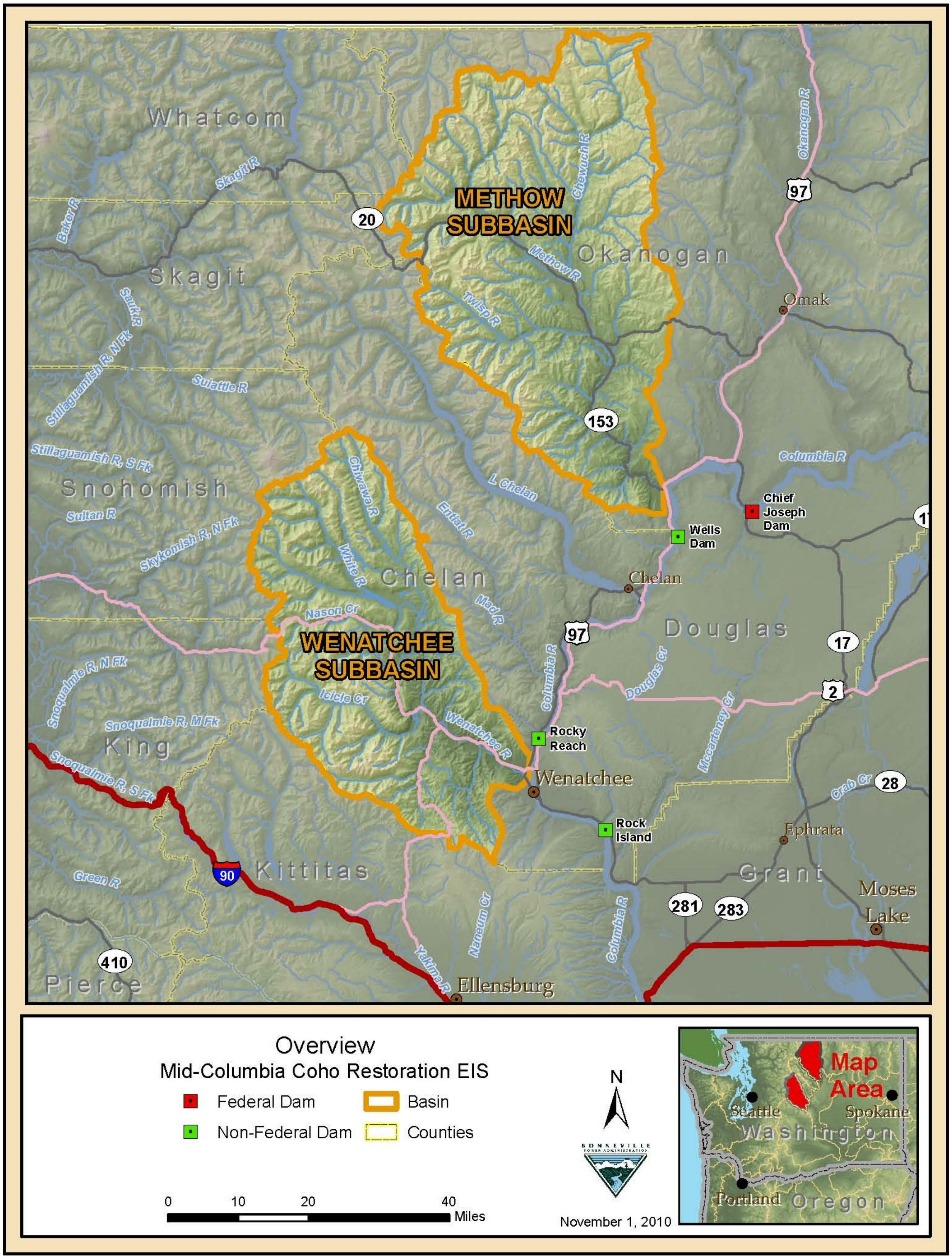


Figure ES-1. Project Area Overview

Purposes

In meeting the underlying need, the alternatives considered should achieve the purposes listed below. BPA will base its choice among alternatives on how well each one meets them.

- Develop a locally adapted, self-sustaining, naturally spawning coho stock that occupies its historical habitat in the Wenatchee and Methow river basins.
- Support efforts to mitigate for effects of the Federal Columbia River Power System (FCRPS) on fish and wildlife in the mainstem Columbia River and its tributaries pursuant to the Northwest Power Act.
- Assist in carrying out commitments related to proposed hatchery actions that are contained in the 2008 Columbia Basin Fish Accords Memorandum of Agreement with the YN and others.
- Minimize harm to natural or human resources, including species listed under the Endangered Species Act.

In addition to these objectives that BPA seeks to fulfill, the Yakama Nation also seeks a preferred alternative that would:

- Increase the abundance of Mid-Columbia coho salmon to numbers sufficient to sustain a mainstem and terminal harvest in most years.
- Support the visions and goals of other regional plans, including subbasin plans and the Tribal Anadromous Fish Restoration Plan (*Wy-Kan-Ush-Mi Wa-Kish-Wit*).
- Maintain consistency with the coho production objectives specified in the 2008-2017 *United States v. Oregon* Fish Management Agreement for the Wenatchee and Methow subbasins.

History of Coho in the Mid-Columbia Region

Historical Conditions and Extirpation

Mullan (1984) estimated historical mid-Columbia River adult coho populations as follows:

- Wenatchee basin—6,000 - 7,000
- Methow basin—23,000 - 31,000.

Prior to the establishment of BPA in 1937, mid-Columbia coho salmon populations were decimated by impassable dams (including one that blocked the Methow River at Pateros between 1915 and 1929), harmful forestry practices, and unscreened irrigation diversions in the tributaries, along with an extremely high harvest rate in the lower Columbia River (YN 2010; NPCC 2004b). The loss of natural stream flow degraded habitat quality and further reduced coho productivity. Over the years, irrigation, livestock grazing, mining, timber harvest, fire management, road and railroad construction, and residential and other development also contributed to destruction of salmon habitat. By the 1930s, coho were considered extirpated from the mid-Columbia region (NPCC 2004b).

Current Conditions

In the past two decades, conditions and practices have changed and improved to a certain degree.

- Some of the local habitat causes of coho depletion have been corrected: many irrigation diversions have been screened, tributary dams have been removed, new logging practice regulations have provided increased environmental protection, mining has ended, and grazing practices have been improved.
- Habitat Conservation Plans have been negotiated between fisheries resource managers and Mid-Columbia Public Utility Districts (PUDs)[3] to ensure that the hydroelectric projects associated with each plan can be considered to have No Net Impact on anadromous species.
- The listings under the Endangered Species Act (ESA) of several salmonid species that migrate through the lower Columbia River have curtailed coho fisheries in the ocean that once over-harvested the mid-Columbia stocks of coho. Fisheries restrictions based on ESA-listings have curtailed ocean harvest of Lower Columbia River coho from an annual average of 80% between 1970 and 1983; to 49% from 1984 to 1993; to 10% from 1994 to 2007 (NMFS 2008a). These restrictions are likely to be in effect for a number of years.
- Recent improvements in artificial production practices would also improve efforts aimed at supporting natural production.

Coho Reintroduction Feasibility Studies

In 1996, BPA began funding the Yakama Nation to study the feasibility of reintroducing coho to the mid-Columbia region.[4] BPA analyzed the effects of a proposed plan for feasibility studies in the Mid-Columbia Coho Reintroduction Feasibility Project Final Environmental Assessment (EA), completed in April 1999 (DOE/EA-1282). Supplemental Analyses (DOE/EA-1282/SA-01, -02, -03, and -04) were prepared to analyze effects of additional activities and facilities proposed for the studies.

Feasibility studies were designed to achieve two primary goals:

1) ***Determine whether a broodstock can be developed from lower Columbia River coho stocks whose progeny can survive in increasing numbers to return as adults to the mid-Columbia region.***
2) ***Initiate natural reproduction in areas of low risk to sensitive species and in other select areas to study the risks and interactions with sensitive species.***

The feasibility goals have been met (see Table 1-1 in Chapter 1). The Yakama Nation prepared a Master Plan based on the results of the feasibility studies (YN 2010). The Master Plan, with review and assistance by a number of scientists and fish and wildlife agencies, developed the

---

[3] Grant County PUD, Chelan County PUD, and Douglas County PUD.

[4] Years after this project began (and was named), many entities in the region began using the term "upper Columbia" to refer to the region in which the Wenatchee and Methow subbasins lie. We have chosen to continue using "mid-Columbia" to refer to this project in order to demonstrate the continuity of the project from the feasibility studies onward. As well, because the Columbia River originates hundreds of miles upstream in Canada, the term "mid-Columbia" seems to be more geographically accurate.

approach and biological rationale for building on the feasibility studies to realize the YN's long term vision for coho in the region (see Proposed Action below and in Chapter 2).

Current Experimental Program

During the feasibility phase of the project, a local coho broodstock was developed. A total of 1.5 million smolts are acclimated and released in the two basins annually. In 2011, approximately 31,000 coho adults passed Rock Island Dam, the closest mainstem Columbia River dam downstream from the Wenatchee River mouth (Figure ES-1). Facilities used in the current program are listed in Table ES-1.

Table ES-1. Facilities used in current coho restoration program

<table>
<tr><th colspan="2">BROODSTOCK COLLECTION</th></tr>
<tr><td>Wenatchee</td><td>Methow</td></tr>
<tr><td>Tumwater Dam</td><td>Wells Fish Hatchery (FH)</td></tr>
<tr><td>Dryden Dam</td><td>Wells Dam ladders</td></tr>
<tr><td>Leavenworth National Fish Hatchery (NFH)</td><td>Winthrop National Fish Hatchery (NFH)</td></tr>
<tr><td></td><td>Methow FH</td></tr>
<tr><th colspan="2">HOLDING, INCUBATION AND/OR REARING</th></tr>
<tr><td>Leavenworth NFH</td><td rowspan="5">Note: Rearing facilities provide coho for both basins</td></tr>
<tr><td>Winthrop NFH</td></tr>
<tr><td>Peshastin Incubation Facility</td></tr>
<tr><td>Cascade FH</td></tr>
<tr><td>Willard NFH</td></tr>
<tr><th colspan="2">SMOLT RELEASES</th></tr>
<tr><td>Wenatchee</td><td>Methow</td></tr>
<tr><td>• 500,000 above Tumwater Dam in Nason Creek and Beaver Creek
• 500,000 from Icicle Creek</td><td>• 300,000 from Winthrop NFH
• 75,000 from Lower Twisp
• 125,000 from Wells FH</td></tr>
<tr><th colspan="2">ACCLIMATION</th></tr>
<tr><td>Wenatchee</td><td>Methow</td></tr>
<tr><td>Leavenworth NFH (Icicle Creek)</td><td>Winthrop NFH</td></tr>
<tr><td>Rohlfing</td><td>Lower Twisp</td></tr>
<tr><td>Coulter</td><td>Wells FH</td></tr>
<tr><td>Butcher</td><td rowspan="2"></td></tr>
<tr><td>Beaver</td></tr>
</table>

Proposed Action

The Proposed Action is for BPA to continue to provide funding to the YN to reintroduce coho into the Wenatchee and Methow basins through the Mid-Columbia Coho Restoration Program. This funding will maintain a phased approach to reintroducing coho into the Wenatchee and Methow basins, and builds on the feasibility studies that have been conducted since 1996.

Vision and Biological Approach

The Yakama Nation's long-term vision for the Mid-Columbia Coho Restoration program, as stated in the Master Plan (YN 2010), is:

> ***To re-establish naturally spawning coho populations in mid-Columbia tributaries to biologically sustainable levels which provide significant harvest in most years.***

Building on the feasibility studies, the proposal would maintain a phased approach to reintroducing coho: two broodstock development phases and three natural production phases. The broodstock development phases were designed to eliminate transfers of lower Columbia brood coho and to encourage broodstock adaptation so that returning coho can reach key habitat within the basins. The first phase of broodstock development has been accomplished, and lower Columbia broodstock are no longer used in the program; however, the second phase continues the process of increasing broodstock stamina. After all broodstock development goals are met (see Section 2.2.1.2), the natural production phases would manage broodstock composition so that eventually the percent of natural-origin fish in the hatchery broodstock exceeds the percent of hatchery-origin fish on the spawning grounds (HSRG 2004). The numbers of smolts released would increase from 1.5 million to 2.16 million for the first three years of the natural production phase, then return to 1.51 million and eventually decrease (see Table 2-5). The short-term increase would begin the local adaptation process by releasing enough smolts in the natural environment to increase the number of adults returning to each tributary to spawn without the aid of a hatchery. The coho restoration program is designed to end when a self-sustaining naturally reproducing population that supports harvest is established. This goal would be met when there is a natural-origin return escapement of more than 1,500 coho to each basin, with a terminal and mainstem harvest in most years; it is expected to be achieved by approximately 2028.

Facilities

Facility requirements for the Proposed Action are listed in Table ES-2 and described in detail in Section 2.2.2. No new facilities would be required during the ongoing broodstock development phase. During the natural production phases, the plan proposes to continue rearing most program fish at existing hatcheries. A new, small, in-basin adult holding/spawning, incubation and rearing facility also is proposed for these phases at a site on the Wenatchee River near Dryden Dam (Dryden) or a site on the Wenatchee River downstream of Lake Wenatchee (George)[5]. Options to the proposed facilities are outlined in the event water quality or other issues, or lack of Mitchell Act funding, prevent their use.

Acclimation is planned at a combination of existing and new sites. Most acclimation sites would be existing water bodies (e.g., beaver ponds, side channels, etc.) and small constructed ponds.

The project proposes to use existing broodstock capture sites in upstream areas in addition to those used during the broodstock development phase, all of which are owned by other entities and operated by the YN and/or other fisheries resource agencies. Three broodstock capture sites (Chiwawa Weir, Twisp Weir, and Methow Fish Hatchery) would need to extend their periods of operation in order to capture coho adults.

Juvenile trapping for monitoring and evaluation of the program would take place at existing traps in both basins, with one exception: a new trap is proposed for the Little Wenatchee River, the site to be determined.

[5] The George site is also known as Natapoc; however, the final EIS will use the name “George” to maintain consistency with the draft EIS.

Table ES-2. Summary of facilities: Proposed Action

BROODSTOCK COLLECTION

Wenatchee	C or F[a]	Construction?	Methow	C or F	Construction?
Dryden Dam	**C**	No	Wells FH	**C**	No
Leavenworth NFH	**C**	No	Wells Dam ladders	**C**	No
Tumwater Dam	**C**	No	Winthrop NFH	**C**	No
Chiwawa Weir	**F**	No	Methow FH	**C**	No
			Twisp Weir	**F**	For acclimation only
			Lower Twisp	**F**	No

INCUBATION/REARING

Cascade FH	**C**	No construction	Note: Rearing facilities provide coho for both basins
Willard NFH	**C**	No construction	
Winthrop NFH	**C**	No construction	
Leavenworth NFH	**C**	No construction	
Peshastin	**C**	No construction	
Entiat NFH **Backup**	**C**	No construction	
Proposed Dryden Hatchery	**F**	New facility on 1.5 acres: hatchery building, 4 raceways, 2 rearing ponds, water pipelines, wells, waste treatment tank and wetland; 4 acres total construction disturbance	
Backup George Hatchery	**F**	New facility on 1.5 acres: similar facilities to proposed Dryden site except no waste treatment wetland; 2.5 acres total construction disturbance	

ACCLIMATION/ADULT PLANTS (Primary)

Wenatchee	C or F[a]	Construction?	Methow	C or F	Construction?
Leavenworth NFH	**C**	No	Winthrop NFH	**C**	No
Beaver	**C**	No	Lower Twisp	**C**	No
Butcher	**C**	No	Goat Wall	**F**	No
Clear	**F**	No	Gold	**F**	Deepen 4 existing ponds
Coulter	**C**	No	Heath	**F**	No
Rohlfing	**C**	No[b]	Lincoln	**F**	No[b]
Brender	**F**	No	Mason[c]	**F**	No
Chikamin	**F**	New off-channel pond, 2 side-by-side water intakes, 120-ft buried pipe, 70-ft surface discharge channel	Twisp Weir	**F**	New pond, two new wells, water intake on diversion ditch, 400-ft surface water channel, buried water (500 ft) & power (400 ft) lines, 20-ft road
Minnow	**F**	New in-channel pond, 3 log weirs, 600-ft road	Methow State Wildlife Area (MSWA) Eightmile	**F**	New well, 100-ft buried water pipe, 2,600-ft buried power line
Tall Timber	**F**	Two new side-by-side water intakes, 350-ft buried pipe	Newby	**F**	New pond, intake structure, 300-ft surface water channel, 120-ft buried discharge pipes.
Two Rivers[c]	**F**	No	Parmley	**F**	No
White River Springs	**F**	No	Pete Creek Pond	**F**	No
Dirty Face (adults)	**F**	No	Hancock (adults)	**F**	No

a. C = Currently used; F = Future

b. Construction at Rohlfing and Lincoln is being done under a different program (Multi-Species Acclimation Project; see Section 3.15.3). Construction impacts were evaluated in a separate NEPA process and ESA consultations (see Sect. 2.2.2.1, Table 2-8).

c. Previously used by project; not in use currently.

Table ES-2 (continued)

ACCLIMATION (Backup)					
Wenatchee	**C or F**	**Construction?**	**Methow**	**C or F**	**Construction?**
Allen	**F**	No	Balky Hill	**F**	No
Coulter/Roaring	**F**	No	Biddle [c]	**F**	No
Dryden[d]	**F**	New ponds, well, 850-ft buried water supply & discharge pipes	Methow Salmon Recovery Foun-dation (MSRF) Chewuch	**F**	New pond, well, 1,000-ft surface water delivery & discharge channels, 100-ft buried power line
McComas[e]	**F**	No	Chewuch Acclimation Facility	**F**	New pond, 300-ft buried water delivery and discharge pipes, 50-ft buried power line
Squadroni	**F**	New pond, well, 50-ft water supply & 20-ft discharge channels	Poorman	**F**	No
Scheibler	**F**	Expand pond	Utley	**F**	New 80-ft long channel as outlet for existing pond.

a. C = Currently used; F = Future

d. Activities refer to those required if the Dryden site is used for acclimation only and not as a hatchery site.

e. McComas is a new site proposed to be constructed by Grant PUD for another project; impacts will be evaluated in other permitting processes.

Program Costs

The expected total cost of the Proposed Action through 2028, including capital costs and operational expenses, is shown in Table ES-3. Depending on results of Council step reviews, timing of some expenditures could change from what is shown in the table. For example, capital costs could be spread over more than one year. Most operational costs assume an inflation rate of 2.5% per year. Details of the how costs were calculated are in the Master Plan (YN 2010, Chapter 8).

The program currently is funded by BPA, Grant County PUD, and Chelan County PUD. (Douglas County PUD contributed $600,000 in 2008 towards capital costs related to the feasibility studies.) The current program also shares rearing costs with National Oceanic and Atmospheric Administration/National Marine Fisheries Service (NMFS) (not shown in table). The total amount from NMFS and Grant and Chelan PUDs is close to $1.5 million annually. The current program also shares monitoring and evaluation costs with Washington Department of Fish and Wildlife (WDFW) (not shown in table). If the Proposed Action is implemented, cost sharing with all these entities is expected to continue.

Table ES-3. Cost schedule for Proposed Action in millions of dollars

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
CAPITAL COST																	
TOTAL CAPITAL	**0.00**	**6.73**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
OPERATING EXPENSE																	
Plan, Design, Per.	0.55	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rearing	0.69	0.71	0.92	0.62	0.63	0.63	0.65	0.66	0.68	0.70	0.72	0.27	0.28	0.29	0.29	0.30	0.31
Tagging	0.62	0.64	0.89	0.91	0.93	0.71	0.72	0.74	0.76	0.78	0.80	0.48	0.49	0.50	0.51	0.53	0.54
O&M	1.19	1.22	1.65	1.70	1.74	1.35	1.38	1.42	1.45	1.49	1.53	0.98	1.00	1.03	1.05	1.08	1.10
M&E	0.58	0.60	0.74	0.76	0.78	0.80	0.82	0.50	0.25	0.26	0.27	0.27	0.28	0.29	0.29	0.30	0.31
TOTAL OP.	**3.63**	**3.33**	**4.21**	**3.99**	**4.09**	**3.49**	**3.57**	**3.32**	**3.15**	**3.22**	**3.31**	**2.00**	**2.05**	**2.10**	**2.15**	**2.21**	**2.26**
TOTAL COST	**3.63**	**10.06**	**4.21**	**3.99**	**4.09**	**3.49**	**3.57**	**3.32**	**3.15**	**3.22**	**3.31**	**2.00**	**2.05**	**2.10**	**2.15**	**2.21**	**2.26**
DIRECT FUNDING																	
Douglas PUD																	
Chelan PUD 10 Year	0.34	0.36	0.37	0.39	0.40	0.42	0.44										
Future Chelan PUD								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grant PUD 10 Year	0.69	0.72	0.75	0.78	0.81	0.84	0.87										
Future Grant PUD								0.45	0.47	0.49	0.51	0.53	0.55	0.58	0.60	0.62	0.65
BPA MOA 10 Year	2.60	8.99	3.09	2.82	2.88	2.23	2.26										
Future BPA								2.86	2.67	2.73	2.79	1.47	1.50	1.52	1.55	1.58	1.61
TOTAL FUNDING	**3.63**	**10.06**	**4.21**	**3.99**	**4.09**	**3.49**	**3.57**	**3.32**	**3.15**	**3.22**	**3.31**	**2.00**	**2.05**	**2.10**	**2.15**	**2.21**	**2.26**

No Action Alternative

NEPA requires federal agencies to consider the effects of not taking the proposed action. Under the 2008 Columbia Basin Fish Accords with the Three Treaty Tribes (one of which is the Yakama Nation [see Section 1.1]), BPA is committed to funding the Mid-Columbia coho project through September 30, 2018. Under the No Action Alternative, BPA would continue funding the existing program at existing facilities, at no greater than existing production levels, at the same level of annual funding as of Fiscal Year 2011 (approximately $1.9 million annually), with an annual inflation adjustment of 2.5 percent. Currently 1.5 million smolts are acclimated and released in the two basins annually. See Section 2.1 for broodstock collection, incubation and rearing, and acclimation and release sites used in the existing program.

Biological Approach

The program would continue acclimated coho releases at the current level of 1 million in the Wenatchee and 500,000 in the Methow. No attempt would be made to expand production into new habitat; the program would not develop or operate new acclimation facilities in additional natural production areas. The program's broodstock currently is essentially a domesticated hatchery stock, not completely adapted to conditions in the wild. Without acclimation and release of coho from more sites in high-quality habitat, coupled with the deliberate selection for increased percentages of natural-origin fish in the broodstock that originate from that habitat, the likelihood that viable natural populations of coho would be established is low. The program primarily would be propagating hatchery fish and might be replaced by a program to promote fisheries only. Such a change would depend on whether a facility could be found to provide sufficient coho for a fishery over the long term. If no such facility could be found, a coho program might have to be abandoned in the Wenatchee and Methow basins.

Facilities

The program would continue to rely on existing facilities. The new facilities proposed as part of the Proposed Action would not be constructed, and it is unlikely that existing facilities would be modified.

- **Broodstock capture:** The current broodstock capture locations—Tumwater, Dryden, Leavenworth NFH, Wells FH, Winthrop NFH, Methow FH—are expected to remain available. New broodstock capture locations would not be added.
- **Incubation/Rearing:** Existing facilities would continue to be used if available. The potential for Leavenworth NFH or the lower river hatcheries (Willard and Cascade) to be eliminated or used on a more limited basis would be the same as under the Proposed Action, with the same options (see Section 2.2.2.1).
- **Smolt releases:** Table ES-4 shows the current production program that would continue under the No Action Alternative and the acclimation sites that would be used. Several other sites are currently planned under a different project for spring Chinook and steelhead acclimation; the Yakama Nation could choose to add coho acclimation at these sites in the future, assuming funding levels are sufficient to do so.
- **Monitoring and Evaluation:** The Nason Creek smolt trap would continue to be used. Currently, Grant County PUD and BPA through the coho project are the funding agencies for this trap. No new traps would be installed. The current monitoring program would continue (see Table 2-9 in Section 2.2.3).

Table ES-4. No Action Alternative release numbers and locations

Location	Facility Name	Smolt Releases	Total Basin Releases
Wenatchee River [a]	Leavenworth NFH	550,000	950,000
	Butcher Creek	140,000	
	Coulter Pond	65,000	
	Beaver Creek	110,000	
	Rohlfing	85,000	
Methow River [b]	Winthrop NFH	325,000	500,000
	Lower Twisp	100,000	
	Wells Dam	75,000	

a. Wenatchee production would be spawned and eggs early-incubated at Leavenworth NFH and transferred to Cascade Hatchery (funded by Mitchell Act) for final incubation and rearing to the pre-smolt stage prior to transfer to acclimation/release sites identified above, assuming these facilities are available. (See Section 2.2.2.1 for constraints.)

b. Methow production would be spawned and eggs early-incubated at Winthrop NFH and transferred to Cascade NFH for final incubation and rearing to the pre-smolt stage prior to transfer to acclimation/release sites identified above. A reduced number of fish may be able to be reared at Winthrop NFH.

Comparison of Alternatives

Table ES-5 compares the two alternatives considered in detail in this EIS—No Action and the Proposed Action—in terms of how well they meet the purposes defined in Section 1.2.

Table ES-5. Comparison of the Proposed Action and the No Action Alternative to Purposes

Purpose	Proposed Action	No Action
Develop a locally adapted, self-sustaining, naturally spawning coho stock that occupies its historical habitat in the Wenatchee and Methow river basins	By providing funding for expanding coho distribution into natural production areas of the basins, model results indicate that a locally adapted, self-sustaining, naturally spawning coho stock has an excellent chance of being established.	Without funding to expand into natural production areas, a locally adapted, self-sustaining, naturally spawning coho stock is unlikely to be established. The majority of fish returning to the basins would be hatchery fish.
Support efforts to mitigate for effects of the FCRPS on fish and wildlife in the Columbia River basin pursuant to the Northwest Power Act	Would support the long-term goal of a program designated as a high-priority mitigation project in the Council's Fish and Wildlife Program.	Would still support the program in the short term by continuing releases of coho from local broodstock.
Assist in carrying out commitments related to proposed hatchery actions contained in the 2008 Columbia Basin Fish Accords Memorandum of Agreement with the YN and others	Providing funding for expansion of the coho project would meet the maximum funding commitment made to the YN in the Accords MOA.	Maintaining the status quo would meet only the base funding commitment (for the current program phase) made to the YN in the Accords MOA.
Minimize harm to natural or human resources, including species listed under the Endangered Species Act	Proposed mitigation measures would minimize harm to natural and human resources. Approvals by and reporting to regulatory agencies would minimize the risk of adverse effects to listed species. Could provide ecological benefits that would aid in listed species recovery.	With no construction of new facilities, natural and human resources would not be adversely affected. Low numbers of naturally produ-ced coho could reduce the risk of adverse effects to listed species but also would not provide potential ecological benefits.
Increase the abundance of Mid-Columbia coho salmon to numbers sufficient to sustain a mainstem and terminal harvest in most years	Program projections indicate that by funding increased coho production for a limited period and expanding their distribution into natural production areas, natural coho abundance would be increased by 2028 sufficient to sustain harvests.	Without BPA funding for increased production and new release areas, it is unlikely that natural coho abundance and distribution would be increased sufficiently to provide significant harvest over the long term.
Support the visions and goals of other regional plans, including subbasin plans and the Tribal Anadromous Fish Restoration Plan (*Wy-Kan-Ush-Mi Wa-Kish-Wit*)	Would support subbasin plans by restoring coho as part of ecologically balanced systems. Would support the tribal plan by restoring natural production of coho to rivers that are important to historical cultural and economic practices of the tribes.	Would not support subbasin plans because naturally spawning populations of coho are unlikely to be restored. Would not support the tribal plan because natural production in historically used rivers would not be restored.
Maintain consistency with the coho production objectives specified in the 2008-2017 *United States v. Oregon* Fish Management Agreement for the Wenatchee and Methow subbasins	Continued BPA funding would provide the personnel, equipment, and facilities needed to maintain the *U.S. v. Oregon* production goal of 1.5 million smolts released from the Wenatchee and Methow subbasins.	Continued BPA funding would meet the *U.S. v. Oregon* production goal of 1.5 million smolts only through 2018, unless other agreements were reached before that time.

Summary of Environmental Effects

Table ES-6 summarizes the environmental effects, discussed in detail in Chapters 3 and 4.

Table ES-6. Summary of Impacts of the Proposed Action and the No Action Alternative

Impact	Proposed Action	No Action Alternative
Effects on water quality from facility discharges	There would be minor, localized impacts from phosphorus in effluent from proposed new facilities, but model simulations show that the maximum possible impact of all facilities, including the proposed hatchery, would be undetectable downstream in the sections of the Wenatchee River that are water quality limited.	No change from current program because no new facilities would be developed and fish production would remain the same.
Effects of surface and groundwater withdrawals on surface water quantity	Local reduction in flows at withdrawal points for groundwater and in 5 bypass reaches for surface water, offset by return flows from facilities.	No change from existing conditions because no new withdrawals are proposed.
Effects of water withdrawals on groundwater supply	Local reductions at 2 primary acclimation sites and the hatchery; no regional reductions.	No change from existing conditions because no new wells would be developed.
Effects of surface and groundwater withdrawals on water rights	Potential impact to groundwater rights at Dryden; potential impact to on- or off-site wells at 2 primary acclimation sites. No impacts to surface water rights at any of the sites.	No change from existing conditions because no new wells would be developed.
Sedimentation effects on fish	Minimal or no effects on ESA-listed and other fish from temporary sedimentation due to excavation and construction: best management practices would be used for erosion control.	No sedimentation effects because no new facilities would be constructed.
Effects of surface water withdrawal on ESA-listed and other fish	Relatively small withdrawal volumes at acclimation sites would not substantially reduce in-stream flow quantities, change habitat availability including hiding/resting/foraging habitats, or affect migratory movements (fry, juvenile, and adult) of listed salmonids. Withdrawals from Dryden fishway and discharge into Peshastin Cr. could increase spawning habitat for summer Chinook in Peshastin Cr. but have little or no effect on species in Wenatchee R. Water intake systems would follow NMFS 2008 guidelines to reduce potential to entrain all fish species.	No change from current conditions because no new surface water withdrawals would be made.
Reduced access to migration or rearing habitat for ESA-listed and other fish	Fish other than coho would be displaced from 1.53 acres of currently accessible habitat at proposed acclimation sites in both basins for 6 weeks to 7 months annually until 2028. For ESA-listed fish, this translates to: - Up to 43 spring Chinook juveniles and 91 steelhead juveniles excluded annually from Wenatchee basin sites out of a total annual wild population of 55,619 – 311,669 Chinook smolts and 17,499 - 85,443 steelhead smolts. - Approx. 233 spring Chinook juveniles and 155 steelhead juveniles excluded annually from Methow basin sites out of a total annual wild population of 15,306 – 33,710 Chinook smolts and 8,809 - 15,003 steelhead smolts. - Juvenile bull trout numbers excluded from sites in each basin are very small (Wenatchee 1; Methow 10). New sites in general displace fish from 1.5-7.3%, of off-channel habitat within specific stream reaches where amount of such habitat is known. Exceptions (30-73% of habitat) are offset by habitat improvements on-site or nearby.	Approximately 1/3 acre of currently accessible habitat at acclimation sites would be newly excluded from use by fish other than coho, for a total of 1.72 acres excluded from use for 6-8 weeks each year. Increase in current amount excluded is due to potential use of 2 Methow basin acclimation sites not in 2010 program, Heath and Lincoln.

Table ES-6 (continued)

Impact	Proposed Action	No Action Alternative
Trapping of fish at adult traps	Trapping at all but three traps is occurring under existing operations. Potential take of bull trout at Chiwawa Weir, Twisp Weir and Methow FH if operations are extended to allow coho trapping.	No change in current conditions; existing traps at Dryden Dam and Wells FH are operated part of the time solely for coho trapping.
Trapping of fish at juvenile traps	Incidental take of spring Chinook or bull trout is possible at a potential new trap on the Little Wenatchee R.; impacts would be evaluated when location is proposed.	No change in current conditions; existing traps are operated with or without coho project. No new traps proposed.
Coho predation on ESA-listed fish	Studies show that approximately 0.28% of hatchery coho smolts and 2.7 % of naturally produced coho prey on listed species, with less than 1% of the Chinook fry population consumed. Listed populations would be monitored and changes evaluated to determine if increasing numbers of coho increase predation with adverse effects on listed species.	Minimal predation by hatchery smolts as in existing program. Minimal predation by naturally produced smolts, as significant numbers of naturally produced coho are unlikely to be established.
Competition between naturally produced coho and ESA-listed species	Studies show species use different microhabitats, so competition is not expected at low densities. Listed species would be monitored to determine if adverse effects occur with increasing densities.	Without the expanded program, naturally produced coho numbers and densities would remain low, so potential competition with listed species would be limited or non-existent.
Effects on ecological balance	The addition of coho carcasses at the onset of winter might provide an increased marine-derived source of nutrients and improve over-winter survival for all species. Juvenile and adult coho provide prey for fish-eating predators including bull trout, bald eagles, mergansers, otters, and bears. Ecological balance could improve with coho occupying a critical niche in the natural environment.	Current conditions would continue; e.g., in Nason Creek, there is very little carcass production, leaving a potential void in the nutrient balance prior to the onset of winter. Little potential for improvement in ecological balance.
Habitat reductions for ESA-listed wildlife	Slight reduction in potential spotted owl habitat possible at Tall Timber (w/in 1 mi. of management circle, w/ suitable forest habitat); qualified biologist would confirm presence or absence of nests in any trees needing removal. Critical habitat not affected.	No change in current conditions.
Habitat reductions for state-listed wildlife	No noticeable reductions in available habitat for any species listed under WDFW Priority Habitat and Species program. Slight increase in aquatic habitat due to new ponds.	No change in current conditions.
Disturbance to wildlife	Construction noise could cause certain species to avoid 8 sites for 1-60 days, May-October of 2012 or 2013. Operations, including use of noise-baffled generators, would not noticeably disturb wildlife because all primary sites currently experience human activity.	No change in current conditions.
Effects on wetlands	No construction would occur in wetlands at any primary project sites, so wetlands would not be affected.	No change in current conditions.
Changes to floodplain function	Construction would occur in floodplains, requiring permits at 3 primary acclimation sites in the Wenatchee and 2 primary acclimation sites in the Methow, and at the proposed new hatchery. - Flood elevations are not expected to change. - New ponds could add a small amount of flood storage. - Excavated material would be disposed outside of floodplains and not change grade that could divert flood flows to nearby properties.	No change in current conditions.
Effects on aesthetic/visual quality	Dryden Hatchery could reduce the contrast of the site with the surrounding area and add to the aesthetic appeal for viewers. Acclimation sites would not change visual quality.	No change in current conditions.

Table ES-6 (continued)

Impact	Proposed Action	No Action Alternative
Effects on recreation	No interference with current recreation uses. Generators at noise-sensitive acclimation sites would be enclosed in noise-muffling structures to meet state noise standards.	No change in current conditions.
Economic effects	Minimal increase in employment, temporary and permanent. No new infrastructure or services required.	No change in current conditions.
Effects on harvest	Potential terminal, mainstem, and ocean tribal, commercial, and sport harvest by 2028.	No harvest of naturally produced fish; potential harvest of hatchery fish if program changes to harvest augmentation.
Effects on cultural resources	No cultural resources were found in the vicinity of project sites; no effect.	No effect.
Noise effects	Construction noise at residences or properties near acclimation sites 8 a.m. – 5 p.m. M-F, for 1 day to 4 months in 2012 or 2013. Construction noise likely not noticeable for the 5-month hatchery construction period due to noise from surrounding uses at Dryden. Noise from generators would be muffled to meet state standards.	No change in current conditions.
Effects on air quality	Minor short-term increases in dust during spring and summer of 2012 or 2013 from construction activities. Undetectable increases in greenhouse gases.	No change in current conditions.
Consistency with comprehensive plans	Proposed activities would be consistent with goals and policies in Chelan County and Okanogan County comprehensive plans.	Current program is consistent with comprehensive plans in Chelan and Okanogan counties.

Chapter 1. Purpose of and Need for Action

Bonneville Power Administration (BPA), in partnership with the Yakama Nation (YN), proposes to fund transition of the Mid-Columbia Coho Restoration Program from its feasibility phase to a comprehensive program to restore naturally spawning populations of coho salmon in harvestable numbers to the Wenatchee and Methow river basins in north central Washington State. Construction of a new hatchery on the Wenatchee River in Chelan County, and construction and use of small acclimation facilities in natural settings in Chelan and Okanogan counties, are included in this proposal. Figure 1-1 shows the general project area.

BPA is a federal power marketing agency within the United States Department of Energy (USDOE). BPA's operations are governed by several statutes, such as the Pacific Northwest Power Planning and Conservation Act of 1980 (Northwest Power Act) (16 U.S.C. § 839b(h)(10)(A)). Under the Act, BPA must protect, mitigate, and enhance fish and wildlife affected by the development and operation of federal hydroelectric facilities on the Columbia River and its tributaries. BPA must fulfill this duty in a manner consistent with the Columbia River Basin Fish and Wildlife Program developed by the Northwest Power and Conservation Council (Council). The Council in turn gives deference to project proposals made by Indian tribes.

Since 1996, BPA has funded the Yakama Nation to study the feasibility of reintroducing coho in north central Washington. The studies show a reasonable likelihood of success for full-scale coho reintroduction, so the YN prepared a Master Plan (YN 2010[6]) for a program to increase local adaptation and self-sustainability of the newly developed Mid-Columbia coho broodstock and to increase their abundance in the upper tributaries of the two basins. After review of the Master Plan, the Council recommended to BPA to proceed with Step 2 of Council's three-step review process for the Mid-Columbia Coho Restoration Program proposed by the Yakama Nation. The tribe proposed the project because naturally spawning populations of coho were extirpated from the Wenatchee and Methow river basins, and currently insufficient facilities exist in the upper basin tributaries to restore coho populations to those basins.

This Environmental Impact Statement (EIS) analyzes the effects of the Proposed Action as described in the Master Plan and the No Action Alternative required by the National Environmental Policy Act (NEPA).

1.1 Underlying Need for Action

BPA needs to respond to the Northwest Power and Conservation Council's recommendation and decide whether to provide funding to the YN for its proposal to move to the next phase of the Mid-Columbia Coho Restoration Program in the Wenatchee and Methow river basins.

[6] http://www.yakamafish-nsn.gov/Production/Coho/MC%20coho%20web/Mid-C%20Coho%20MP%208-17-10%20FINAL.pdf

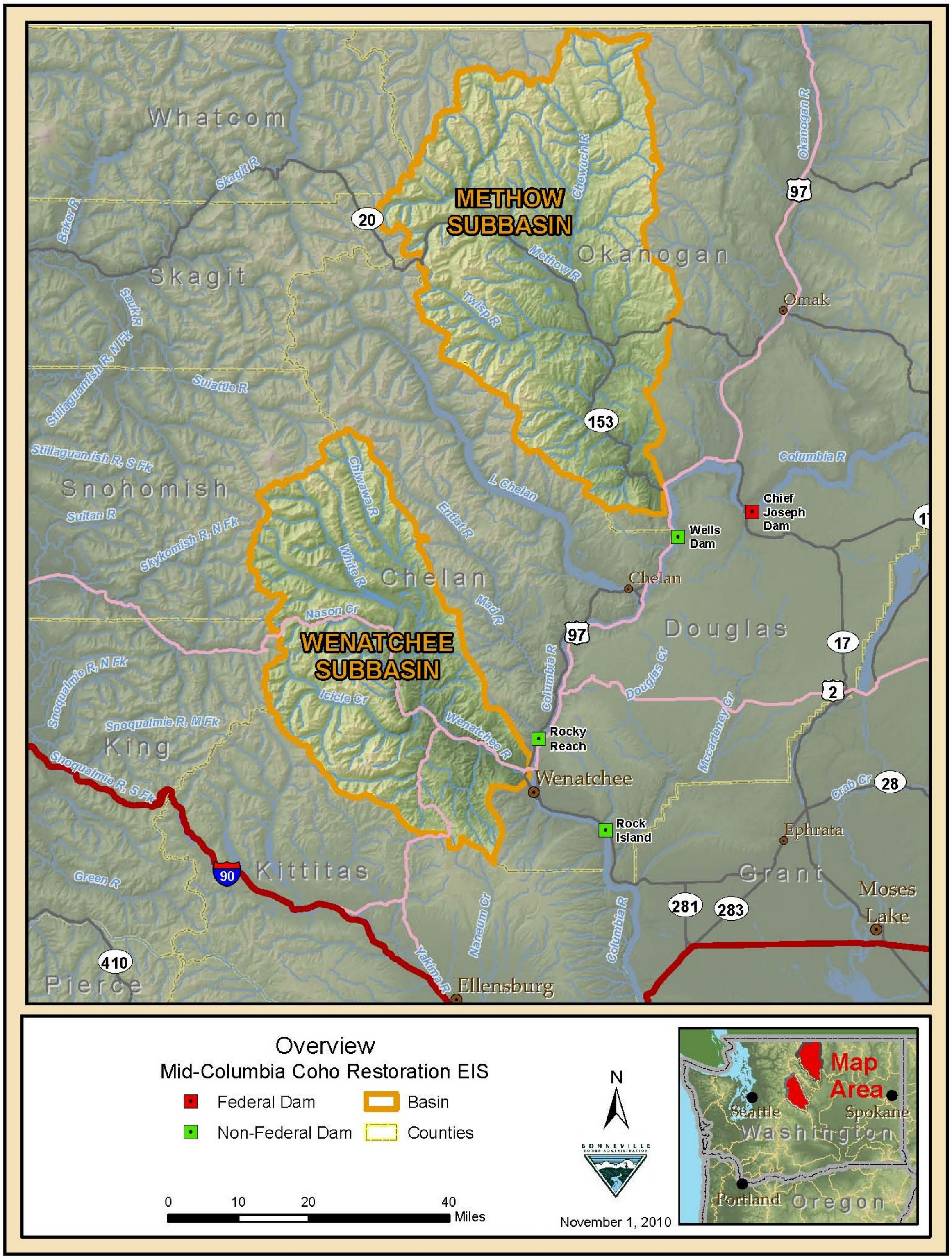


Figure 1-1. Project Area Overview

1.2 Purposes

In meeting the underlying need, the alternatives considered should achieve the purposes listed below. BPA will base its choice among alternatives on how well each one meets them.

- Develop a locally adapted, self-sustaining, naturally spawning coho stock that occupies its historical habitat in the Wenatchee and Methow river basins.
- Support efforts to mitigate for effects of the Federal Columbia River Power System (FCRPS) on fish and wildlife in the mainstem Columbia River and its tributaries pursuant to the Northwest Power Act.
- Assist in carrying out commitments related to proposed hatchery actions that are contained in the 2008 Columbia Basin Fish Accords Memorandum of Agreement with the YN and others.
- Minimize harm to natural or human resources, including species listed under the Endangered Species Act.

In addition to these objectives that BPA seeks to fulfill, the Yakama Nation also seeks a preferred alternative that would:

- Increase the abundance of Mid-Columbia coho salmon to numbers sufficient to sustain a mainstem and terminal harvest in most years.
- Maintain consistency with the visions and goals of other regional plans, including subbasin plans and the Tribal Anadromous Fish Restoration Plan (*Wy-Kan-Ush-Mi Wa-Kish-Wit*).
- Maintain consistency with the coho production objectives specified in the 2008-2017 *United States v. Oregon* Fish Management Agreement for the Wenatchee and Methow subbasins.

1.3 Background Information

The Council has a three-step process for review of artificial propagation projects (i.e., hatcheries) proposed for funding by the BPA (NPPC[7] 2001). Step 1 is conceptual planning, represented primarily by master plan development and approval. Step 2 is preliminary design and cost estimation, along with environmental review. Step 3 is final design review. The Council's Independent Scientific Review Panel reviews the proposed projects as they move from one stage of the process to the next.

The Council and its Independent Science Review Panel reviewed drafts of the Mid-Columbia Coho Restoration Program Master Plan, and on March 9, 2010, the Council recommended that BPA and the Yakama Nation move to Step 2 of the Council's process, which includes BPA's NEPA review and drafting of preliminary designs.

In addition to its responsibilities under the Northwest Power Act, on May 2, 2008, BPA, Bureau of Reclamation, and U.S. Army Corps of Engineers signed the 2008 Columbia Basin Fish Accords Memorandum of Agreement between the Three Treaty Tribes and FCRPS Action

[7] Northwest Power Planning Council, now called Northwest Power and Conservation Council (NPCC, or the Council).

Agencies. The three tribes are the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of Warm Springs Reservation, and the Confederated Tribes of the Umatilla Indian Reservation. The agreement includes funding for the YN's Mid-Columbia Coho Restoration Program, including its proposed hatchery. BPA conditioned its funding commitment on securing a favorable recommendation from the Council and on compliance with all its other mandates, including NEPA.

Salmon are a part of the spiritual and cultural identity of the Columbia River tribes. Salmon also play an important role in the economic well-being of tribal members. Restoring coho salmon to north central Washington would help the tribes to exercise their fishing rights as well as provide for fishing by sport and commercial fishers. Reintroducing coho in these basins could also contribute to restoring the ecological balance of the system. The Wenatchee Subbasin Plan recognizes that "Restoration of individual populations may not be possible without restoration of other fish and wildlife populations with which they co-evolved." (NPCC 2004a).

1.4 History of Coho in the Mid-Columbia Region

1.4.1 Historical Conditions and Extirpation

Mullan (1984) estimated historical mid-Columbia River adult coho populations as follows:

- Wenatchee basin—6,000 - 7,000
- Methow basin—23,000 - 31,000

Prior to the establishment of BPA in 1937, mid-Columbia coho salmon populations were decimated by impassable dams, harmful forestry practices, and unscreened irrigation diversions in the tributaries, along with an extremely high harvest rate in the lower Columbia River (YN 2010). A Washington Water Power dam blocked the Methow River at Pateros between 1915 and 1929, preventing all fish passage during those years; by the time the project was removed, the Methow River run of coho was extirpated (NPCC 2004b). The loss of natural stream flow degraded habitat quality and further reduced coho productivity. Over the years, irrigation, livestock grazing, mining, timber harvest, fire management, road and railroad construction, and residential and other development also contributed to destruction of salmon habitat. By the 1930s, coho were considered extirpated from the entire mid-Columbia region (NPCC 2004b).

For several reasons, self-sustaining coho populations were not re-established in mid-Columbia basins despite plantings of 46 million fry, fingerlings, and smolts from Leavenworth, Entiat, and Winthrop National Fish Hatcheries between 1942 and 1975:

- A substantial amount of critical physical fish habitat was lost or severely degraded (Tyus 1990; Petts 1980; Diamond and Pribble 1978).
- Existing coho programs were unsuccessful or lower priority than programs for other salmonid species. For example, the most recent coho hatchery program in the mid-Columbia region was at Turtle Rock Hatchery, funded by Chelan Public Utility District. The coho program was terminated due to poor adult returns, thought to be caused in part by pathogenic water supplies resulting in disease problems at the hatchery. Because fall Chinook and steelhead were higher priority species, they were given priority use of the limited supply of high quality hatchery water. The last coho releases from this program were in 1994.

- Fish culture practices in general resulted in poor adult return rates. Rearing at high densities in concrete raceways, an incomplete understanding of fish health and nutritional needs, the use of water supplies with unnatural temperature profiles, and un-acclimated, non-volitional releases directly from hatcheries into the wild environment produced smolts with low survival rates.
- Release locations did not support returns to high quality coho habitat. Releases from hatcheries did not imprint smolts with migratory clues that would encourage them to populate habitats that were far upstream of the release sites.
- The construction and operation of mainstem Columbia River hydropower projects were detrimental to mid-Columbia River salmonid populations. Coho had to pass through a number of dams and reservoirs, leading to deaths from turbines, predation, migration delays, gas bubble trauma, and so forth.
- Hatchery spawning protocols did not support the development of coho stocks that would be successful in the natural environment and migrate long distances to the upper Columbia basin.
- Harvest was not managed for the protection of weak stocks. Open-ocean troll and gill net fisheries, the lack of near real-time catch monitoring, and the limited ability to predict run sizes resulted in over-harvest of wild fish and weak hatchery stocks.

Since Priest Rapids Dam northeast of Yakima, Washington, was completed in 1960, the peak escapement of adult coho upstream of the dam was probably never greater than 10,000 coho and, as of 1998, had not exceeded 1,300 since 1974 (WDFW/ODFW 1998). From 1988 to 1994, adult counts at Priest Rapids Dam averaged only 16 coho, probably a result of releases from Turtle Rock Hatchery, which annually produced about 600,000 coho smolts until the program was terminated in 1994 (WDFW/ODFW 1995).

While no one knows for sure why natural populations of spring Chinook and steelhead persisted (admittedly at low levels) when coho did not, possible reasons include:

- Very high harvest rates on coho in the lower Columbia River in the late 19th and early 20th centuries—as much as 90-95%; other species were not harvested at this rate.
- The fixed three-year coho life cycle. Spring Chinook and steelhead have greater variability in their life cycles than do coho. Spring Chinook can return as age 3, 4, or 5 adults. Steelhead can be residents in freshwater for up to 3 years and then migrate to the ocean, or they can be freshwater residents for their entire life cycle and still have progeny that migrate to the ocean. This variability in life cycles allows more potential for at least some members of a generation of spring Chinook or steelhead to survive adverse local or regional environmental conditions. For coho, however, the production from any one spawning year would occupy the same habitat at the same time throughout their life cycle. Thus all would be exposed to extreme conditions at the same time, with the potential to significantly reduce the survival rate of the entire generation.
- Unscreened irrigation diversions on small tributaries in mid-Columbia basins. Coho spawn in smaller tributaries than spring Chinook or steelhead, so these small diversions could have diverted and trapped more coho juveniles than juveniles of other species that might not occupy small tributaries. This entrainment could have reduced the numbers of juveniles that survived to negotiate the other hazards that affect all salmonids in their life cycle.

1.4.2 Current Conditions

In the past two decades, conditions and practices have changed and improved to a certain degree. Some of the local habitat causes of coho depletion have been corrected, although there is still work to be done. For example, many irrigation diversions have been screened, tributary dams have been removed, new logging practice regulations have provided increased environmental protection, mining has ended, and grazing practices have improved.

Habitat Conservation Plans have been negotiated between fisheries resource managers and Mid-Columbia Public Utility Districts (PUDs).[8] The plans have strict performance standards (survival criteria) for both project passage and hatchery compensation so that the hydroelectric projects associated with each plan can be considered to have No Net Impact on anadromous species.

The ESA listings of several salmonid species that migrate through the lower Columbia River have curtailed coho fisheries in the ocean that once over-harvested the mid-Columbia stocks of coho. Fisheries restrictions based on ESA-listings have curtailed ocean harvest of Lower Columbia River coho from an annual average of 80% between 1970 and 1983; to 49% from 1984 to 1993; to 10% from 1994 to 2007 (NMFS 2008a). These restrictions are likely to be in effect for a number of years.

Recent improvements in artificial production practices would also improve efforts aimed at supporting natural production. Supplementation techniques, featuring refined genetic objectives, the production of "natural-like" hatchery smolts, and acclimation and release in wild habitat, are being used.

1.5 Coho Reintroduction Feasibility Studies

In 1996, BPA began funding the Yakama Nation to study the feasibility of reintroducing coho to the mid-Columbia region.[9] BPA analyzed the effects of a proposed comprehensive plan for feasibility studies in the Mid-Columbia Coho Reintroduction Feasibility Project Final Environmental Assessment (EA), completed in April 1999 (DOE/EA-1282). Supplemental Analyses (DOE/EA-1282/SA-01, -02, -03, and -04) were prepared to analyze effects of additional activities and facilities proposed for the studies.

Feasibility studies were designed to achieve two primary goals:

1) ***Determine whether a broodstock can be developed from lower Columbia River coho stocks whose progeny can survive in increasing numbers to return as adults to the mid-Columbia region.***
2) ***Initiate natural reproduction in areas of low risk to sensitive species and in other select areas to study the risks and interactions with sensitive species.***

[8] Grant County PUD, Chelan County PUD, and Douglas County PUD.

[9] Years after this project began (and was named), many entities in the region began using the term "upper Columbia" to refer to the region in which the Wenatchee and Methow subbasins lie. We have chosen to continue using "mid-Columbia" to refer to this project in order to demonstrate the continuity of the project from the feasibility studies onward. As well, because the Columbia River originates hundreds of miles upstream in Canada, the term "mid-Columbia" seems to be more geographically accurate.

The feasibility goals have been met; results are summarized in Table 1-1 and documented in detail in a series of annual reports (Dunnigan and Hubble 2008; Dunnigan 2009; Murdoch and Dunnigan 2001; Murdoch and LaRue 2002; Murdoch et al. 2004 and 2005).

Table 1-1. Summary of feasibility study goals and results

Feasibility Study Goals	Results	Goal Achieved
1) Determine whether a broodstock can be developed from Lower Columbia River stocks.	Lower Columbia River (LCR) coho were transferred to the Wenatchee Basin in 1999, 2000, and 2001. A limited number of LCR transfers were used to supplement local broodstocking efforts in 2002. Since 2003, no LCR broodstock have been released in the Wenatchee basin (YN 2010 Table 3-4). Releases of LCR coho salmon smolts were discontinued in the Methow River basin in 2006. Broodstock collection goals have been met or exceeded since 2006 in the Wenatchee basin and since 2009 in the Methow basin. By no longer relying on the transfer of coho from Lower Columbia River hatcheries, YN has demonstrated that a local broodstock can be developed from Lower Columbia River stocks. Smolt-to adult returns (SARs) have trended upwards with each generation of broodstock development (YN 2010 Figures 3-1 & 3-2).	Yes
2) Initiate natural reproduction in areas of low risk to sensitive species and in other select areas to study the risks and interactions with sensitive species.	The YN has documented spawning escapement in the Wenatchee and Methow basins (YN 2010 Figures 3-4 & 3-5). In the Wenatchee basin, redd counts have ranged from a low of 28 in 2002 to a high of 1,666 in 2007 (mean = 627; YN 2010 Figure 3-4). While redd numbers are lower in the Methow (a maximum of 306 redds in 2007), the annual fluctuations are similar to the Wenatchee. Juvenile production has been documented in the Wenatchee (Methow analysis is incomplete). Annual population estimates of naturally produced coho emigrating from the Wenatchee River range from a low of 5,826 in 2002 to a high of 48,708 in 2007 (YN 2010 Table 3-7). The naturally produced coho smolts have survived to return as adults. SARs for naturally produced coho range from 0.15% to 1.64% (YN 2010 Table 3-7). Studies of interactions with sensitive species (spring Chinook, steelhead, and sockeye) were developed under the direction, guidance, review and approval of the Mid-Columbia Coho Technical Work Group[a]. Critical uncertainties answered include rates of residualism, redd superimposition, predation by hatchery coho on naturally produced spring Chinook fry, and competition for space and food during freshwater rearing. The YN detected no significant impacts on listed fish throughout the evaluations (YN 2010 section 3.2).	Yes

a. Members of the Technical Work Group (TWG) represented National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Dept. of Fish and Wildlife, Northwest Power and Conservation Council, BPA, Colville Tribe, Nez Perce Tribe, U.S. Forest Service, Chelan County PUD, Douglas County PUD.

1.6 Decisions to be Made and Responsible Officials

BPA will use the final EIS to decide whether to fund increased coho reintroduction efforts, including the construction of new facilities, in the Wenatchee and Methow basins. The Responsible Official is the Administrator and Chief Executive Officer.

The EIS is part of the second step in a 3-step project planning process established by the Council. The first step was preparation of the project Master Plan (YN 2010)[10] which provides the basis for the proposal analyzed in this EIS. The third step is the final design and cost estimate review leading to construction of the proposed facilities, should BPA decide to fund the program.

[10] http://www.yakamafish-nsn.gov/Production/Coho/MC%20coho%20web/Mid-C%20Coho%20MP%208-17-10%20FINAL.pdf

The Yakama Nation is a cooperating agency and assisted with preparation of this EIS. The YN must decide whether to support BPA's decision on a preferred alternative for the Mid-Columbia Coho Restoration Program. As co-manager with the Washington Department of Fish and Wildlife (WDFW) of fish and wildlife resources in the Wenatchee and Methow basins, and because of its long-term cultural interest in the project, the YN must consider the potential effects of the project on the tribal community and the natural resources it manages.

Okanogan County is a cooperating agency and has agreed to serve as the lead agency to satisfy Washington State Environmental Policy Act (SEPA) procedural requirements.

Information in this EIS may also be used by other agencies to base decisions on permits, authorizations, management plans and other approvals associated with the project.

1.7 Public Involvement

1.7.1 Scoping

Over the years, the Mid-Columbia Coho Restoration Program has involved state and federal agencies, other tribes, Mid-Columbia public utilities, the Northwest Power and Conservation Council, and interested residents and citizens in developing and reviewing the scope of the feasibility studies, methods used, and monitoring and evaluation studies and results. The YN also consulted with these organizations and individuals, as well as with a variety of scientists throughout the region, to develop the Master Plan (YN 2010), on which the proposed action is based.

On July 30, 2009, the public process for the NEPA review of the current proposed action began with the publication in the Federal Register of a Notice of Intent to Prepare an Environmental Impact Statement. Meetings to provide an opportunity for the public to contribute to defining the scope of the EIS analysis and alternatives were held in Leavenworth, Washington, on August 20, 2009 and in Twisp, Washington, on August 21, 2009. At those meetings, YN staff presented an overview of the proposed project, and oral and written comments were recorded at both meetings. Written comments were accepted by BPA until September 15, 2009 and are posted on BPA's web site.

The following summary lists the general issues raised at the meetings and in written comments and where they are addressed in the EIS. Complete comments are accessible through the BPA website. http://www.bpa.gov/applications/publiccomments/CommentList.aspx?ID=79

Need for Project

YN has access to adequate supplies of coho and other species on the lower Columbia; the tribes have plenty of money from casinos and should pay for the project themselves; too many ratepayer dollars are spent on salmon restoration projects that benefit only a small number of people; money should be spent on salmon programs in the lower Columbia, not here. (See Chapter 1)

Reviewers and Decision-makers

Does the project receive an independent scientific review; who makes the decision on this project; which agencies have been involved in this project. (See Chapter 1)

Alternatives to consider

Can you get wild donor fish from out of the area, like Alaska or Canada; can you use egg boxes instead of hatcheries as an alternative rearing method. (See Section 2.4)

No Action Alternative

Effect on Yakama Nation's ability to implement the program; effect on BPA's ability to meet Power Act responsibilities. (See Section 2.5)

Results of Feasibility Studies

(Summarized briefly in Section 1.5; more detail in Master Plan [YN 2010]; greatest detail in project annual reports, cited in Chapter 5, References)

Biological Program Design

Manage composition of the return to incorporate more natural fish than hatchery fish in the broodstock; need clear production goals; number of adults for harvest vs. for broodstock; likelihood that population will be self-sustaining. (See Section 2.2.1)

Facilities Location, Design, and Operation

Provide details on project design and location of new and temporary facilities; water quality and temperature requirements for coho; how will acclimation ponds be maintained; are fish fed in the ponds; techniques of predator control, including use of paid employees or volunteers. (See Section 2.2.2, Section 3.8.2, and Appendices 1, 2, and 3)

Monitoring Program

Compare survival rates of hatchery and natural fish; amount of mortality caused by dams; percent of fish released that return as adults; techniques used to monitor competition between naturally produced coho and other species; coho escapement; coho losses to predation; coho production numbers in small tributaries; superimposition of coho redds on summer Chinook redds. (See Section 2.2.3 and Appendix 5 [monitoring program techniques]; Section 3.7 [redd superimposition]; Master Plan and annual reports [detailed monitoring results])

Existing Environment

History of coho in basins; reasons for coho extirpation and how or if conditions are different now; why spring Chinook and steelhead persisted in the basins and coho did not; current status of coho; numbers of spring Chinook, steelhead and bull trout in Icicle Cr.; status of spring Chinook in Mission Cr.; existing water quality. (See Sections 1.4.1, 1.4.2, 3.4 [history and status of coho]; 3.5 [water quality]; and 3.7 and Appendix 9 [status of other fish species])

Impacts

Fish: predation by coho on at-risk and/or ESA-listed species, including steelhead, spring Chinook, lamprey, bull trout; interspecies competition, specifically coho with steelhead and spring Chinook; differences in competition between hatchery and natural fish; benefits to listed fish from coho carcasses; benefits of volitional releases to other salmonids. (See Section 3.7)

Water quality: effects of existing, new, and temporary facilities; effects of runoff contaminants on fish; effects of discharge from ponds; types of contaminants from ponds; disposal of carcasses from acclimation ponds; proposed mitigation. (See Section 3.5 [project effects on water quality]; 3.7 [discharge effects on fish])

Water use/quantity: effects of existing, new, and temporary facilities; effects of use of water from storage in riparian areas, ponds, irrigation; effects of project on water rights of irrigation districts; availability of water rights; proposed mitigation. (See Section 3.6)

Floodplains: impacts to floodplain function, channel migration, riparian habitat. (See Section 3.10 and 4.5)

Visual quality: effects on riverfront view of property owner. (See Section 3.11)

Recreation: effect of the Dryden facility on boaters. (See Section 3.11)

Land use: effects on farmers; effects on state highway rights-of-way; access and mitigation issues on private property used for acclimation sites. (See Sections 3.11, 3.12, and 4.8)

Socioeconomic: effect of project costs on electricity and irrigation rates. (See Section 3.12)

Consistency with local, regional, and national plans and programs: consistency of this project and MOA projects in general with Northwest Power Act, ESA, and the Columbia Basin fish and wildlife program. (See Sections 1.3, 4.2, 4.3, and the last bullet in Section 1.7.2 below)

Harvest: effect of harvest on native runs of salmon, steelhead, walleye, and sturgeon in Wenatchee area; location of harvest; condition of fish for harvest; who can participate in harvest. (See Section 3.12 and the first bullet in Section 1.7.2 below)

1.7.2 Issues Beyond the Scope of this EIS

The following issues were raised during scoping but are beyond the scope of this EIS; the issues are more appropriately addressed in other forums or with other agencies, as specified below.

- Potential for increase in gillnetting in the project area; effects of various harvest techniques, including gillnetting, on other species; how harvest is regulated on lower Columbia to protect mid-Columbia fish: (Harvest methods, timing, and numbers would be regulated by state, federal, and tribal agencies through the Columbia River Fish Management Plan (CRFMP), as part of Court-supervised requirements of *U.S. v. Oregon*).
- Use of surplus coho for Colville Tribal programs: (The potential for the Colville Tribe to use surplus coho to build a broodstock for programs under their jurisdiction is a short-term activity currently being negotiated and would not affect the number of coho available for this proposal).
- Purchase of conservation easements in the lower Methow: (Habitat protection activities, including purchase of conservation easements, are part of other BPA and YN programs focused on protecting habitat of the ESA-listed mid-Columbia spring Chinook salmon).
- Effects on wild coho: (No wild coho exist in these basins).
- Effects on landowners of regulations regarding activities in riparian areas, e.g., cutting trees and keeping cattle out: (Washington State and federal agencies have regulations governing forestry and grazing practices in riparian areas. Coho in a stream would not change a stream classification or the state regulations governing forestry or grazing adjacent to the stream.)
- Consistency of MOA projects with Northwest Power Act, ESA, and Columbia Basin fish and wildlife program. (Projects other than the one that is the subject of this EIS are beyond the scope of the analysis.)

1.7.3 Public Review of Draft EIS

The Draft EIS was issued for public review in June 2011. Public meetings were held in Leavenworth and Twisp, Washington, on July 13 and 14, 2011, respectively. BPA and YN staff presented an overview of the project and summarized the impacts. Oral and written questions and comments were recorded at those meetings, and written comments were accepted until August 22, 2011.

This section summarizes comments received at the meetings and in written correspondence. Individual comments and BPA's responses to them are in Appendix 12 attached at the end of this EIS.[11] The response to each comment includes an indication of whether changes were made in the EIS and where those changes can be found. Complete comments are also reproduced in Appendix 12.

Comments were submitted on the following issues:

Alternatives:

- Is the No Action Alternative properly defined in the EIS?
- How will loss of Mitchell Act funding affect existing hatcheries proposed for use?
- Question whether all reasonable alternatives were evaluated in the EIS.
- How were acclimation sites identified?
- Questions about specific acclimation sites and operations.

NEPA Process: What was the NEPA documentation for Lincoln acclimation site?

Conservation Easements: Review processes and policies for sites with conservation easements.

Biological Rationale for Proposed Action:

- Technical questions about the meaning of PNI [Proportionate Natural Influence], how project success will be determined.
- What will be done if project goals are not met?

Coho Status:

- Reasons why coho were extirpated but other species survived.
- Questions about coho strength and adaptability, where they are spawning now.

Water quality:

- Question adequacy of the water quality assessment for Leavenworth NFH.
- Question estimates of effluent levels and waste water treatment methods for the proposed Dryden hatchery.
- Questions about effects of discharges from acclimation ponds on streams in the Methow basin and on water temperatures.

---

[11] Of the other 11 appendices published with the Draft EIS, only Appendix 5 (Monitoring and Evaluation Plan) was revised and reissued with this Final EIS; the others required no revision and so were not reissued.

Habitat and ESA-listed Fish:

- Concerns that acclimation sites will reduce off-channel and rearing habitat for ESA-listed fish.
- Suggest phasing coho reintroduction to coincide with habitat improvements.
- How were numbers of fish excluded from habitat calculated?
- What measures will be used to avoid impacts to listed fish and to control coho populations?
- Include a description of the monitoring and evaluation plan in the EIS.
- Concerns about the adequacy of the analysis of competition effects between coho and listed fish.

White River:

- Concerns about backfilling wetlands in White River.
- Concern about impacts to this pristine watershed.

Other Sensitive Species:

- Question accuracy of list of affected species for sites in the Methow basin.
- Concerned that impacts to sockeye salmon be evaluated.

Wetlands: The FEIS should update the wetland discussion to reflect results of wetland delineations and any compensation that might be required.

Economic Costs and Benefits:

- Why are costs different between the Wenatchee and Methow basins?
- What were costs of feasibility studies?
- What would total cost of the project be?
- Was a cost/benefit analysis done?
- How will people in the mid-Columbia area benefit financially?

Comments supporting and opposing the program and miscellaneous comments.

Chapter 2. Alternatives Including the Proposed Action

This EIS analyzes in detail the Proposed Action and the No Action alternatives. Other options considered and eliminated from detailed analysis in this EIS are briefly discussed in Section 2.4.

2.1 Current Experimental Program

Chapter 1, Section 1.5 describes the history of the Yakama Nation's coho reintroduction experiments that BPA has funded to date. The history includes feasibility studies to determine if the Yakama Nation could succeed in developing a local coho stock, originating from lower Columbia River hatchery stocks, that would return to mid-Columbia tributaries with increasing survival rates. That goal was achieved (YN 2010): in 2009, 100% of the coho smolts released in both basins were progeny of second- and third-generation mid-Columbia broodstock.

The program currently is collecting more of its broodstock from upstream capture sites than during the feasibility studies. The objective is to determine if spawning more adults from upstream sites selects for characteristics that allow their progeny to exceed what might be the current limits of stamina and run timing for the reintroduced population. Such characteristics might allow coho to return to the better quality habitat in the upstream portions of the basins if they are acclimated in those areas as proposed in the Proposed Action (Murdoch et al. 2004).

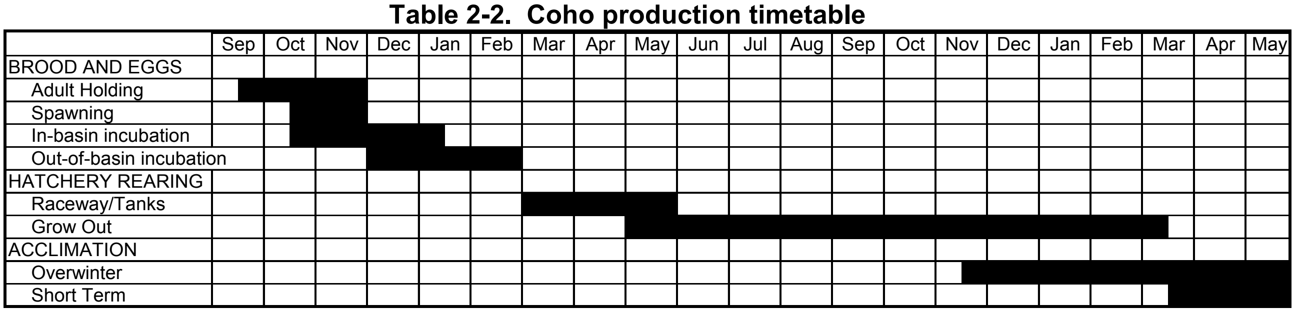
A total of 1.5 million smolts are acclimated and released in the two basins annually. In 2011, approximately 31,000 adults passed Rock Island Dam, the closest mainstem Columbia River dam downstream from the Wenatchee River mouth (Figure 1-1). Facilities used in the current program are listed in Table 2-1 and shown in Figures 2-1 through 2-3.

The schedule of fish culture activities is shown in Table 2-2. The timing of egg and fish transfers between facility components is guided by this schedule. Adults are moved from capture sites to holding facilities in the fall for ripening and spawning. Green eggs are incubated at or near these holding facilities. All eyed eggs from the Wenatchee program and a portion of the Methow production are transported to hatcheries in late fall/early winter for final incubation and rearing to the pre-smolt stage. The following fall, some of the hatchery production can be moved to target watersheds for over-winter/intermediate rearing to take advantage of a prolonged period of imprinting on natal waters and rearing in a semi-natural environment. Locations may vary depending on which rearing strategy is employed. In late winter to early spring (mostly weather dependent), the remaining pre-smolts are moved to final acclimation/release sites.

Table 2-1. Facilities used in current coho restoration program

BROODSTOCK COLLECTION	
Wenatchee	**Methow**
Tumwater Dam	Wells Fish Hatchery (FH)
Dryden Dam	Wells Dam ladders
Leavenworth National Fish Hatchery (NFH)	Winthrop National Fish Hatchery (NFH)
	Methow FH
HOLDING, INCUBATION AND/OR REARING	
Leavenworth NFH	Note: Rearing facilities provide coho for both basins
Winthrop NFH	
Peshastin Incubation Facility	
Cascade FH	
Willard NFH	
SMOLT RELEASES	
Wenatchee	**Methow**
• 500,000 above Tumwater Dam in Nason Creek and Beaver Creek • 500,000 from Icicle Creek	• 300,000 from Winthrop NFH • 75,000 from Lower Twisp • 125,000 from Wells FH
ACCLIMATION	
Wenatchee	**Methow**
Leavenworth NFH (Icicle Creek)	Winthrop NFH
Rohlfing	Lower Twisp
Coulter	Wells FH
Butcher	
Beaver	

Table 2-2. Coho production timetable



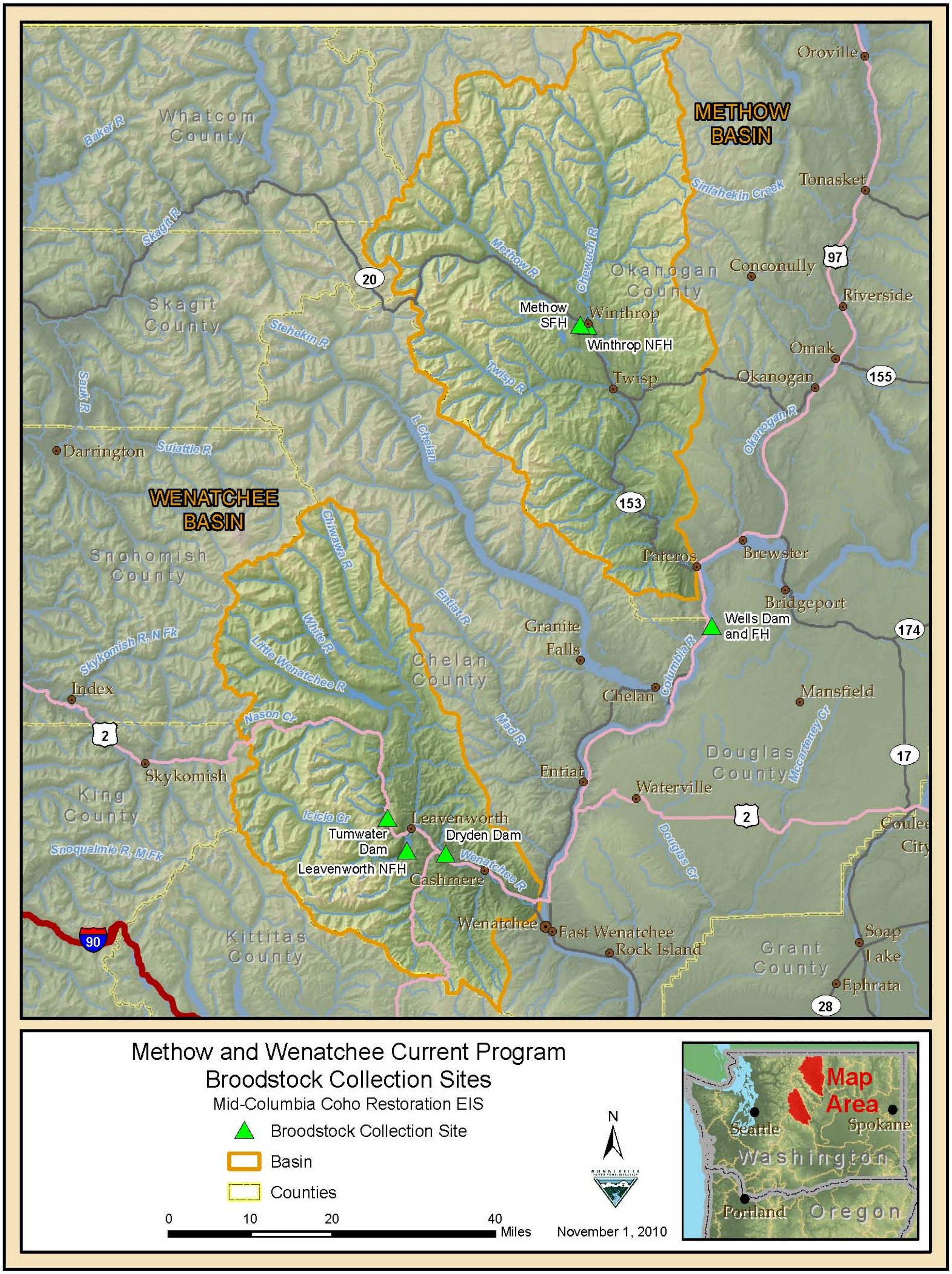


Figure 2-1. Current Program: Broodstock Collection Sites

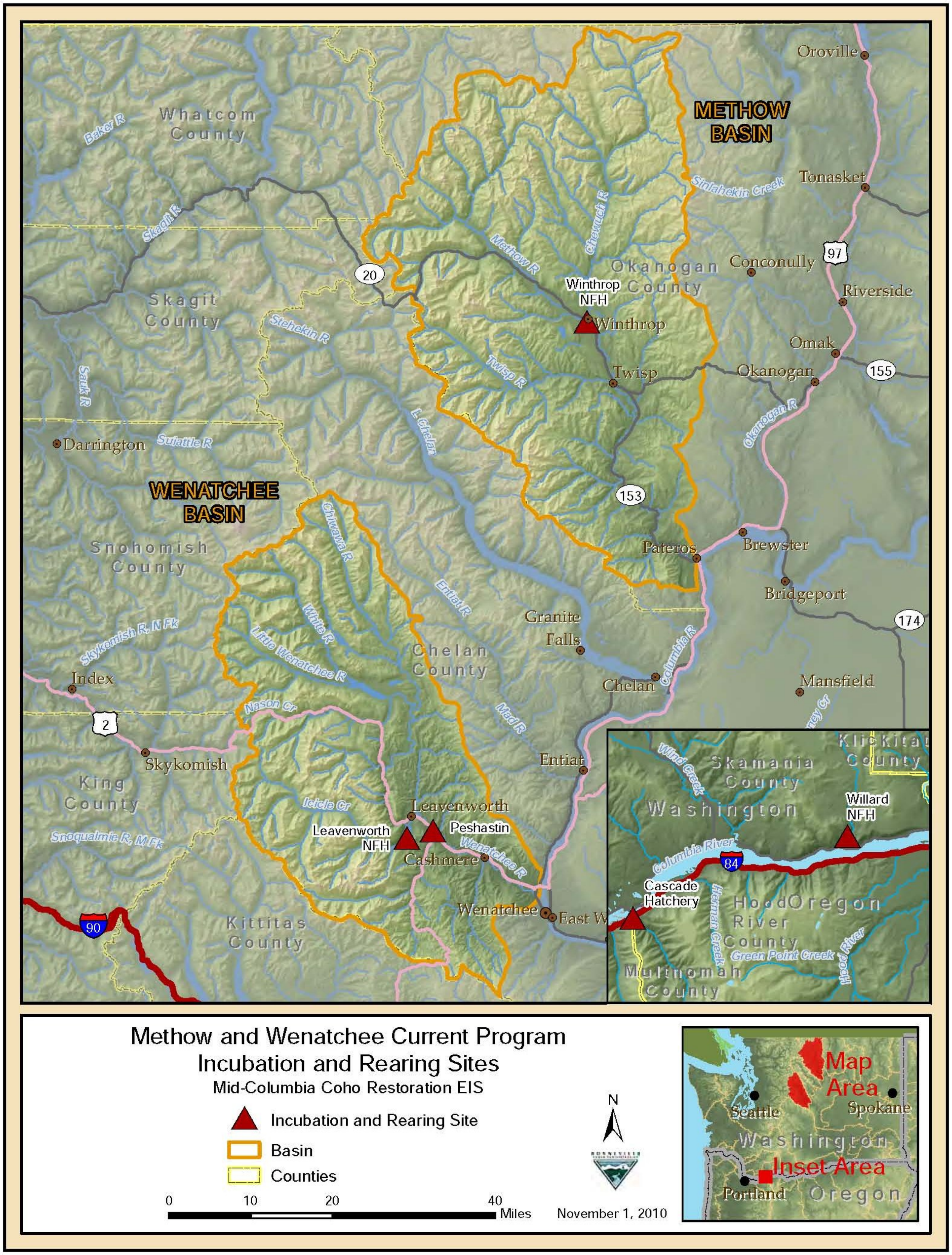


Figure 2-2. Current Program: Incubation and Rearing Sites

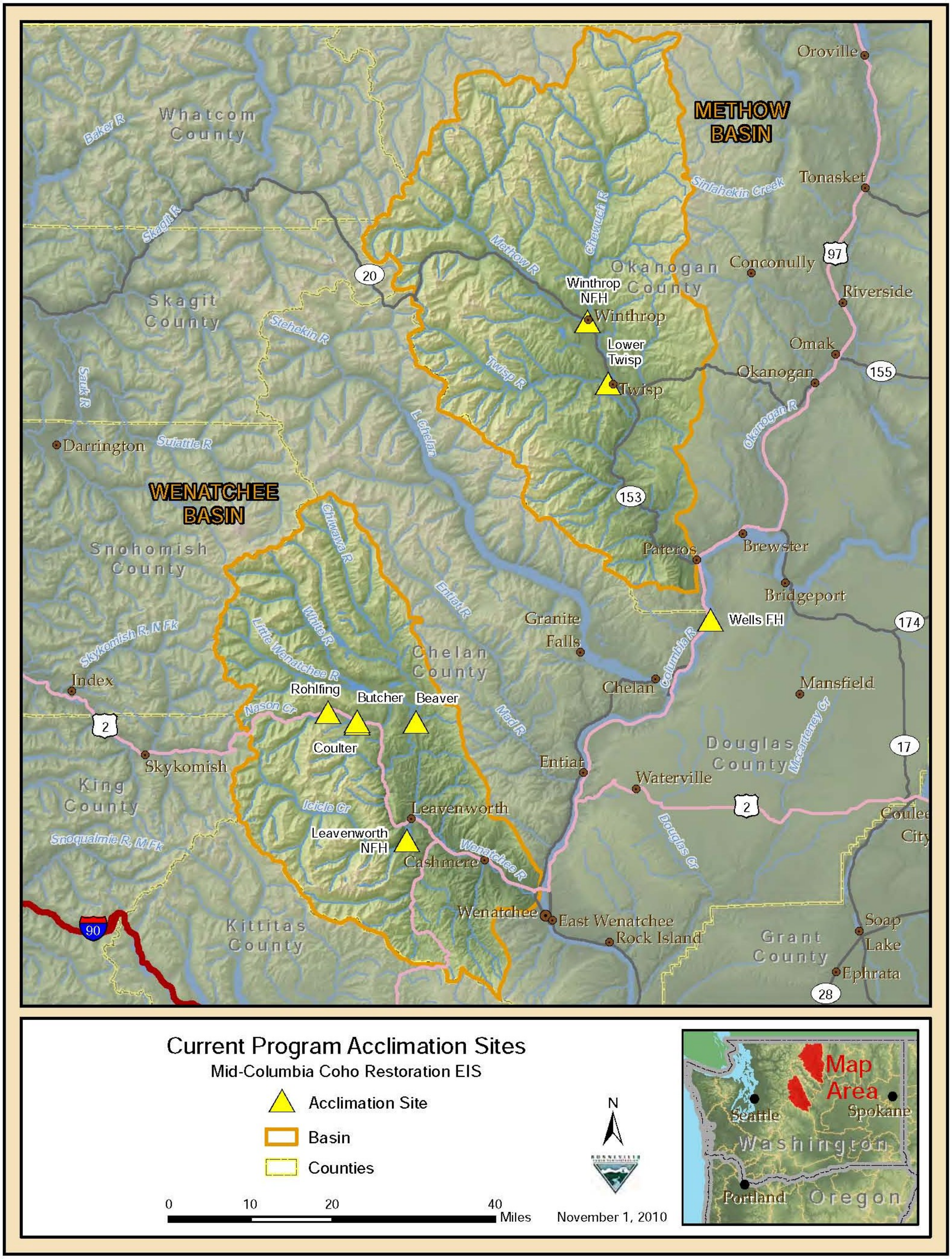


Figure 2-3. Current Program: Acclimation Sites

2.2 Proposed Action

The Proposed Action is for BPA to continue to provide funding to the YN to reintroduce coho into the Wenatchee and Methow basins through the Mid-Columbia Coho Restoration Program. This funding will maintain a phased approach to reintroducing coho into the Wenatchee and Methow basins, and builds on the feasibility studies that have been conducted since 1996.

2.2.1 Vision and Biological Approach

The Yakama Nation's long-term vision for the Mid-Columbia Coho Restoration program, as stated in the Master Plan (YN 2010) is:

> ***To re-establish naturally spawning coho populations in mid-Columbia tributaries to biologically sustainable levels which provide significant harvest in most years.***

Building on the feasibility studies, the proposal would maintain a phased approach to reintroducing coho: two broodstock development phases and three natural production phases. The broodstock development phases were designed to eliminate transfers of lower Columbia brood coho and to encourage broodstock adaptation so that returning coho can reach key habitat within the basins. The first phase of broodstock development has been accomplished, and lower Columbia broodstock are no longer used in the program; however, the second phase continues the process of increasing broodstock stamina. After all broodstock development goals are met (see Section 2.2.1.2), the natural production phases would manage broodstock composition so that eventually the percent of natural-origin fish in the hatchery broodstock exceeds the percent of hatchery-origin fish on the spawning grounds (HSRG 2004). The Mid-Columbia Coho Restoration Program is designed to end when a self-sustaining naturally reproducing population that supports harvest is established. This goal would be met when there is a natural-origin return escapement of more than 1,500 coho to each basin, with a terminal and mainstem harvest in most years; it is expected to be achieved within five coho generations[12] (by approximately 2028).

2.2.1.1 Objective and Measures of Success

> ***Biological Objective: By 2028, develop a locally adapted, naturally spawning coho stock in the Wenatchee and Methow river basins capable of supporting harvest.***

The Yakama Nation proposes to increase the fitness of reintroduced coho salmon by reducing the effects of hatchery breeding and emphasizing local adaptation. Broodstock composition would be managed to incorporate natural-origin fish in the broodstock and limit the proportion of hatchery-origin adults on the spawning ground. Ultimately, the natural environment must have a greater influence on the population than the hatchery environment. The objective would be considered successful when the following numeric goals have been achieved:

> *Metric 1. The 3-year mean escapement of natural-origin returns in the Wenatchee (upstream of Tumwater Dam) and the Methow river basins exceeds 1,500 per basin.*

This metric predicts the abundance and effective population size required to satisfy the restoration goal without further hatchery supplementation. The figure of 1,500 per basin is supported by modeling results detailed in the Master Plan (YN 2010). Briefly, the All H's Analyzer model calculations predict a level of sustainability based on:

[12] One coho generation = 3 years.

- inputs from a habitat analysis system that predicts an individual stream's capacity for coho production;
- harvest rates; and
- hydro-system and marine survival (YN 2010).

Metric 2. Achieve a total harvest rate of 23%, which includes a 10% mixed stock ocean harvest, 10% mainstem harvest, and 5% terminal harvest in most years. [13]

The harvest management plan was developed to ensure that exploitation rates are based on forecasts of survival, abundance, and escapement goals, and are responsive to fluctuations in abundance (e.g., due to fluctuating ocean conditions). A detailed description of the harvest management schedule throughout the phases of the project can be found in the Master Plan (YN 2010).

2.2.1.2 Phased Reintroduction

The YN's proposed project, first described in the draft Master Plan submitted to the Northwest Power and Conservation Council (Council) in 2006, originally included five distinct phases. Since that version of the Master Plan was written, the first phase (Broodstock Development Phase 1), has been completed in both basins (YN 2010). The description of that phase is provided to show a complete picture of how each project phase is designed to build on the previous one. The program is projected to be discontinued after a minimum of five generations of natural production.

The objectives of each phase are described in more detail below.

- **Broodstock Development Phase 1** was designed to develop a mid-Columbia broodstock from lower Columbia River coho, so that they would become increasingly adapted to the longer migration to mid-Columbia tributaries. This phase focused on eliminating reliance on lower Columbia stocks and transitioning to a local broodstock and has been completed in both basins; lower Columbia-origin broodstock are no longer used. Broodstock collection goals have been met or exceeded since 2006 in the Wenatchee basin and since 2009 in the Methow basin (see detailed summary of feasibility study results in the Master Plan (YN 2010).

- **Broodstock Development Phase 2** would increase the percentage of broodstock captured from sites further upstream. The objective is to ensure that the reintroduced stock can reach the preferred habitat in the upstream portions of the basins (Murdoch et al. 2004), in preparation for the Natural Production phases. Both Wenatchee and Methow basins are expected to operate in this phase until 2013 or later.

- **Natural Production Phases** focus on decreasing domestication selection and increasing fitness in the natural environment. These phases differ from broodstock development in that broodstock development selects for coho that can return to the Wenatchee and Methow rivers but does not address loss of fitness and adaptation to the natural environment. During the natural production phases, hatchery coho would be introduced to areas predicted by a habitat analysis system to be the most successful for coho. Broodstock compositions would be

[13] These three types of harvest do not add up to 23% because the harvests occur sequentially. Harvest on 10% of the mixed stocks would leave the remaining 90% of the run subject to a 10% mainstem harvest; after the mainstem harvest, the remaining 80% of the run would be subject to a 5% terminal harvest.

managed to increase the proportionate natural influence (PNI) in the population, with the goal of having a PNI value greater than 0.5; that is, the natural environment must have a greater influence on the population than the hatchery environment.[14] Harvest could be used as a mechanism to manage the broodstock composition. Potential harvest schedules are detailed in the Master Plan but are only theoretical until actual returns of hatchery-origin and natural-origin coho occur. The natural production phases are described below.

- **Natural Production Implementation Phase** proposes high smolt release numbers into most habitat areas for one generation (3 years). The goal is to begin the local adaptation process by releasing enough hatchery smolts in the natural environment to result in a sufficient number of adult coho returning to each tributary to spawn without the aid of a hatchery. Their progeny would in turn produce enough returning first-generation natural-origin adults to be incorporated into the broodstock as the natural production phases continue. This phase is expected to begin in both basins as early as 2013.
- **Natural Production Support Phases 1 and 2** would emphasize further local adaptation and naturalization. Initially, release numbers would be reduced by 30% from the numbers released during the Natural Production Implementation Phase. The goal would be to increase the proportion of natural-origin fish in the broodstock (pNOB) to 35% and to limit the proportion of hatchery-origin fish on the spawning grounds (pHOS) to 75%. When this initial goal is reached, managers would continue to reduce the hatchery program size, increase the proportion of natural-origin broodstock and decrease the proportion of hatchery-origin coho in the spawning grounds to the point that the PNI value is greater than 0.5 (pNOB = 80%, pHOS less than 65%). A PNI greater than 0.5 is predicted to result in increased natural fitness and survival rates for the population (L. Mobrand, pers. comm.). The Wenatchee and Methow basins are expected to begin this phase in 2016, if the Implementation Phase begins in 2013. The total expected duration of the Support Phases is 4 generations (12 years).

Tables 2-3 and 2-4 summarize key goals and management strategies for the five phases in each basin. These goals and strategies are the Yakama Nation's best estimate of a program that has a realistic ultimate goal while acknowledging that many unknowns exist because of the experimental nature of this goal. A contingency plan was developed that suggests alternate courses of action in case goals of each phase are not met within the timeframe proponents believe is reasonable. This plan is detailed in the Master Plan (YN 2010). It suggests a decision-making process that includes evaluating reasons the goal was not achieved, determining if the cause can be ameliorated, and considering alternate courses of action or program changes. See Section 4.3.5 of the Master Plan for the detailed contingency plan.

[14] PNI or proportionate natural influence has become a key theory in hatchery reform planning to address the loss of fitness commonly associated with hatchery programs. Proportionate natural influence is defined as the interaction between the proportion of hatchery fish on the spawning ground (pHOS) and the proportion of natural-origin fish in the broodstock (pNOB). PNI or proportionate natural influence is measured with the following formula:

$$\mathrm{PNI} = \frac{pNOB}{pNOB + pHOS}$$

Table 2-3. Wenatchee basin program summary

	Broodstock Development Phase 1 (Completed)	Broodstock Development Phase 2	Natural Production Implementation	Natural Production Support	Fully Restored Population
Management Goal	-Eliminate transfers of Lower Columbia River broodstock. -Broodstock collection = 1,312.	-“Fine tune” broodstock so that returning coho can reach key habitat in the basins. -Broodstock collection = 1,050.[a]	-Initiate natural production in key habitat areas. -NOR [b] escapement >600.	-Develop locally adapted fully integrated stock. -NOR escapement >900	-Self-sustaining, naturally reproducing population is established. -NOR escapement >1,500. -Terminal and mainstem harvest in most years.
Management Strategy	-Primary release site in Icicle Creek. -Broodstock collected at Dryden Dam and Leavenworth NFH.	-Release 50% of smolts above Tumwater Dam, 50% in Icicle Creek. -Broodstock collected at Dryden and Tumwater Dam.	-Release Wenatchee broodstock in areas predicted by ecosystem models to be most productive for coho in sufficient numbers to seed habitat and begin local adaptation. -Implement schedule for harvest and broodstock management. pNOB [c] = 10% pHOS [c] = 90%	-Continue local adaptation and reduce effects of hatchery breeding. -Convert to integrated hatchery program and move towards PNI >0.5.[d] -Implement matrix schedule for harvest and broodstock management. pNOB = 80% pHOS = 65%	-Harvest according to the matrix schedule. -Implement hatchery supplementation as needed to prevent extirpation and achieve harvest goals, subject to condition that PNI >0.5.

a. Broodstock Development Phase 2 would be considered completed when 50% of the broodstock are available for trapping at Tumwater Dam.

b. NOR = natural-origin recruits: the number of natural-origin coho allowed to pass collection points and proceed to spawning grounds.

c. pNOB = proportion of natural-origin fish in broodstock; pHOS = proportion of hatchery-origin fish on spawning grounds.

d. PNI = proportionate natural influence (in the population).

Table 2-4. Methow basin program summary

	Broodstock Development Phase 1 (Completed)	Broodstock Development Phase 2	Natural Production Implementation	Natural Production Support	Fully Restored Population
Management Goal	-Eliminate transfers of Lower Columbia River broodstock. -Broodstock collection = 656.	"Fine tune" broodstock so that returning coho can reach key habitat in the basins. -Broodstock collection = 1,312 trappable coho: at least 656 [a] at Winthrop NFH, the remainder at Wells FH.	-Initiate natural production in key habitat areas. -NOR [b] escapement >600.	-Develop locally adapted, fully integrated stock. -NOR escapement >900.	Self-sustaining naturally reproducing population is established. -NOR escapement >1,500. -Terminal and mainstem harvest in most years.
Management Strategy	-Primary release site(s) at Winthrop NFH and Wells FH. -Primary broodstock collection site is Wells Dam.	-Primary release site(s) at Winthrop NFH and selected tributaries (Twisp, Chewuch, etc.). -Primary collection site(s) at Winthrop NFH and tributary weirs.	-Release Methow broodstock in areas predicted by ecosystem models to be most productive for coho in sufficient numbers to seed habitat and begin local adaptation. -Implement matrix schedule for harvest and broodstock management. pNOB [c] = 10% pHOS [c] = 90%	-Continue the local adaptation process and reduce effects of hatchery breeding. -Convert to integrated hatchery program and move towards PNI >0.5.[d] -Implement matrix schedule for harvest and broodstock management. pNOB = 80% pHOS = 65%	-Harvest according to the matrix schedule. -Implement hatchery supplementation as needed to prevent extirpation and achieve harvest goals, subject to condition that PNI >0.5.

a. A total of 1,312 broodstock would be needed to increase release numbers during the Natural Production Implementation Phase, some of which may be trapped at Wells FH.

b. NOR = natural-origin recruits.

c. pNOB = proportion of natural-origin fish in broodstock; pHOS = proportion of hatchery-origin fish on spawning grounds.

d. PNI = proportionate natural influence (in the population).

Although water quality data collected for this project indicate that flows and temperatures currently are more than adequate to support this project (see Appendix 6), one of the potential reasons a goal might not be achieved could be related to water temperature and flow changes resulting from climate change. For example, Karl et al. (2009) suggest that approximately "one-third of the current habitat for the Northwest's salmon and other cold water fish will no longer be suitable for them by the end of this century as key temperature thresholds are exceeded." It has also been suggested that up to 40 percent of Northwest salmon populations may be lost by 2050 (Battin et al. 2007). These projections could result in more emphasis on regional hatchery production. In light of these concerns, it is important to understand how climate change could affect the Proposed Action, how it can be monitored, and the types of actions that may be necessary in the future to respond to those changes. Appendix 11 describes potential climate change adaption strategies that could be pursued based on projected changes in conditions.

If program or facility changes are required to respond to climate change or other contingencies, project proponents recognize that decision-makers must take into account political policies and ramifications as well as scientific methods and practices. If the Proposed Action is implemented, any changes to the approved original program must fall within legal limits established for the program, must still meet policy goals of many organizations at many levels, and must be scientifically credible. Changes are likely to require additional environmental review.

Table 2-5 shows proposed smolt release numbers for each program phase in both the Wenatchee and Methow basins. Tables 2-6 and 2-7 show release numbers for individual acclimation sites.

Table 2-5. Proposed smolt release numbers (in millions) by basin and project phase

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
WENATCHEE																				
Broodstock Dev																				
Phase 1																				
Phase 2	1.00	1.00	1.00	1.00	1.00															
Natural Production																				
Implementation						1.16	1.16	1.16												
Support Phase 1									0.81	0.81	0.81	0.81	0.81	0.81						
Support Phase 2															0.40	0.40	0.40	0.40	0.40	0.40
WEN. SUBTOTAL	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.16**	**1.16**	**1.16**	**0.81**	**0.81**	**0.81**	**0.81**	**0.81**	**0.81**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**
METHOW																				
Broodstock Dev																				
Phase 1	0.50	0.50																		
Phase 2			0.50	0.50	0.50															
Natural Production																				
Implementation						1.00	1.00	1.00												
Support Phase 1									0.70	0.70	0.70	0.70	0.70	0.70						
Support Phase 2															0.35	0.35	0.35	0.35	0.35	0.35
MET. SUBTOTAL	**0.50**	**0.50**	**0.50**	**0.50**	**0.50**	**1.00**	**1.00**	**1.00**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.35**	**0.35**	**0.35**	**0.35**	**0.35**	**0.35**
TOTAL	**1.50**	**1.50**	**1.50**	**1.50**	**1.50**	**2.16**	**2.16**	**2.16**	**1.51**	**1.51**	**1.51**	**1.51**	**1.51**	**1.51**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**

Table 2-6. Proposed smolt release numbers and locations for the Natural Production phases in the Wenatchee basin

Location	**Implementation Phase** Release Number (one generation only)	**Support Phase (1)** Initial Release Number (est. 2 generations)	**Support Phase (2)** Final Release Number (PNI >0.5; est. 2 generations)
Chiwawa R.	350,000	245,000	122,500
White R.	150,000	112,000	56,000
Nason Cr.	210,000	147,000	73,500
Little Wenatchee R.	120,000	84,000	42,000
Upper Wenatchee R.	100,000	70,000	35,000
Chumstick Cr.	65,000	45,500	22,750
Brender Cr.	50,000	35,000	17,500
Icicle Cr.	100,000	70,000	35,000
Total	**1,155,000**	**808,500**	**404,250**

Table 2-7. Proposed smolt release numbers and locations for the Natural Production phases in the Methow basin

Location	**Implementation Phase** Release Number (one generation only)	**Support Phase (1)** Initial Release Number (est. 2 generations)	**Support Phase (2)** Final Release Number (PNI >0.5; est. 2 generations)
Mainstem Methow R.	350,000	245,000	122,500
Chewuch R.	300,000	210,000	105,000
Twisp R.	250,000	175,000	87,500
Beaver Cr. (Parmley)	50,000	35,000	17,500
Gold Cr.	50,000	35,000	17,500
Total	**1,000,000**	**700,000**	**350,000**

The release numbers proposed for the Natural Production Implementation Phase (a three-year period that could begin as early as 2013) are generally based upon the predicted number of hatchery fish needed to initially seed the habitat. Two methods were used to estimate the capacity of naturally produced smolts in the Wenatchee and Methow basins: 1) the smolt production model described by Zillges (1977) and 2) Ecosystem Diagnosis and Treatment (EDT) (Mobrand et. al. 1997).

The Zillges (1977) method is a smolt production model which has been used for Puget Sound and Washington coastal systems when actual data are not available (Seiler et al. 2004). The method described by Zillges uses stream length in larger tributaries, and stream area (length x width) in smaller tributaries, to estimate coho smolt production. Bradford et al. (1997) found that coho salmon smolt abundance was primarily correlated with stream length, and that stream length was the most appropriate general measure of coho production. The number of smolts produced per unit of stream length was constant and independent of stream size (Bradford et al. 1997). They found that other variables such as discharge, stream gradient, and valley slope were not correlated with coho smolt production. However, they cautioned that models which predict coho smolt production based on stream length, such as Zillges (1977), are suitable at the regional or watershed level, but the precision of a prediction for a single stream may be poor. Because different factors may be important in different streams at different times, there are no general predictive models that will yield precise estimates of coho smolt production potential (Bradford et al. 1997).

EDT (Mobrand et al. 1997) was also used to provide an estimate of juvenile and adult capacity in the Wenatchee and Methow rivers. In some cases, such as in the Little Wenatchee and the White River, both models yielded almost identical estimates, lending confidence to the capacity estimates in these tributaries. In other cases, such as Icicle Creek and Nason Creek, the EDT estimates appeared unrealistically low, based on data collected to date, and the Zillges (1977) method appeared unrealistically high. In cases with a discrepancy between the capacity estimates, YN used the mid-point between the two values (YN 2010).

The capacity values were used as upper limits for the program. To minimize potential species interactions, the actual release numbers will result in seeding levels below the estimated capacity, but are predicted to result in an adequate spawning escapement for which natural selection will begin the local adaptation process.

As shown in Tables 2-5, 2-6, and 2-7, after three years (one coho generation) of Implementation Phase releases, the release numbers would be reduced by 30% as the program enters the Natural

Production Support Phases, and reduced by another 50% beginning in approximately 2022. To address the fitness loss commonly associated with hatchery programs, the Support Phases use the fitness computations in the All H's Analyzer model to guide program management, with the goal of reducing domestication selection and increasing local adaptation.

2.2.2 Facilities

The ongoing Broodstock Development Phase does not require construction of new facilities. The Natural Production phases, beginning in approximately 2013, would require additional acclimation facilities, some of which currently exist, a few of which would require new construction. A new incubation and rearing facility also is proposed in the Wenatchee basin.

Additional acclimation facilities are needed in order to acclimate juveniles in tributaries throughout the basins so that they return to those tributaries to spawn as adults, thus increasing the distribution of naturally spawning coho throughout the basins. An in-basin incubation and rearing facility is proposed to replace the Entiat NFH, which is currently not available to the coho program.[15] Such a facility located within the project area reduces the transfer of fish and gametes between watersheds and reduces transportation stress for part of the juvenile coho population; capital costs would be minimized by keeping the size of the new facility small and continuing to use additional rearing capacity at existing available facilities.

2.2.2.1 Facility Locations

Table 2-8 lists all the facilities that might be used for the proposed program, including alternative (backup) sites that might be used if one or more of the preferred (primary) sites is unavailable. The table shows those currently in use as of 2010 (C), those proposed for use in the future (F), potential backup sites, and whether any require new construction.

Characteristics of the facilities are discussed following the table. Further detail is provided in Appendix 1 (Rearing and Brood Capture Site Descriptions); Appendix 2 (Wenatchee Acclimation Site Descriptions) and Appendix 3 (Methow Acclimation Site Descriptions).

[15] Entiat NFH is not available to the coho program because the hatchery's focus is changing to a summer Chinook program which overlaps with coho spawn timing, causing logistical problems with holding and spawning.

Table 2-8. Summary of facilities: Proposed Action

BROODSTOCK COLLECTION

Wenatchee	C or F[a]	Construction?	Methow	C or F	Construction?
Dryden Dam	**C**	No	Wells FH	**C**	No
Leavenworth NFH	**C**	No	Wells Dam ladders	**C**	No
Tumwater Dam	**C**	No	Winthrop NFH	**C**	No
Chiwawa Weir	**F**	No	Methow FH	**C**	No
			Twisp Weir	**F**	For acclimation only
			Lower Twisp	**F**	No

INCUBATION/REARING

Cascade FH	**C**	No construction	Note: Rearing facilities provide coho for both basins
Willard NFH	**C**	No construction	
Winthrop NFH	**C**	No construction	
Leavenworth NFH	**C**	No construction	
Peshastin	**C**	No construction	
Entiat NFH **Backup**	**C**	No construction	
Proposed Dryden Hatchery	**F**	New facility on 1.5 acres: hatchery building, 4 raceways, 2 rearing ponds, water pipelines, wells, waste treatment tank and wetland; 4 acres total construction disturbance	
Backup George Hatchery	**F**	New facility on 1.5 acres: similar facilities to proposed Dryden site except no waste treatment wetland; 2.5 acres total construction disturbance	

ACCLIMATION/ADULT PLANTS (Primary)

Wenatchee	C or F	Construction?	Methow	C or F	Construction?
Leavenworth NFH	**C**	No	Winthrop NFH	**C**	No
Beaver	**C**	No	Lower Twisp	**C**	No
Butcher	**C**	No	Goat Wall	**F**	No
Clear	**F**	No	Gold	**F**	Deepen 4 existing ponds
Coulter	**C**	No	Heath	**F**	No
Rohlfing	**C**	No [b]	Lincoln	**F**	No [b]
Brender	**F**	No	Mason [c]	**F**	No
Chikamin	**F**	New off-channel pond, 2 side-by-side water intakes, 120-ft buried pipe, 70-ft surface discharge channel	Twisp Weir	**F**	New pond, two new wells, water intake on diversion ditch, 400-ft surface water channel, buried water (500 ft) & power (400 ft) lines, 20-ft road
Minnow	**F**	New in-channel pond, 3 log weirs, 600-ft road	MSWA Eightmile	**F**	New well, 100-ft buried water pipe, 2,600-ft buried power line
Tall Timber	**F**	Two new side-by-side water intakes, 350-ft buried pipe	Newby	**F**	New pond, intake structure, 300-ft surface water channel, 120-ft buried discharge pipes.
Two Rivers [c]	**F**	No	Parmley	**F**	No
White River Springs	**F**	No	Pete Creek Pond	**F**	No
Dirty Face (adults)	**F**	No	Hancock (adults)	**F**	No

a. C = Currently used; F = Future

b. Construction at Rohlfing and Lincoln is being done under the Multi-Species Acclimation Project (see Section 3.15.3), with those impacts evaluated in a separate NEPA process and ESA consultations (BPA 2003, BPA 2007, BPA 2009; NMFS letter re: informal consultation on Lincoln Pond dated July 27, 2010; no effect determination for construction at Rohlfing [burying a pipeline from an existing well to an off-channel pond]). **c.** Previously used by project; not in use currently.

Table 2-8 (continued)

ACCLIMATION (Backup)					
Wenatchee	**C or F**	**Construction?**	**Methow**	**C or F**	**Construction?**
Allen	**F**	No	Balky Hill	**F**	No
Coulter/Roaring	**F**	No	Biddle [c]	**F**	No
Dryden[d]	**F**	New ponds, well, 850-ft buried water supply & discharge pipes	Methow Salmon Recovery Foundation (MSRF) Chewuch	**F**	New pond, well, 1,000-ft surface water delivery & discharge channels, 100-ft buried power line
McComas[e]	**F**	No	Chewuch Acclimation Facility (AF)	**F**	New pond, 300-ft buried water delivery and discharge pipes, 50-ft buried power line
Squadroni	**F**	New pond, well, 50-ft water supply & 20-ft discharge channels	Poorman	**F**	No
Scheibler	**F**	Expand pond	Utley	**F**	New 80-ft long channel as outlet for existing pond.

a. C = Currently used; F = Future
d. Activities refer to those required if the Dryden site is used for acclimation only and not as a hatchery site.
e. McComas is a new site proposed to be constructed by Grant PUD for another project; impacts will be evaluated in other permitting processes.

Broodstock Development Phase Facilities

Fish produced for the ongoing broodstock development phase are captured at existing adult traps, produced from existing hatcheries, and released from acclimation sites that do not require new construction. Locations of the facilities are shown under the description of the current program (Section 2.1) in Figures 2-1 through 2-3.

- Broodstock capture:
  Wenatchee: traps at Leavenworth NFH, Tumwater Dam and Dryden Dam.
  Methow: trapping facilities at Wells Dam and FH, Winthrop NFH and Methow Fish Hatchery.
- Broodstock holding and incubation:
  Winthrop NFH for adult holding, spawning, and incubation; Leavenworth NFH for adult holding, spawning and early incubation (green to eyed egg); Peshastin Incubation Facility for early incubation only. Entiat NFH would be used only as a backup site.
- Rearing to pre-smolt size:
  Cascade FH and Willard and Winthrop NFHs.
- Acclimation:
  Wenatchee: Rohlfing, Coulter, Butcher, and Beaver ponds in the upper Wenatchee and the Leavenworth NFH on Icicle Creek.
  Methow: Winthrop NFH, Lower Twisp, and Wells FH.

Natural Production Phase Facilities

Broodstock Collection

The project proposes to use existing broodstock capture sites in upstream areas in addition to those used during the broodstock development phase, all of which are owned by other entities and operated by the YN and/or other fisheries resource agencies. Three broodstock capture sites (Chiwawa Weir, Twisp Weir, and Methow FH) would need to extend their periods of operation in order to capture coho adults. Figure 2-4 shows their locations.

Incubation and Rearing

During the Natural Production Phases, the plan proposes to continue incubating and rearing most program fish at hatcheries currently in use (Willard NFH, Winthrop NFH, Leavenworth NFH, Peshastin Incubation Facility, and Cascade Hatchery). A new, small, in-basin adult holding/spawning, incubation and rearing facility also is proposed for these phases at a site on the Wenatchee River near Dryden Dam (Dryden) or a site on the Wenatchee River downstream of Lake Wenatchee (George). See Figure 2-5 and "Facility Designs" later in this section. If water quality issues prevent coho from being reared to pre-smolt stage at the new facility (see Section 3.5), it could be used for adult holding and egg incubation only, because fish are not fed during these life stages and thus would not add phosphorus to the river. Fish that are proposed for full-term rearing at Dryden or George could be reared at Cascade and Willard hatcheries instead and returned to the Wenatchee basin for acclimation and release, but an in-basin facility is preferable for fish health and other reasons.

NMFS issued a draft EIS in 2010 that includes an alternative that eliminates funding for Mitchell Act hatcheries such as Willard NFH and Cascade Hatchery (NMFS 2010). It has not yet issued a final EIS or Record of Decision. If all Mitchell Act funding for Cascade and/or Willard hatcheries is terminated, BPA could use its own funding as needed to continue to rear a portion or all of the maximum 2.16 million mid-Columbia coho production for this project at these hatcheries, consistent with the Accord agreements and federal appropriations law. Given this funding flexibility, BPA's decision under this EIS will not prejudice or preempt NMFS' decision regarding the Mitchell Act EIS.

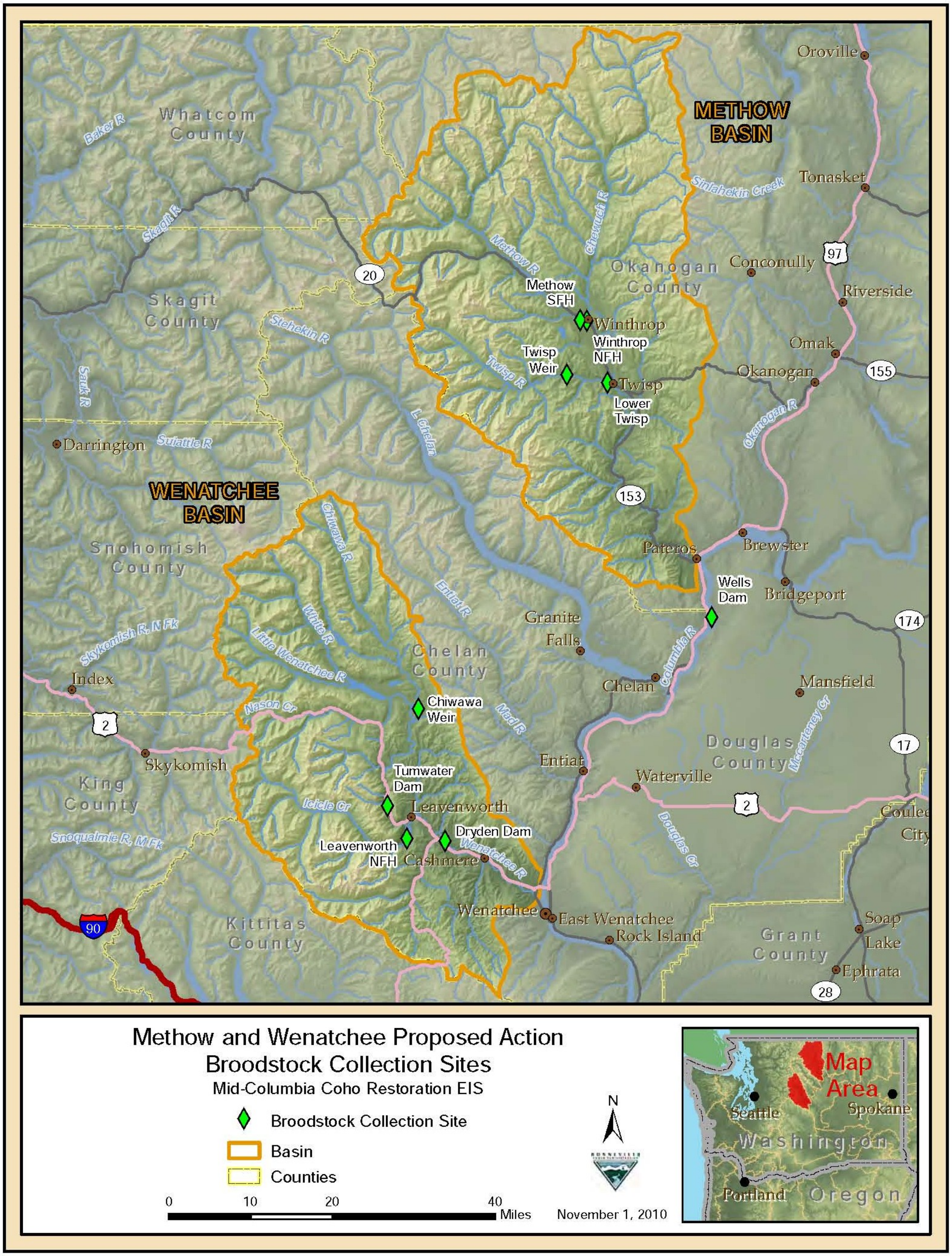


Figure 2-4. Proposed Action: Broodstock Collection Sites

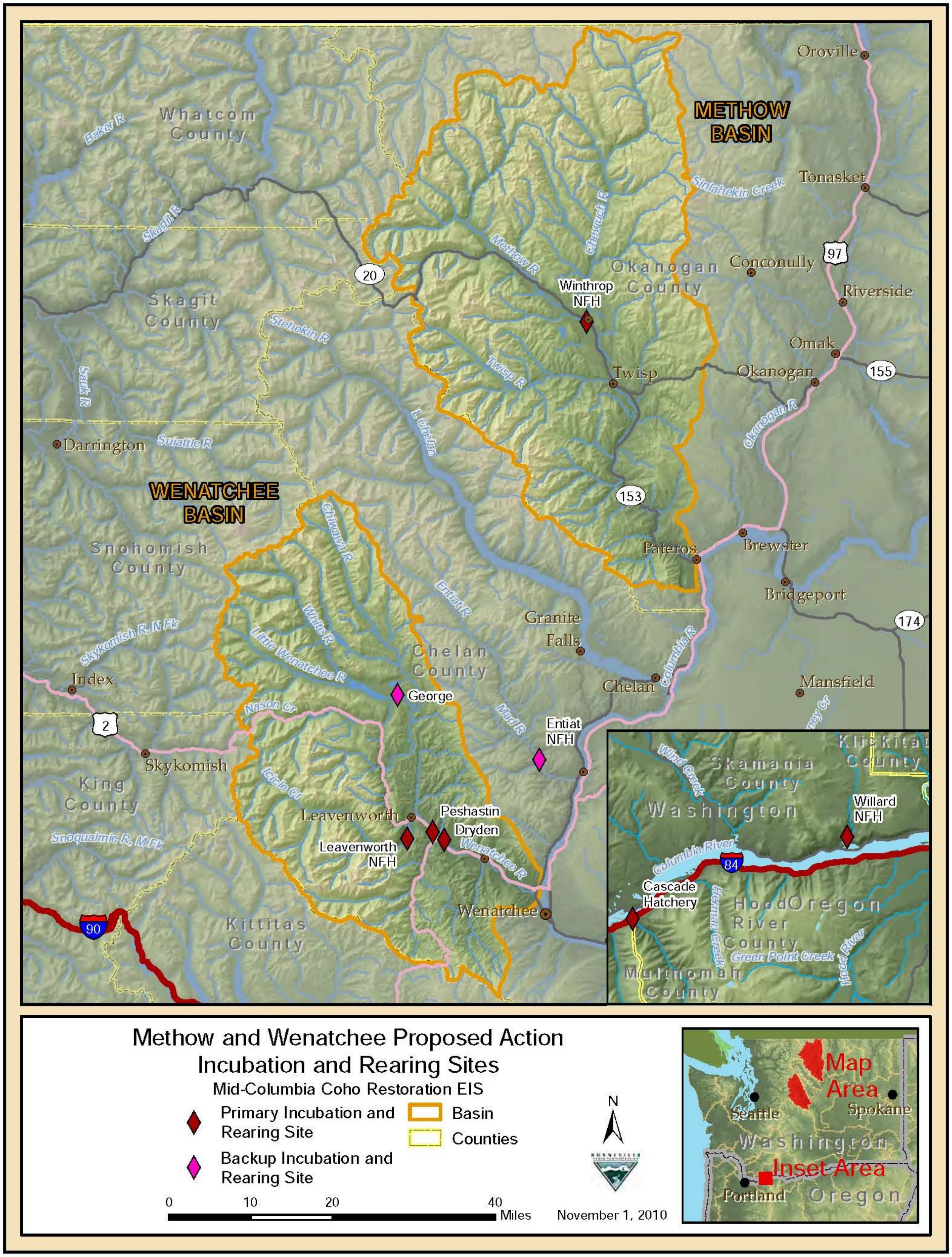


Figure 2-5. Proposed Action: Hatchery and Rearing Sites

Acclimation and Release

Acclimation is planned at a combination of existing and new sites. Most acclimation sites would be existing water bodies (e.g., beaver ponds, side channels, etc.) and small constructed ponds. See Section 3.3.2 for a brief description of each site, or Appendices 2 and 3 for more detailed descriptions and photographs. For locations, see Figures 2-6 and 2-7.

The proposed acclimation and release system has the following characteristics (backup sites are not included in this list):

- At least two acclimation/release sites are proposed in each major tributary stream (one low in the system and one as far upstream as is practical); and one site is proposed in most minor streams.
- A total of 24 acclimation sites are proposed in the Wenatchee and Methow basins, 12 in the Wenatchee and 12 in the Methow. This number includes acclimation and releases at Leavenworth NFH in the Wenatchee and Winthrop NFH in the Methow. It is expected that a 13th Wenatchee basin site would be established on Chumstick Creek. If the Scheibler backup site on the Chumstick is not used, a new site would be the subject of a separate environmental review.
- In each basin, one additional site would be for adult plants (Hancock and Dirty Face).
- Seven of the proposed acclimation sites (not including Dryden) would require some kind of construction, as follows:
    - A new pond at 4 sites (Minnow, Chikamin, Newby, Twisp Weir)
    - Expansion of existing ponds at 1 site (Gold)
    - New wells at 2 sites (MSWA Eightmile, Twisp Weir)
    - New water delivery systems at 5 sites (Tall Timber, Chikamin, MSWA Eightmile, Newby, Twisp Weir)
    - New buried power lines at 1 site (MSWA Eightmile)
    - New road at 2 sites (Minnow, Twisp Weir)
- New groundwater rights are required at 2 sites (MSWA Eightmile and Twisp Weir); new surface water rights at 4 sites (Tall Timber, Chikamin, Twisp Weir, and Newby).
- Five sites require the use of generators (Rohlfing, Two Rivers, MSWA Eightmile, Lincoln, Twisp Weir).
- Eight sites are proposed to be used for overwinter acclimation, four in each basin, in addition to the two existing in-basin hatcheries.
- Seven of the primary sites have been used in the past by the current coho program.

In the event that Leavenworth NFH cannot be used for rearing and acclimation due to new limits on nutrient discharges into Icicle Creek, or for other reasons, fish proposed to be acclimated and released at LNFH would not be distributed among other acclimation sites but would be either directly planted as pre-smolts in Icicle Creek or total release numbers in the Wenatchee basin would be reduced by 100,000 at the beginning of the Natural Production phase (2013 or later).

Monitoring and Evaluation

Juvenile trapping for monitoring and evaluation of the program would take place at existing traps in both basins, with one exception: a new smolt trap is proposed for the Little Wenatchee River, the site yet to be determined.

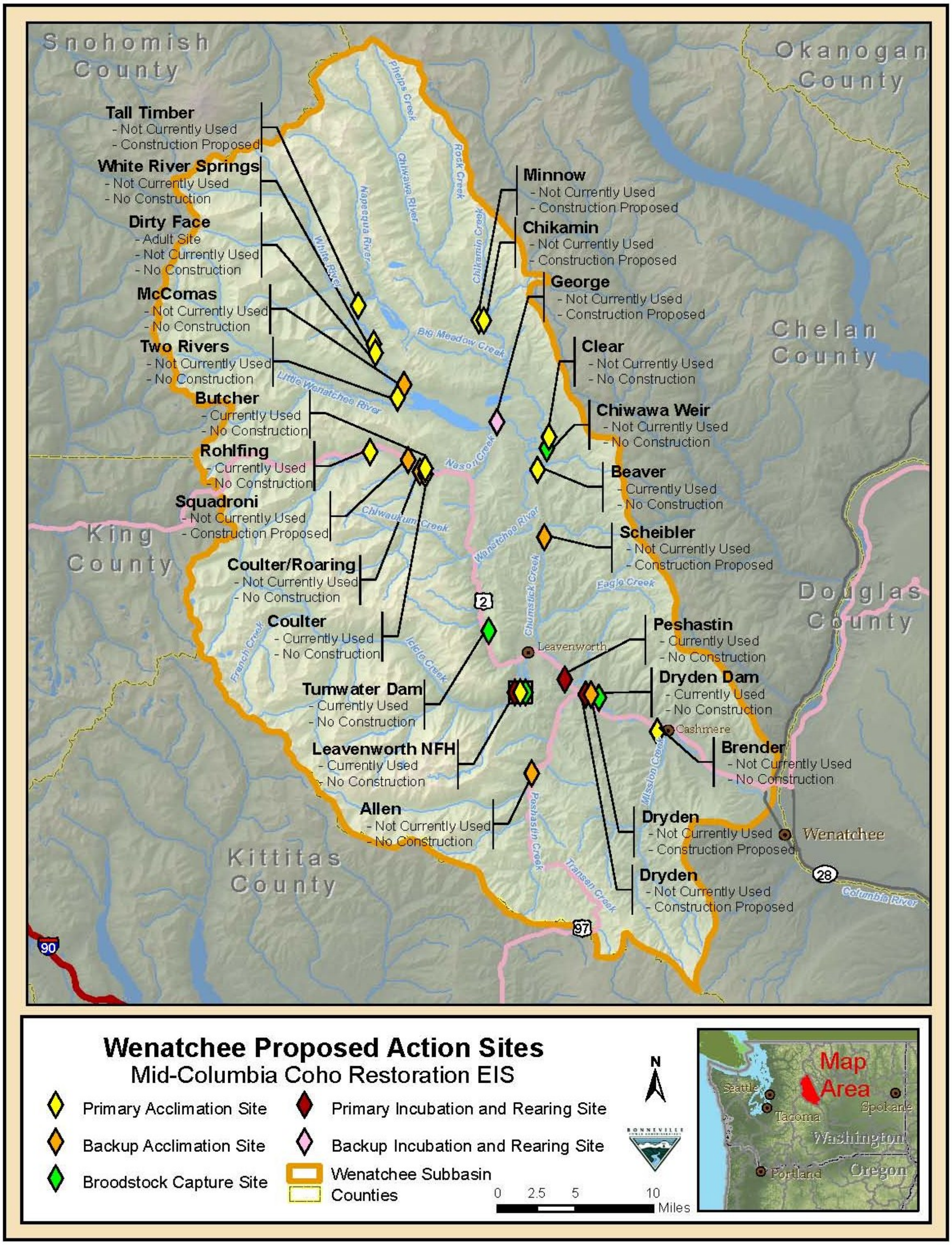


Figure 2-6. Proposed Action: Wenatchee Basin Primary and Backup Sites

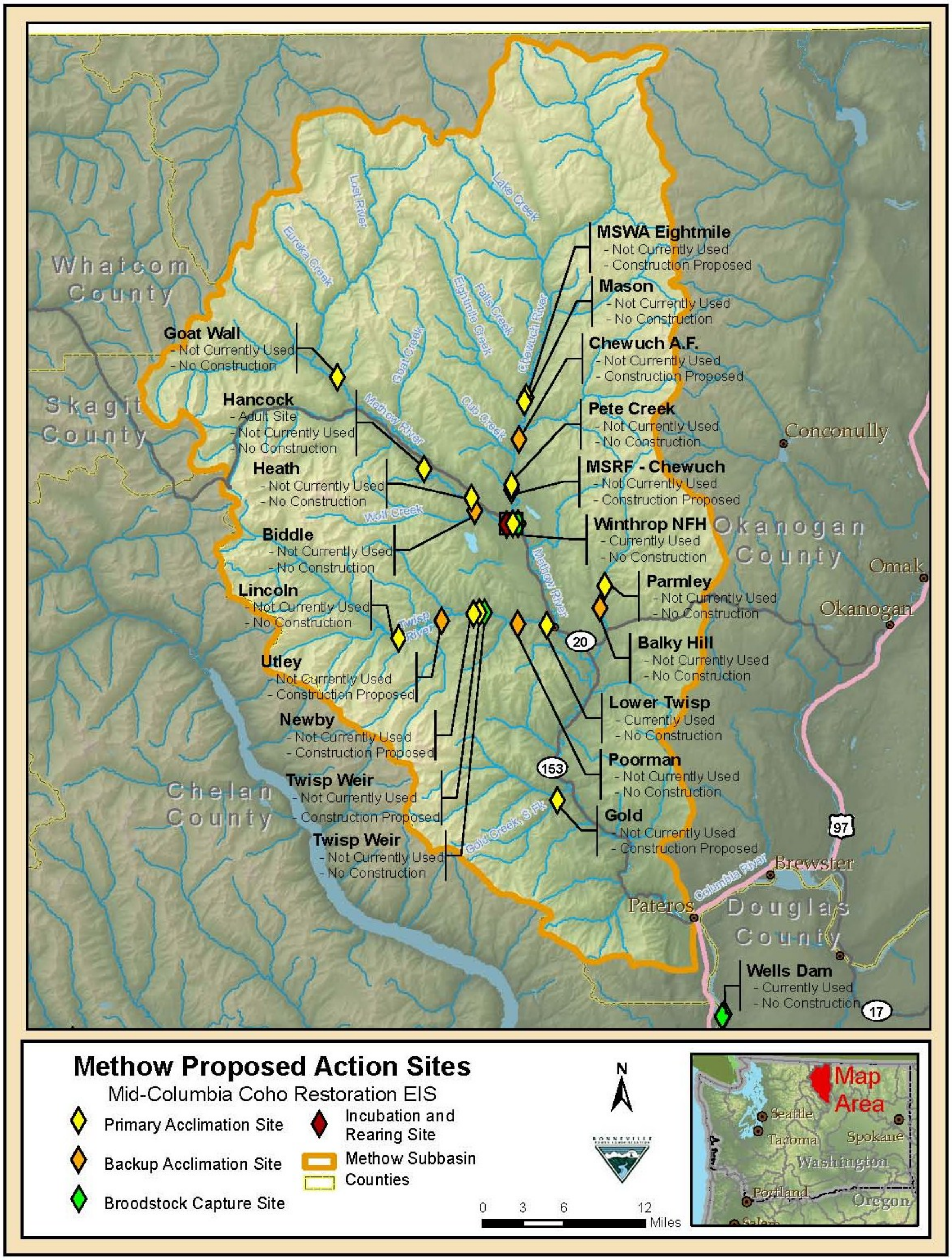


Figure 2-7. Proposed Action: Methow Basin Primary and Backup Sites

2.2.2.2 Factors Considered in Facility Location

Incubation/rearing sites

- Water quality and quantity.
- Proximity to other program facilities, especially acclimation sites.
- Availability of power: Three-phase power is required to operate water pumps, chillers, and other major motor-driven machinery.
- Environmental impacts.
- Environmental liability: Sites that have previously been used in other ways may have ground contamination, resulting in potential liability.
- Flexibility to adapt to future fish culture needs and changes in fish culture practices.
- Access in winter and high water periods.
- Cost.

Acclimation sites

Habitat analysis models were used to quantify the carrying capacity of tributaries in each basin and to identify which tributaries would provide high-quality coho habitat. Factors considered in identifying potential acclimation sites included the following:

- Water quality and quantity.
- Proximity to expected habitat based on model predictions, local experience, and professional judgment.
- Flexibility to adapt to monitoring results. For example, little is known about the preferred habitat of coho in snow-dominated watersheds, despite a thorough literature review and visits to Fraser River tributaries in British Columbia with First Nation groups and the interior Fraser coho recovery group. Ponds in multiple locations in the tributaries and sites scattered throughout the basins help maintain flexibility. If monitoring shows that habitat in certain areas is more productive, then those areas can be emphasized as the program progresses.
- Potential for low rearing densities, i.e., maximum density of 0.3 pounds of fish per cubic foot (lb/ft^3) at release for water supplies with high reliability, and 0.1 lb/ft^3 for sites without backup water supply systems.[16]
- Natural rearing environment.
- Environmental impacts.
- Accessibility by staff and by smolt trucks.
- Potential for overwintering coho.
- Distribution throughout the basins.
- Cost.
- Willing property owners.

[16] Studies have shown a survival benefit to low rearing densities, but it is unclear why both low volume densities and large rearing units perform well. They may reduce stress by providing escape areas when fish perceive threats (YN 2010 Appendix A).

2.2.2.3 Facility Designs

Hatchery Design

- Site functions: All captured local Wenatchee brood would be trucked to the proposed facility for holding and spawning. Eggs would be reared to the eyed stage, after which most would be moved to the lower river facilities, Cascade FH and Willard NFH, for hatching and early rearing. Eggs that remained would be reared until ready to be moved to acclimation sites. Some juvenile coho would also be trucked back to Dryden from the lower river hatcheries after spawning season for rearing through the winter.
- Production numbers: 1,300 adults, 1,400,000 eyed eggs, 200,000 smolts reared full-term.
- Development timing: Current plans call for hatchery construction to start in 2013.

Dryden (Proposed Site)

Site Information

- Location, elevation: Near the mouth of Peshastin Creek at Wenatchee River (river mile [RM] 18.6); in T24N, R18E, SW ¼ of S22 in Chelan County; adjacent to Dryden Dam; elevation 984 feet.
- Ownership: The 24-acre Washington State Department of Transportation (WSDOT) property is lot number 241822745006, zoned Commercial Agricultural Lands (AC).
- Flood designation: Zone X500 (between 100- and 500-year floods).
- Land use: Used in the past by WSDOT for storage of highway sand. The site currently provides access to Dryden Dam and Fishway, portage for river rafters, and anglers' access to the Wenatchee River.
- Access: Plowed, paved roads.
- Utilities: 3-phase power is available at the nearby Dryden right bank ladder facility.

Water Supplies

- Groundwater availability: Drill logs for nearby wells and the geology of the site suggest productive groundwater conditions. Historic gravel deposition at the Peshastin alluvial fan may have left layers of clean gravel. A new groundwater right would be required.
- Groundwater withdrawal: Shallow wells near the river are proposed, minimizing impacts to deeper wells in the vicinity and producing water with some seasonal temperature variation. The production goal is 3.3 cubic feet per second (cfs) (including a 50% safety factor).
- Surface water supply: Wenatchee River water is proposed to be pumped from the Dryden fishway. An intake would be built into the existing concrete structure. This location allows water to be pumped at all river flow conditions without affecting fishway operation and does not require excavation in the river bank for construction. Water would be delivered to the hatchery in an 850-foot-long buried pipeline. Modeling for the hatchery estimates that a minimum flow of 3.1 cubic feet per second (cfs) is needed. Applying a 50% safety factor results in a water requirement of 4.7 cfs. A new surface water right would be needed.
- Water Return: The option of returning water (and fish) upstream of the removal location in Peshastin Creek, at the dam, or just downstream of the dam would be possible by installing various return pipelines.

Facilities

- Adult holding: Four concrete raceways (100 x 10 x 4 feet deep), with multiple divisions in the raceways to allow sorting.
- Incubation: Vertical stack incubators and deep troughs inside a hatchery building would be fed with aerated, chilled groundwater.
- Rearing: The four concrete raceways would be used for fish production when adults are not present. Also, two ponds (40 x 120 x 3 feet deep) would add low-density rearing space.
- Predator control and cover: The site would be fenced with an 8-foot-tall chain link fence, and an overhead net system would be installed over the rearing units.
- Waste treatment: Discharge water treatment requires a high degree of nutrient removal to meet conditions of the Total Maximum Daily Load restrictions in place for the Wenatchee River (see Chapter 3, Section 3.5.1). Two treatment systems are proposed. An off-line treatment tank (10 x 20 x 4 feet deep) would hold and settle wastes vacuumed from the rearing units. Water from the hatchery would be directed to a 2-acre constructed wetland for additional nutrient removal. The waste treatment system would meet National Pollutant Discharge Elimination System (NPDES) permit requirements. To offset the introduction of a new discharge source in the section of the Wenatchee River subject to the TMDL, the project proposes to remove from an upstream well an amount of phosphorus equivalent to that produced by the hatchery. If approved, it would be considered a Water Quality Offset as described in the Washington Administrative Code (WAC) 173-201A-450. Chapter 3, Section 3.5.5 and Appendix 13 provide more detail.
- Support systems: A 3,000-square-foot hatchery building would enclose the incubators, rearing troughs, offices, and a small shop. Generators would provide backup power. Parking would be provided for up to 10 vehicles.
- Site footprint: The Yakama Nation would acquire approximately 18.5 acres of the 24-acre parcel owned by WDOT, the purchase funded by other YN habitat projects in addition to the coho project. The hatchery site would require 1.5 acres of land. The full hatchery facility, including pipelines, water supply construction, the constructed wetland, and hatchery facilities, would require construction disturbance to a total of 4 acres of land. The additional 14.5 acres of the acquired parcel could be used by the YN in the future to re-establish a connection between an historic side-channel and Peshastin Creek.

Figure 2-8 shows the draft site plan.

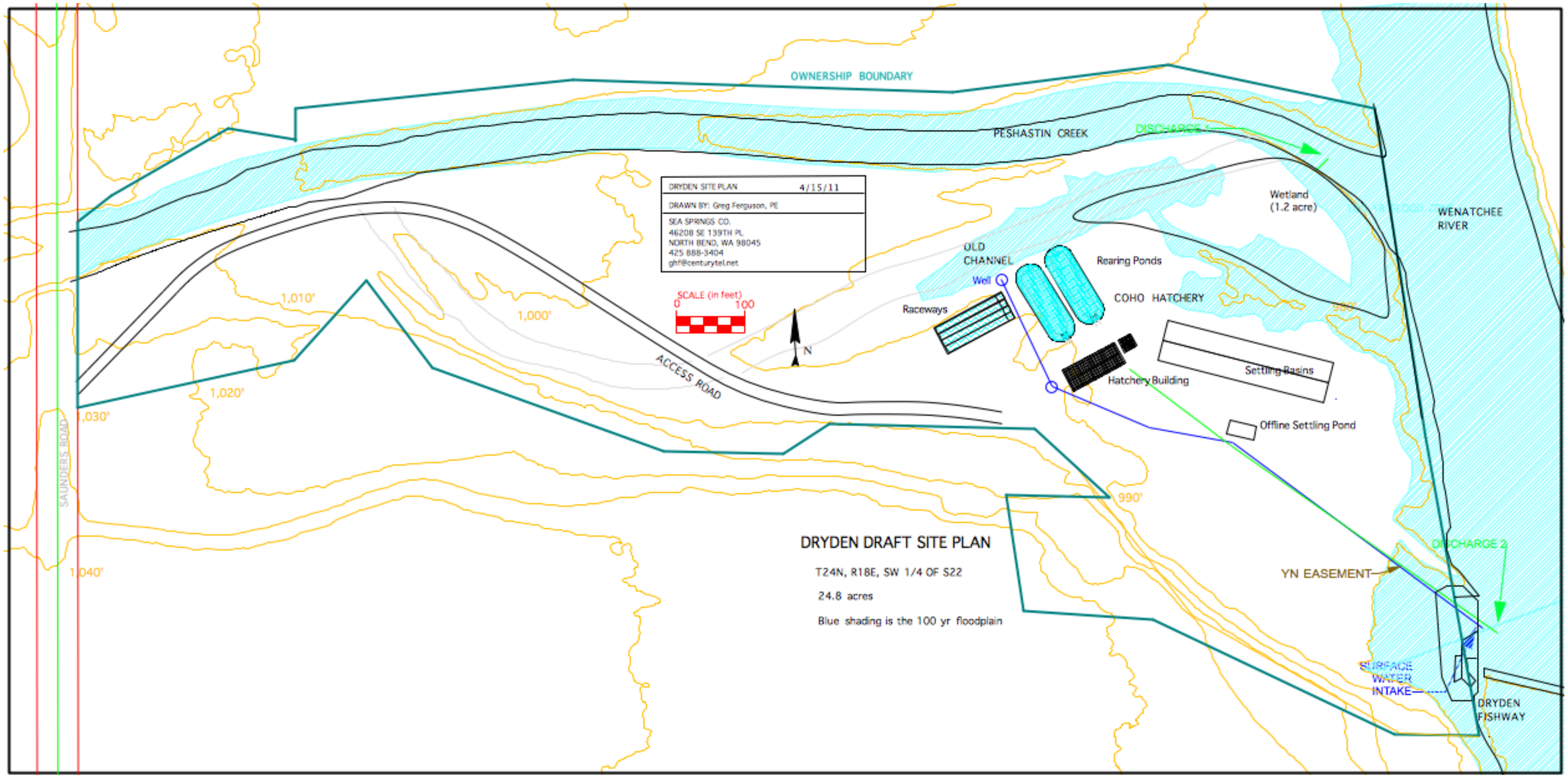


Figure 2-8. Proposed Dryden Hatchery: Draft Site Plan

George (Backup Site)[17]

A facility would be constructed at this site only if the Dryden site becomes infeasible.

Site Information

- Location, elevation: Downstream of Lake Wenatchee at Wenatchee River (RM 51.6); T27N, R17E, NW ¼ of S26 in Chelan County; elevation 1,870 feet.
- Ownership: The 150-acre parcel is currently in private ownership. The Yakama Nation is considering buying the site for habitat mitigation.
- Flood designation: Most of the site is in Zone A3, in the 100-year flood hazard area. The Base Flood Elevation near the proposed hatchery site is 1,875 feet.
- Land use: The site is undeveloped and has been logged in the past. It is zoned RR20, rural residential with a minimum lot size of 20 acres.
- Access: Un-surfaced, primitive roads provide limited access.
- Utilities: 3-phase power is 4,000 feet away.
- Soils: The Natural Resources Conservation Service classifies soils on the site as adfluvial (NRCS 2010).

Water Supply

- Groundwater: A preliminary evaluation would identify the potential for developing groundwater on the site. Two or more new wells could produce the required 3.3 cfs.
- Surface water: 4.7 cfs of surface water would be pumped from the Wenatchee River. A submerged intake screen would be built into an existing rock barb in the river (Figure 2-9).
- Pipelines: Surface water and groundwater would be delivered to the hatchery in separate pipelines approximately 1,500 feet long.

Facilities

- Adult holding: Four concrete raceways (100 x 10 x 4 feet deep).
- Incubation: Vertical stack incubators and deep troughs inside a hatchery building would be fed with aerated, chilled groundwater.
- Rearing: The four concrete raceways would be used for fish production when adults are not present. Two ponds measuring 40 x 120 x 3 feet deep would add low-density rearing space.
- Predator control and cover: The site would be fenced and an overhead net system installed over the rearing units.
- Waste treatment: Discharge water treatment would likely require a high degree of nutrient removal to meet conditions of the Total Maximum Daily Load restrictions in place for the Wenatchee River. An off-line treatment tank measuring 10 x 20 x 4 feet would hold and settle wastes vacuumed from the rearing units. Treated water from the hatchery would be directed to the existing 5,600-foot-long side channel on the site for further nutrient removal prior to entering the Wenatchee River.
- Support systems: A 3,000-square-foot hatchery building would enclose the incubators, rearing troughs, offices, and a small shop. Generators would provide backup power. Parking would be provided for up to 10 vehicles.
- Site footprint: Hatchery facilities would require 1.5 acres of land. Pipelines, water supply construction, and hatchery facilities would disturb a total of 2.5 acres of land.

[17] This site is also called Natapoc, but the name "George" will be used in this final EIS in order to be consistent with the draft EIS.

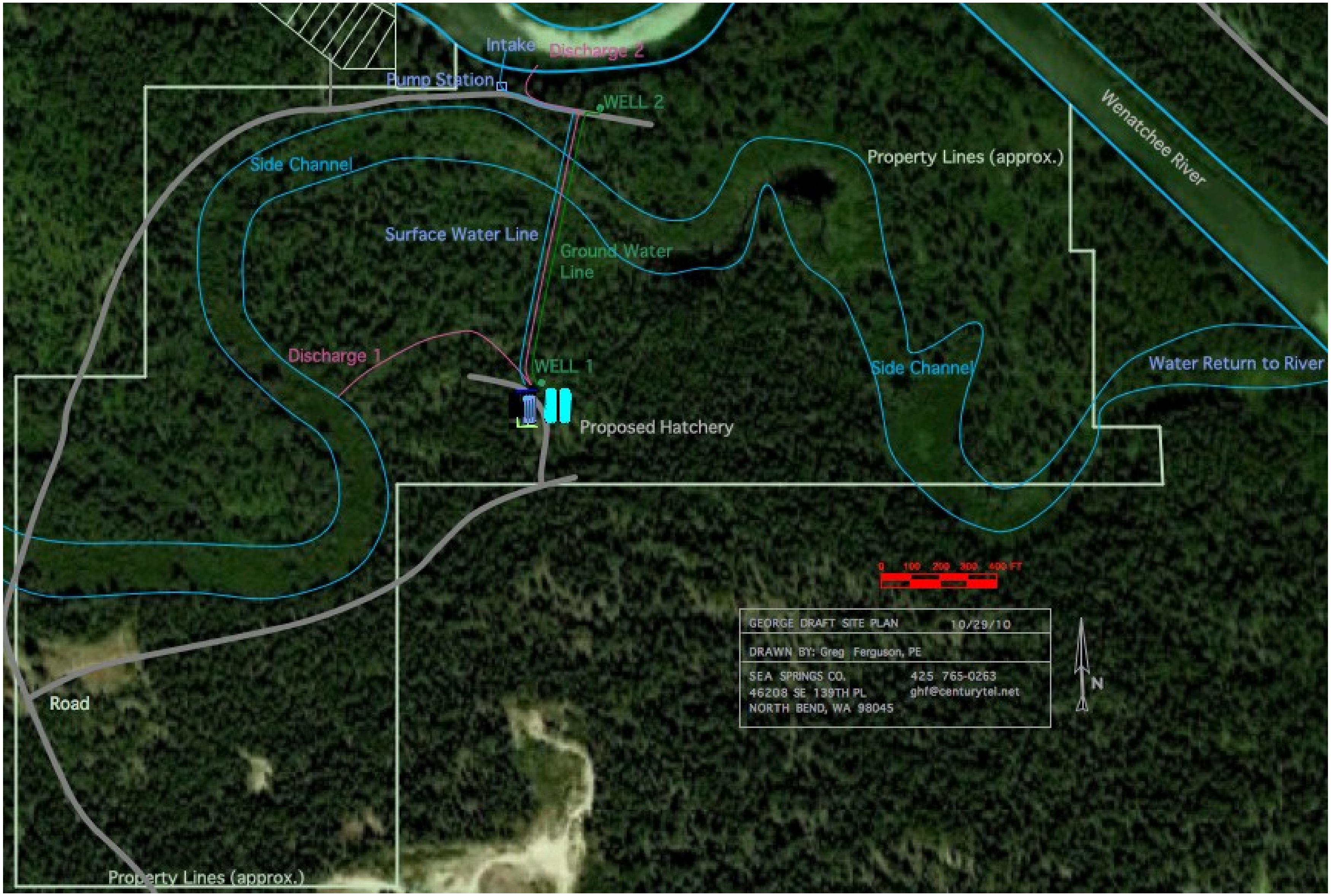


Figure 2-9. George Hatchery (Backup Site): Draft Site Plan

Acclimation Site Designs

Details of designs for each acclimation site (primary and backup) are outlined in Appendix 2 for Wenatchee basin sites and Appendix 3 for Methow basin sites. Photographs accompany the site descriptions. Figures 2-10 and 2-11 show a typical acclimation pond used by this program.

Net systems would be used to confine coho during the acclimation period at most sites. They can be configured in one of two ways (Figures 2-10 and 2-11). Both types are temporary and are in place only during acclimation. They would be designed to minimize premature escape and would include jump barriers and double lead lines. Double lead lines are weighted lines woven into the bottom of the net to maintain a sealed barrier across the earthen bottom of the pond.

Where listed fish species are not present in or above the ponds, nets that fully block fish passage in the ponds (barrier nets) could be installed. They are placed perpendicular to the flow (Figure 2-10).

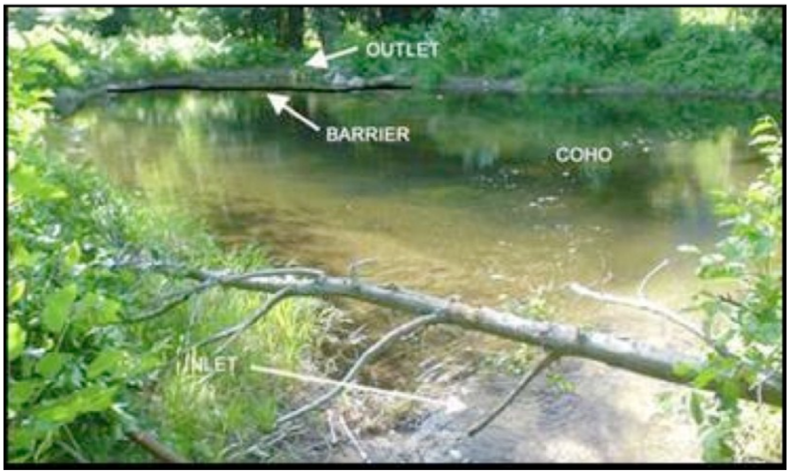


Figure 2-10. Barrier Net Example

Where free passage of fish up- and downstream is required, seine nets could be used: they form an enclosed impoundment of only a portion of the pond (Figure 2-11).

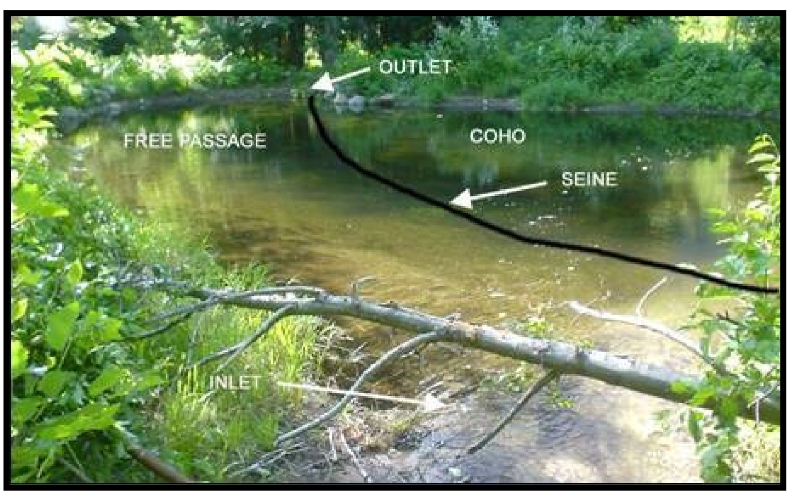


Figure 2-11. Seine Net Example

Proposed General Conservation Measures for Construction and Maintenance Activities

The measures listed in this section to avoid or minimize adverse effects to listed fish will be applied at all project sites, as appropriate.

Preparation

1. In areas where the bank will be disturbed, a temporary filter fabric fence will be installed before work begins to prevent sediment from entering the stream. Accumulated sediments will be removed as work progresses and before removing the filter fence once work is completed.
2. The type of filter fabric used will be based on soil conditions at the site: for soils that will pass U.S. standard sieve 200, the equivalent opening size (EOS) will be selected to retain 85% of the soil; for all other soil types, the EOS will be no larger than U.S. standard sieve 100.
3. For standard-strength filter fabric, a wire mesh support fence will be fastened securely to the upslope side of the posts and the fabric stapled or wired to the mesh. If extra-strength fabric is used, the wire mesh fence may be eliminated.
4. Any large wood, native vegetation, weed-free topsoil or native material displaced during construction will be stockpiled for use in site restoration.
5. All temporary erosion controls will be in place and appropriately installed downslope of applicable project activities until site restoration is complete.
6. The ingress and egress of side channels will be protected from flows before work begins.
7. The ingress and egress diversions will be screened consistent with the current WDFW and NMFS screening criteria. The screen shall remain in place and functioning properly whenever water is withdrawn from the stream.

Dewatering

8. The construction area will be isolated at the inlet and outlet by the placement of cofferdams consisting of gravel-filled bags and plastic sheeting to prevent water and fish from entering the work area.
9. The pond will be dewatered using screened pumps, after fish have been removed using approved methods, and before excavation begins.
10. YN will capture and safely move food fish, game fish, and other fish from the impounded area as it becomes de-watered. YN will have fish-capture and transportation equipment ready and on the job site. Captured fish shall be immediately and safely transferred to free-flowing water downstream of the project site.
11. Any device used for diverting water from a fish-bearing stream will be equipped with a fish guard to prevent passage of fish into the diversion device pursuant to RCW 77.57.010 and 77.57.070. The pump intake will be screened with 3/32-inch mesh to prevent fish from entering the system. The screened intake will consist of a facility with enough surface area to ensure that the velocity through the screen is less than 0.4 feet per second. Screen maintenance will be adequate to prevent injury or entrapment to juvenile fish and the screen will remain in place whenever water is withdrawn from the stream through the pump intake.
12. Water pumped from within the work area will be routed to an upland area to allow removal of fine sediment and other contaminants prior to being discharged to state waters.
13. Flows and weather conditions will be monitored daily for events that may cause extremely high flows. In such events, all equipment will be removed from the work site until flows have abated.

14. All work below the bankfull elevation will be completed during the appropriate in-water work period as specified in the Hydraulic Permit Approval.

Bank Stabilization

15. Bank stabilization material will be clean, angular rock, and will be installed to withstand 100-year peak flows. Stream gravels or other round cobbles will not be used as exterior armor.
16. Bank stabilization will be limited to what is necessary to prevent channel erosion from the river.

Water Quality Protection

17. The contractor will develop an adequate, site-specific Spill Control, Containment and Countermeasures Plan or Pollution Control Plan which will include: site plan and narrative describing methods of erosion/sediment control; methods for confining/removing/disposing of excess construction materials and measures for equipment washout facilities; a spill containment plan; and measures to reduce the use of or to recycle hazardous and non-hazardous wastes.
18. The spill containment control plan will include the following information: notification procedures, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures, proposed methods of disposal of spilled materials, and employee training on spill containment.
19. Materials for containment and cleanup will be available onsite during pre-construction, construction, and restoration phases of the project.
20. The sediment plume created by any work below the Ordinary High Water Line (OHWL) of the adjacent river, stream, or pond will not exceed 5 NTUs above background at 300 feet downstream of the project location. If this criterion is exceeded during project implementation, work will be suspended until the criterion is met.
21. Equipment used for this project that operate with hydraulic fluid will use only those fluids certified as non-toxic to aquatic organisms.
22. Vehicle staging, cleaning, maintenance, refueling, and fuel storage will be located a minimum of 150 feet from any acclimation pond or any flowing stream or water body.
23. When heavy equipment is used, the equipment selected will have the least adverse effect on the environment, e.g., minimally sized, low ground pressure.
24. Equipment used for this project will be free of external petroleum-based products. Accumulations of soil or debris will be removed from the drive mechanisms (wheels, tires, tracks, etc.) and undercarriage of equipment prior to its use within 150 feet of any acclimation pond or adjacent water body. Equipment will be checked daily for leaks; any necessary repairs will be completed before beginning work.
25. All stationary power equipment such as generators, cranes, or stationary drilling equipment operated within 150 feet of any water body will be diapered to prevent leaks unless suitable containment is provided to prevent potential spills from entering the water.
26. All waste material such as construction debris, silt, excess dirt or overburden from this project will be deposited above the limits of floodwater in an approved upland disposal site.

27. Extreme care will be taken to ensure that no petroleum products, hydraulic fluid, fresh cement, sediments, sediment-laden water, chemicals, or any other toxic or deleterious materials are allowed to enter or leach into the water bodies.
28. No concrete or fresh cement or grout will be poured directly within, allowed to fall or leach into, or wasted within the area below the OHWL or wetted perimeter of the river, stream, or acclimation pond.
29. Wastewater from project activities and water removed from within the work area will be routed to an area landward of the OHWL to allow removal of fine sediment and other contaminants prior to being discharged to the stream.
30. Sites will be monitored as flow returns to assure adequate water quality is maintained within adjacent water bodies once the pond water levels return and start flowing out of the pond to the adjacent water bodies.
31. If at any time during or as a result of project activities, fish are observed in distress, fish are killed, or water quality problems develop (including equipment leaks or spills), the Washington Military Department Emergency Management Division and the designated Area Habitat Biologist will be immediately notified. Work will not resume until WDFW approves. WDFW may require additional measures to mitigate the impacts.

Site Restoration and Plantings

32. Damaged banks will be restored to a natural slope pattern and profile that is suitable for establishment of permanent woody vegetation.
33. Disturbed areas and areas of soil spoils will be graded and covered with at least 2 inches of compost.
34. To prevent future erosion and to stem the invasion of noxious weeds, the disturbed areas will be seeded with a native grass seed mix that will provide wildlife benefit and erosion control.
35. Upon completion of all construction activities, all temporary structures, devices materials or equipment will be completely removed from the site and all excess spoils and/or waste materials properly disposed of in compliance with federal, state, and local regulations.
36. When floating or submerged large woody debris must be moved to allow access to or function of the newly created habitat, the wood will be relocated within the water at a similar depth and location such that it will continue to provide comparable aquatic habitat function in the new location.
37. Any plantings will be protected from deer, beaver, rodents, etc., regularly watered and weeded, and properly maintained until established, and replaced as necessary for a period of at least three years to assure and achieve a minimum of 80% survival by the end of the third growing season.
38. YN will provide the designated WDFW Habitat Biologist with clear color photographs or digital photos of the project areas and work sites before, during and after project construction; and of the finished project (including photos of the boulder clusters, engineered logjam and/or all other instream fish habitat structures; and of the restored streambed, stream banks and shorelines throughout the project work sites and area including all newly replanted stream bank and other disturbed shoreline areas) within thirty days of project completion, for WDFW's permit compliance records and ongoing ESA and project monitoring.

Annual Operation and Maintenance of Inlet Diversions and Outlets

39. Operation of diversions will be consistent with NMFS and WDFW screening guidelines and the water rights of the permittee.
40. Operation and maintenance of screens will be consistent with manufacturer's instructions and attached operation and maintenance instructions. Screen maintenance will be adequate to prevent injury to or entrapment of fish. All maintenance work will be done with care to avoid harm to fish and minimize discharge of sediment to the stream.
41. The annual installation of screens will be done with handheld tools. Emergency maintenance and repair work performed with hand tools may be performed anytime.
42. Large woody debris that must be removed from the intake will be placed in the river or stream downstream from the diversion facility.

2.2.3 Monitoring and Evaluation Plan

The success of the proposed coho reintroduction plan depends on extensive monitoring and evaluation to answer key questions such as:

- which acclimation sites are most successfully producing fish that return to coho habitat;
- when the program in each basin can move into a new phase;
- whether continued supplementation would be appropriate; and
- whether naturally produced coho are adversely affecting ESA-listed or other sensitive species.

Table 2-9 summarizes the monitoring and evaluation plan. References to activities for Broodstock Development Phase 1 are left in the table to show the monitoring that was done for that phase, which is now completed in both basins, and the continuity of program monitoring. Details of the monitoring and evaluation plan are presented in Appendix 5. The impacts of the plan are not discussed in this EIS because the plan is essentially the same as the current program.

Table 2-9. Summary of monitoring and evaluation activities

M&E Activity	Indicator Measured	Strategy	Restoration Phases[1]	Coordinated with other programs?
Release-to-McNary survival	Project Performance	PIT tags	BDP1, BDP2, NPIP, NPSP[2]	No
In-pond survival	Project Performance	PIT tags Predation control	BDP1, BDP2, NPIP, NPSP[2]	No
Pre-release fish condition	Project Performance	Physical examination	BDP1, BDP2, NPIP, NPSP	No
Volitional release run-timing and tributary residence	Project Performance / Species Interaction	PIT tags Smolt trapping	BDP1, BDP2, NPIP, NPSP[2]	Yes: Integrated Status & Effectiveness Monitoring Program (ISEMP) (BPA project #2003-017-00); CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Spawning escapement and distribution	Project Performance	Redd counts Carcass recovery Radio-telemetry Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	No
Natural smolt production	Project Performance	Smolt trapping Coded Wire Tag	BDP1, BDP2, NPIP, NPSP[3]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Egg-to-emigrant survival	Project Performance	Smolt trapping Redd counts Coded Wire Tag	BDP1, BDP2, NPIP, NPSP[3]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Adult-to-adult survival	Project Performance	Adult trapping Redd counts Carcass recovery Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	No
Adult-to-adult productivity	Project Performance	Adult trapping Carcass recovery Coded Wire Tag Scale analysis	NPIP, NPS	No
Harvest rates	Project Performance	Coded Wire Tag Scale analysis Database queries	BDP1, BDP2, NPIP, NPSP	Yes: Coordinated with harvest management agencies

1. BDP 1 = Broodstock Development Phase 1; BDP2 = Broodstock Development Phase 2; NPIP = Natural Production Implementation Phase; NPSP = Natural Production Support Phases
2. PIT tags will be used during NPSP if smolt-to-adult rates are not meeting program goals and further investigation into survival is warranted.
3. Natural smolt production and egg-to-emigrant survival estimates will be specific to release tributaries during NPIP and NPSP, and basin-wide during BDP1 and BDP2.

Table 2-9 (continued)

M&E Activity	Indicator Measured	Strategy	Restoration Phases	Coordinated with other programs?
Non-target Taxa of Concern (NTTOC) – Size structure	Species Interactions	Smolt trapping	BDP1, BDP2, NPIP, NPSP[4]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
NTTOC – Abundance and survival	Species Interactions / Status of NTTOC	Smolt trapping Underwater observation	BDP1, BDP2, NPIP, NPSP[4]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
NTTOC – Distribution	Species Interactions / Status of NTTOC	Redd counts Underwater observation	BDP1, BDP2, NPIP, NPSP[4]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Competition	Species Interactions / Mechanisms of Interaction	Underwater observation Enclosures Size and growth	NPIP	No
Predation by naturally produced coho on spring Chinook fry	Species Interactions / Mechanisms of Interaction	Smolt trapping Emergence and emigration timing	NPIP	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Morphometrics and life history traits	Genetic Adaptability	Adult trapping Redd counts Carcass recovery Smolt trapping Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Genetic monitoring	Genetic Adaptability	Genetic sampling Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	No

4. Baseline NTTOC monitoring during BDP1 and BDP2, effects monitoring during NPIP and NPSP.

2.2.4 Program Cost Summary

This section summarizes estimated costs for all the program elements. Costs are based on a fish release plan that is expected to last until 2028, as shown in Table 2-5 (Section 2.2.1).

The cost of the feasibility studies (estimated through 2010) was approximately $24 million (from Feb. 25, 2010 Decision Memorandum, NPCC.) The additional cost of the program through 2028, including capital costs and operational expenses, is expected to be approximately $59 million; the breakdown is shown in Table 2-10. Depending on results of Council step reviews, timing of some expenditures could change from what is shown in the table. For example, capital costs could be spread over more than one year. Most operational costs assume an inflation rate of 2.5% per year. Details of the how costs were calculated are in the Master Plan (YN 2010, Chapter 8).

The program currently is funded by BPA, Grant County PUD, and Chelan County PUD. (Douglas County PUD contributed $600,000 in 2008 towards capital costs related to the feasibility studies.) The current program also shares rearing costs with National Oceanic and Atmospheric Administration/National Marine Fisheries Service (NMFS), but this cost-share is not shown in the table. The NMFS contributions are funded through the Mitchell Act. The total amount from NMFS and Grant and Chelan PUDs is close to $1.5 million annually. The current program also shares monitoring and evaluation costs with Washington Department of Fish and Wildlife (WDFW) (not shown in table). If the Proposed Action is implemented, cost sharing with all these entities is expected to continue.

Table 2-10. Cost schedule for Proposed Action in millions of dollars

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
CAPITAL COST																	
TOTAL CAPITAL	**0.00**	**6.73**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
OPERATING EXPENSE																	
Plan, Design, Per.	0.55	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rearing	0.69	0.71	0.92	0.62	0.63	0.63	0.65	0.66	0.68	0.70	0.72	0.27	0.28	0.29	0.29	0.30	0.31
Tagging	0.62	0.64	0.89	0.91	0.93	0.71	0.72	0.74	0.76	0.78	0.80	0.48	0.49	0.50	0.51	0.53	0.54
O&M	1.19	1.22	1.65	1.70	1.74	1.35	1.38	1.42	1.45	1.49	1.53	0.98	1.00	1.03	1.05	1.08	1.10
M&E	0.58	0.60	0.74	0.76	0.78	0.80	0.82	0.50	0.25	0.26	0.27	0.27	0.28	0.29	0.29	0.30	0.31
TOTAL OP.	**3.63**	**3.33**	**4.21**	**3.99**	**4.09**	**3.49**	**3.57**	**3.32**	**3.15**	**3.22**	**3.31**	**2.00**	**2.05**	**2.10**	**2.15**	**2.21**	**2.26**
TOTAL COST	**3.63**	**10.06**	**4.21**	**3.99**	**4.09**	**3.49**	**3.57**	**3.32**	**3.15**	**3.22**	**3.31**	**2.00**	**2.05**	**2.10**	**2.15**	**2.21**	**2.26**
DIRECT FUNDING																	
Douglas PUD																	
Chelan PUD 10 Year	0.34	0.36	0.37	0.39	0.40	0.42	0.44										
Future Chelan PUD								0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grant PUD 10 Year	0.69	0.72	0.75	0.78	0.81	0.84	0.87										
Future Grant PUD								0.45	0.47	0.49	0.51	0.53	0.55	0.58	0.60	0.62	0.65
BPA MOA 10 Year	2.60	8.99	3.09	2.82	2.88	2.23	2.26										
Future BPA								2.86	2.67	2.73	2.79	1.47	1.50	1.52	1.55	1.58	1.61
TOTAL FUNDING	**3.63**	**10.06**	**4.21**	**3.99**	**4.09**	**3.49**	**3.57**	**3.32**	**3.15**	**3.22**	**3.31**	**2.00**	**2.05**	**2.10**	**2.15**	**2.21**	**2.26**

Estimates of the capital and operating costs cover the proposed project period from 2012 through 2028. Capital costs are expected to total $6,730,000 and would include land purchase and facility construction. Most capital costs are expected to be incurred in 2012 or 2013. To minimize capital costs, the Proposed Action makes extensive use of existing regional facilities, including those for broodstock capture, rearing, and acclimation.

Operating expenses include the operation and maintenance of these facilities, as well as the monitoring and evaluation program, and general and administrative project costs. Operating costs would change over time. Expenses during years when release numbers and operating costs would be at their maximum are shown in Table 2-11. The year of peak operating expenses is expected to be in 2013 or 2014, after construction of the new in-basin rearing facility and the beginning of the Natural Production phases. Of these costs, approximately 27% is projected to be contributed by Chelan County and Grant County PUDs. Their share of the operating costs gradually increases so that by 2017 they would contribute approximately 36% of the operating costs. After 2018, contributions are less certain; for example, Douglas County PUD is expected to contribute funding but the amount is unknown at this time.

The difference in operating costs between the two basins primarily reflects the costs of operating the proposed new hatchery in the Wenatchee basin and the larger number of coho initially released there. Two fewer dams for the coho to cross and existing in-basin trapping facilities made the Wenatchee the preferred basin to focus on for the broodstock development efforts. However, when the program transitions to the Natural Production phases in 2013 or later, the effort in the Methow would increase and the smolt release numbers would increase to one million, comparable to smolt release numbers in the Wenatchee (see Table 2-5).

Table 2-11. Peak operating costs by basin

	Wenatchee	Methow	Total
Planning, Design, Permits	-	-	-
Rearing	$ 530,870	$ 388,385	$ 919,255
Tagging	$ 513,820	$ 375,911	$ 889,731
O&M	$ 955,706	$ 699,196	$ 1,654,902
M&E	$ 429,586	$ 314,286	$ 743,872
TOTAL OPERATING	**$ 2,429,982**	**$ 1,777,778**	**$ 4,207,760**

2.3 No Action Alternative

NEPA requires federal agencies to consider the effects of not taking the proposed action. Under the 2008 Columbia Basin Fish Accords with the Three Treaty Tribes (one of which is the Yakama Nation [see Section 1.1]), BPA is committed to funding the Mid-Columbia coho project through September 30, 2018. Under the No Action Alternative, BPA would continue funding the existing program at existing facilities, at no greater than existing production levels, at the same level of annual funding as of Fiscal Year 2011 (approximately $1.9 million annually), with an annual inflation adjustment of 2.5 percent. Currently 1.5 million smolts are acclimated and released in the two basins annually. See Section 2.1 for broodstock collection, incubation and rearing, and acclimation and release sites used in the existing program.

If BPA were to choose the No Action Alternative, discussions among interested parties, including the Yakama Nation, BPA, the Northwest Power and Conservation Council, mid-Columbia PUDs, and other project partners, would probably begin well before 2018 to determine whether and how coho restoration would continue in the Wenatchee and Methow basins.

Presently, BPA is the main funding source for this coho restoration project, although not the only one, as described in the previous section. The total amount from NMFS and Grant and Chelan PUDs is close to $1.5 million annually. NMFS issued a draft EIS in 2010 that includes an alternative that eliminates funding for Mitchell Act hatcheries such as Willard NFH and Cascade Hatchery that are used in the current coho program (NMFS 2010). The agency has not yet issued a final EIS or Record of Decision. Depending on the outcome of that decision, BPA might need to consider—within the terms of the Fish Accords—additional funding for rearing at current Mitchell Act or alternative facilities. See more discussion in Section 2.2.2.1.

2.3.1 Biological Approach

The program would continue acclimated coho releases at the current level of 1 million in the Wenatchee and 500,000 in the Methow. No attempt would be made to expand production into new habitat; the program would not develop or operate new acclimation facilities in additional natural production areas. The program’s broodstock currently is essentially a domesticated hatchery stock, not fully adapted to conditions in the wild. Without acclimation and release of coho from more sites in high-quality habitat, coupled with the deliberate selection for increased percentages of natural-origin fish in the broodstock that originate from that habitat, the likelihood that viable natural populations of coho would be established is low. The program primarily would be propagating hatchery fish and might be replaced by a program to promote fisheries only. Such a change would depend on whether a facility could be found to provide sufficient coho for a fishery over the long term. If no such facility could be found, a coho program might have to be abandoned in the Wenatchee and Methow basins.

2.3.2 Facilities

The program would continue to rely on existing facilities. The new facilities proposed as part of the Proposed Action would not be constructed, and it is unlikely that existing facilities would be modified.

- **Broodstock capture**: The current broodstock capture locations—Tumwater, Dryden, Leavenworth NFH, Wells FH, Winthrop NFH, Methow FH—are expected to remain available. New broodstock capture locations would not be added.
- **Incubation/Rearing:** Existing facilities would continue to be used if available. The potential for Leavenworth NFH or the lower river hatcheries (Willard and Cascade) to be eliminated or used on a more limited basis would be the same as under the Proposed Action, with the same options (see Section 2.2.2.1).
- **Smolt releases:** Table 2-12 shows the current production program that would continue under the No Action Alternative and the acclimation sites that would be used. Several other sites are currently planned under a different BPA-funded YN project (Multi-Species Acclimation Project; see Section 3.15.3) for spring Chinook and steelhead acclimation; the Yakama Nation could choose to add coho acclimation at these sites in the future, assuming funding levels are sufficient to do so.

Table 2-12. No Action Alternative release numbers and locations

Location	Facility Name	Smolt Releases	Total Basin Releases
Wenatchee River [a]	Leavenworth NFH [a]	550,000	950,000
	Butcher Creek	140,000	
	Coulter Pond	65,000	
	Beaver Creek	110,000	
	Rohlfing	85,000	
Methow River [b]	Winthrop NFH	325,000	500,000
	Lower Twisp	100,000	
	Wells Dam	75,000	

a. Wenatchee production would be spawned and eggs early-incubated at Leavenworth NFH and transferred to Cascade Hatchery (funded by Mitchell Act) for final incubation and rearing to the pre-smolt stage prior to transfer to acclimation/release sites identified above, assuming these facilities are available. (See Section 2.2.2.1 for constraints.)

b. Methow production would be spawned and eggs early-incubated at Winthrop NFH and transferred to Cascade NFH for final incubation and rearing to the pre-smolt stage prior to transfer to acclimation/release sites identified above. Some fish may be able to be reared at Winthrop NFH but at a very reduced number.

- **Monitoring and Evaluation:** The Nason Creek smolt trap would continue to be used. Currently, Grant County PUD and BPA through the coho project are the funding agencies for this trap. No new traps would be installed. The current monitoring program would continue (see Table 2-9 in Section 2.2.3).

2.4 Alternatives Considered but Eliminated from Detailed Evaluation

As discussed in Section 1.3, the Northwest Power Act requires the ISRP to review fish and wildlife projects in the Council's program to ensure that they are based on sound science and that they are consistent with the program (16 U.S.C. § 839b(h)(10)(D)(iv)). The Council through its ISRP subjected the coho project analyzed in this EIS to a rigorous and lengthy planning and review process.

The first step in the process requires that the proponent submit a Master Plan which must examine alternatives to solving the resource problem, which in this case was that coho had been extirpated from mid-Columbia river basins. Before the Master Plan was developed, program reviewers suggested that the YN consider the alternative of continuing feasibility studies that had been ongoing for several years. This option was rejected because feasibility questions had been answered; it seemed unreasonable to spend more money on studies in lieu of beginning to achieve practical results.

Restoring coho to the Entiat basin was in early versions of the proposed action, because it was part of YN's long-term vision. However, program activity in that basin was removed from the proposal partly due to the need to limit project costs and partly because the resource managers (NMFS, WDFW, YN, USFWS, Colville Tribe, Chelan and Douglas PUDs) were considering using the Entiat basin as a potential reference stream for both spring Chinook and steelhead, to measure the success of the PUDs' HCP hatchery programs (Murdoch and Peven 2005).

In the final Master Plan (YN 2010), the YN examined rearing and acclimation system alternatives in two appendices;[18] and the proposed action was modified several times in response to comments from ISRP and from a Technical Work Group made up of BPA and federal, state, tribal, and other entities' staff (see Chapter 1 of the EIS). On March 9, 2010, the Council approved the Master Plan and recommended that BPA and the Yakama Nation move to Step 2 of the Council's process, which includes BPA's NEPA review and drafting of preliminary designs.

Sections 2.4.1, 2.4.2, and 2.4.3 summarize the alternatives that were examined during review of the YN's Mid-Columbia coho program and development of the Master Plan. It is not reasonable to develop these alternatives to include specific locations and designs, and to attempt a detailed review of the environmental consequences of these alternatives at a level commensurate with the proposed action, when the alternatives have been deemed in other analyses to be ineffective, too costly, or to cause significant environmental impacts. No scientifically acceptable and environmentally superior alternative that also meets the need was suggested during Council's Step 1 phase or during scoping or review of the EIS.

2.4.1 Alternative Rearing Systems

Appendix B.1 of the Master Plan for the coho reintroduction program evaluated several alternative rearing systems, including the following:

- Existing public hatcheries
- A central conventional hatchery
- Small watershed rearing facilities
- Natural habitat rearing facility
- Long-term rearing at acclimation sites
- Constructed habitat

[18] YN 2010, Appendix B.1 Rearing Facilities Alternatives; Appendix B.2 Acclimation Facilities Alternatives.

The analysis in the Master Plan shows that the alternative of using existing hatcheries has a much lower overall cost than the other options. It has no capital cost and a moderate operating cost. The construction and use of multiple small watershed hatcheries is estimated to have a very high total cost; all the other options are intermediate (YN 2010, Appendix B.1).

The differences in operating costs reflect the higher expense of producing fish from multiple locations. There is a certain fixed base cost associated with operating a facility that is independent of the numbers of fish produced. The difference between producing all the fish at one location versus at multiple locations may be in excess of $6,000,000 over a 20-year period. Differences in capital cost result from the number of facilities and their complexity.

Important factors used to evaluate rearing system options include the ability to produce fish that return to targeted areas at high survival rates. The degree of difference between the various systems' adult survival rates is unknown. Adult return rates are expected to be affected by the type and length of acclimation: long acclimation periods in natural conditions would improve the performance of fish produced from conventional hatcheries (YN 2010, Appendix B.2).

The central, conventional hatchery and the small watershed rearing facility had too many disadvantages related to cost and operational difficulties. Also, the natural habitat rearing facility is an untested concept. These alternatives were eliminated as rearing options. The program combined and modified the remaining options into the proposal evaluated in this EIS.

2.4.2 Alternative Acclimation Systems

Appendix B.2 of the Master Plan evaluated alternative acclimation systems. The analysis in that appendix, incorporated into this EIS by reference, led to identification of low-priority options for acclimation systems and methods. The low-priority options and the reasons they were eliminated from further consideration are summarized below.

- The no-acclimation option results in lower survival rates and less homing fidelity than acclimated fish (Johnson et al., 1990; Isaksson et al. 1978; Whitesal 1994); and a coho-specific study in the Yakima basin showed that direct truck plants of smolts were not successful in establishing large-scale natural populations of coho (Yakima/Klickitat Fisheries Project 2003).
- The option of one large site per watershed is less likely to disperse adults into distant habitat in the tributary, would require high capital costs to construct, would require large and potentially environmentally significant water withdrawals, and would limit the flexibility to change acclimation locations in response to monitoring results.
- The constructed concrete raceway option has a high capital cost and does not match the natural landscape features of upstream habitat areas where it is hoped coho would establish naturally spawning populations.
- One release site per tributary using existing ponds is not realistic in the major tributaries. The capacity of existing ponds is not large enough to acclimate the numbers projected to be needed to establish coho populations.
- The combination of pumped water supplies and constructed acclimation facilities along with multiple sites per watershed would have much higher capital costs.

- Releasing all program fish from constructed natural habitats is a relatively new concept (Smith et al. 2004) with high capital costs due to the large amount of land required and has not been subject to long-term testing and evaluation.

2.4.3 Independent Science Review Panel Alternative

During reviews of the Master Plan prepared for the Council, its Independent Science Review Panel (ISRP) suggested modifications to the program design. In some cases, their suggestions became part of the proposal. The most recent and significant alternative suggested by the ISRP is reproduced below from the ISRP letter of November 24, 2009 (Memorandum ISRP 2009-47 to Tony Grover, Director, Fish and Wildlife Division, Northwest Power and Conservation Council from Eric Loudenslager, ISRP Chair).

> *Under ideal circumstances one program design would involve splitting the combined production into lower and upper releases, each with unique tags, in the first generation. These two groups would be genetically identical for all practical purposes. The proportions (or numbers) of each of these two groups that arrive at Tumwater Dam would be compared. In this first generation, this would measure the environmental effect of the different release sites on the migration distance within the subbasin. In the second generation, fish that returned to Dryden and fish that returned to Tumwater would be mated within return locations. Paired releases of the progeny of these parents would be conducted both in the upper and lower sites in the river. The contrast of return site between the two subpopulations released from the same location would serve as a measure of response to selection (adaptation). The magnitude of the response would serve to predict the number of generations required to achieve the goals for each of the program phases and facilitate establishing causation, which is needed if the contingency plan needs to be implemented. If a program like this was used it would make a significant contribution to documenting genetic and environmental sources of variation influencing an attempt to reestablish a self-sustaining extirpated population.*

While this approach to program design could provide interesting data, it delays practical results in favor of a scientific exercise that develops alternative program designs in order to model their potential differing outcomes in advance. In addition, it would be difficult to evaluate the effect of migration distance on adult coho survival within the two basins. After surviving the hundreds of miles of migration from the Columbia River mouth to the mid-Columbia basins, it is unlikely that adult migration distance within the basins would be a significant survival factor. For example, in the Wenatchee basin, the distance between Dryden Dam and Tumwater Dam is only 15 miles, compared to the 486 miles and 7 dams from the mouth of the Columbia River to Dryden Dam. More likely, the in-basin key to survival would be the habitat conditions within the basins, and, for the Wenatchee, the hydrographic difficulty for adults (rather than the distance) of reaching high quality spawning and rearing habitat above Tumwater Canyon (K. Murdoch, YN Fisheries Biologist, personal communication, November 2009). The hydrographic challenge of Tumwater Canyon is also a reason not to try to breed separate upper and lower Wenatchee basin coho populations. Biologists do not know which characteristics, visible or not, contribute to coho successfully navigating Tumwater Canyon, so they do not want to unintentionally select out the genetic diversity that would allow these fish to survive the highly variable conditions of that reach of the Wenatchee River.

This ISRP alternative does not require detailed evaluation in this EIS because the effects on the environment would fall within the range of effects already being analyzed.

2.4.4 Use of Egg Boxes

During scoping, it was suggested that egg boxes could be used instead of building a hatchery. This is not a feasible alternative. Egg boxes could not replace a hatchery in this case for two main reasons. Due to the time of year and locations where coho spawn, egg boxes placed in those areas probably would freeze and the eggs would be killed. Even if egg boxes were used, the project still would need to capture, hold, spawn, and early-incubate the eggs, which would require the same infrastructure as proposed.

2.4.5 Use of Out-of-Area Wild Donor Fish

During scoping, a commenter suggested that the project use wild donor fish from other regions such as Alaska or Canada. At the outset of the feasibility studies, the project investigated using coho from the Fraser River in British Columbia to develop a locally adapted broodstock. This stock was the only remaining wild stock in the Northwest that migrates long distances, similar to the coho that used to occupy the mid-Columbia basins. At the time (mid-1990s), such fish were unavailable. With declining coho populations in the Fraser system, it is currently unlikely that an international agreement could be negotiated.

2.5 Comparison of Alternatives in this EIS

Table 2-13 compares the two alternatives considered in detail in this EIS—the Proposed Action and the No Action Alternative—in terms of how well they meet the purposes defined in Section 1.2. A discussion of the comparison follows the table.

Table 3-1 at the beginning of Chapter 3 summarizes the environmental effects of the two alternatives that are identified in the detailed analyses presented in the remainder of Chapter 3.

Table 2-13. Comparison of the Proposed Action and the No Action Alternative to Purposes

Purpose	Proposed Action	No Action
Develop a locally adapted, self-sustaining, naturally spawning coho stock that occupies its historical habitat in the Wenatchee and Methow river basins	By providing funding for expanding coho distribution into natural production areas of the basins, model results indicate that a locally adapted, self-sustaining, naturally spawning coho stock has an excellent chance of being established.	Without funding to expand into natural production areas, a locally adapted, self-sustaining, naturally spawning coho stock is unlikely to be established. The majority of fish returning to the basins would be hatchery fish.
Support efforts to mitigate for effects of the FCRPS on fish and wildlife in the Columbia River basin pursuant to the Northwest Power Act	Would support the long-term goal of a program designated as a high-priority mitigation project in the Council's Fish and Wildlife Program.	Would still support the program in the short term by continuing releases of coho from local broodstock.
Assist in carrying out commitments related to proposed hatchery actions contained in the 2008 Columbia Basin Fish Accords Memorandum of Agreement with the YN and others	Providing funding for expansion of the coho project would meet the maximum funding commitment made to the YN in the Accords MOA.	Maintaining the status quo would meet only the base funding commitment (for the current program phase) made to the YN in the Accords MOA.
Minimize harm to natural or human resources, including species listed under the Endangered Species Act	Proposed mitigation measures would minimize harm to natural and human resources. Approvals by and reporting to regulatory agencies would minimize the risk of adverse effects to listed species. Could provide ecological benefits that would aid in listed species recovery.	With no construction of new facilities, natural and human resources would not be adversely affected. Low numbers of naturally produced coho could reduce the risk of adverse effects to listed species but also would not provide potential ecological benefits.
Increase the abundance of Mid-Columbia coho salmon to numbers sufficient to sustain a mainstem and terminal harvest in most years	Program projections indicate that by funding increased coho production for a limited period and expanding their distribution into natural production areas, natural coho abundance would be increased by 2028 sufficient to sustain harvests.	Without BPA funding for increased production and new release areas, it is unlikely that natural coho abundance and distribution would be increased sufficiently to provide significant harvest over the long term.
Support the visions and goals of other regional plans, including subbasin plans and the Tribal Anadromous Fish Restoration Plan (*Wy-Kan-Ush-Mi Wa-Kish-Wit*)	Would support subbasin plans by restoring coho as part of ecologically balanced systems. Would support the tribal plan by restoring natural production of coho to rivers that are important to historical cultural and economic practices of the tribes.	Would not support subbasin plans because naturally spawning populations of coho are unlikely to be restored. Would not support the tribal plan because natural production in historically used rivers would not be restored.
Maintain consistency with the coho production objectives specified in the 2008-2017 *United States v. Oregon* Fish Management Agreement for the Wenatchee and Methow subbasins	Continued BPA funding would provide the personnel, equipment, and facilities needed to maintain the *U.S. v. Oregon* production goal of 1.5 million smolts released from the Wenatchee and Methow subbasins.	Continued BPA funding would meet the *U.S. v. Oregon* production goal of 1.5 million smolts only through 2018, unless other agreements were reached before that time.

The intent of the Proposed Action is to further mitigate the adverse effects of the Federal Columbia River Power System on fish in the Wenatchee and Methow basins by restoring naturally spawning coho salmon runs to these basins. Coho runs to these basins were virtually non-existent by the end of the 20^{th} century due to a combination of factors discussed in detail in Section 1.4.1. By applying the most current findings regarding acclimation and integrated hatchery reform, the Yakama Nation, through the Proposed Action, endeavors to establish self-sustaining, naturally reproducing coho populations in the Wenatchee and Methow basins. To that end, the YN would implement best available science for production and acclimation to encourage a locally adapted population that would eventually rebuild the coho runs to harvestable numbers. By reintroducing coho in these basins, BPA and the Yakama Nation also hope to contribute to restoring the ecological balance of the system. The Wenatchee Subbasin Plan recognizes that "Restoration of individual populations may not be possible without restoration of other fish and wildlife populations with which they co-evolved." (NPCC 2004a). By funding the Proposed Action, BPA would make continued progress toward meeting its obligations under the Pacific Northwest Electric Power Planning and Conservation Act and the commitments made in the 2008 Columbia Basin Fish Accords.

The No Action Alternative would be unlikely to achieve a self-sustaining, naturally reproducing population. The broodstock currently used by the coho program in the Wenatchee and Methow basins is essentially a domesticated hatchery stock, not fully adapted to conditions in the wild. Without the acclimation and release of coho from new sites in key habitat coupled with deliberate selection for increased percentages of natural-origin fish in the broodstock, with increased numbers of those fish originating from high-quality habitat, the likelihood that viable natural populations of coho would be established is low. This alternative would likely further reduce the very low risk to listed fish posed by naturally spawning coho. A harvestable number of coho could be produced if the current program eventually was replaced by a program to produce only hatchery fish, funded by other entities. However, such an outcome is not predictable and would not help restore natural populations as envisioned in the subbasin plans and the Tribal Restoration Plan.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction: How this Chapter is Organized

This chapter analyzes the potential effects of the Proposed Action and the No Action Alternative on the physical, biological, and human environments.

- Section 3.2 summarizes the environmental effects analyzed in the remainder of the chapter.
- Section 3.3 provides an overview of the geography of the two basins and a brief description of each project site.
- Section 3.4 discusses the past and current status of coho salmon in the basins.
- Sections 3.5 through 3.14 evaluate the effects of the Proposed Action and the No Action Alternative on environmental and human resources.
- Section 3.15 discusses the cumulative effects of the project.
- Sections 3.16 and 3.17 identify adverse effects that cannot be avoided, irreversible and irretrievable commitments of resources, short-term uses of the environment, and effects on long-term productivity.

  The analysis considers the effects of the alternatives in the following categories of action:

  - development and operation of a new small hatchery for adult holding/spawning, incubation and rearing;
  - development and operation of new, expanded, and existing acclimation and adult plant sites;
  - changes in the numbers and locations of coho being released into the basins.

Direct, indirect, and combined effects are described for each resource affected.

Effects of program use of facilities that are not proposed for physical modification or change in current operations are not evaluated. These facilities include:

- hatcheries near Bonneville Dam on the Columbia River (Willard and Cascade), impacts of which have been evaluated in other processes;
- Winthrop NFH and Leavenworth NFH;[19]
- existing juvenile and broodstock capture sites in the two basins where operations would remain the same;
- the monitoring and evaluation program, because it is essentially the same as the current program, effects of which were evaluated in previous NEPA processes.

Although impacts of these sites and programs are not evaluated in this EIS, maps in the main document and in Appendix 4 show the locations of all facilities proposed for use in this program, and Appendix 5 describes the monitoring and evaluation program in detail.

The Mid-Columbia Coho Restoration Master Plan (Master Plan) (YN 2010) is incorporated by reference in this EIS in its entirety. It includes biological data, ecological rationale, and environmental and engineering research used to support much of the analysis in this EIS.

[19] Water quality issues at Leavenworth NFH due to coho rearing are evaluated in this EIS; see Section 3.5.3.

3.2 Summary of Environmental Effects

Table 3-1 summarizes the environmental effects that are discussed in detail in Chapters 3 and 4.

Table 3-1. Summary of Impacts of the Proposed Action and the No Action Alternative

Impact	Proposed Action	No Action Alternative
Effects on water quality from facility discharges	There would be minor, localized impacts from phosphorus in effluent from proposed new facilities, but model simulations show that the maximum possible impact of all facilities, including the proposed hatchery, would be undetectable downstream in the sections of the Wenatchee River that are water quality limited.	No change from current program because no new facilities would be developed and fish production would remain the same.
Effects of surface and groundwater withdrawals on surface water quantity	Local reduction in flows at withdrawal points for groundwater and in 5 bypass reaches for surface water, offset by return flows from facilities.	No change from existing conditions because no new withdrawals are proposed.
Effects of water withdrawals on groundwater supply	Local reductions at 2 primary acclimation sites and the hatchery; no regional reductions.	No change from existing conditions because no new wells would be developed.
Effects of surface and groundwater withdrawals on water rights	Potential impact to groundwater rights at Dryden; potential impact to on- or off-site wells at 2 primary acclimation sites. No impacts to surface water rights at any of the sites.	No change from existing conditions because no new wells would be developed.
Sedimentation effects on fish	Minimal or no effects on ESA-listed and other fish from temporary sedimentation due to excavation and construction: best management practices would be used for erosion control.	No sedimentation effects because no new facilities would be constructed.
Effects of surface water withdrawal on ESA-listed and other fish	Relatively small withdrawal volumes at acclimation sites would not substantially reduce in-stream flow quantities, change habitat availability including hiding/resting/foraging habitats, or affect migratory movements (fry, juvenile, and adult) of listed salmonids. Withdrawals from Dryden fishway and discharge into Peshastin Cr. could increase spawning habitat for summer Chinook in Peshastin Cr. but have little or no effect on species in Wenatchee R. Water intake systems would follow NMFS 2008 guidelines to reduce potential to entrain all fish species.	No change from current conditions because no new surface water withdrawals would be made.
Reduced access to migration or rearing habitat for ESA-listed and other fish	Fish other than coho would be displaced from 1.53 acres of currently accessible habitat at proposed acclimation sites in both basins for 6 weeks to 7 months annually until 2028. For ESA-listed fish, this translates to: - Up to 43 spring Chinook juveniles and 91 steelhead juveniles excluded annually from Wenatchee basin sites out of a total annual wild population of 55,619 – 311,669 Chinook smolts and 17,499 - 85,443 steelhead smolts. - Approx. 233 spring Chinook juveniles and 155 steelhead juveniles excluded annually from Methow basin sites out of a total annual wild population of 15,306 – 33,710 Chinook smolts and 8,809 - 15,003 steelhead smolts. - Juvenile bull trout numbers excluded from sites in each basin are very small (Wenatchee 1; Methow 10). New sites in general displace fish from 1.5-7.3%, of off-channel habitat within specific stream reaches where amount of such habitat is known. Exceptions (30-73% of habitat) are offset by habitat improvements on-site or nearby.	Approximately 1/3 acre of currently accessible habitat at acclimation sites would be newly excluded from use by fish other than coho, for a total of 1.72 acres excluded from use for 6-8 weeks each year. Increase in current amount excluded is due to potential use of 2 Methow basin acclimation sites not in 2010 program, Heath and Lincoln.

Table 3-1 (continued)

Impact	Proposed Action	No Action Alternative
Trapping of fish at adult traps	Trapping at all but three traps is occurring under existing operations. Potential take of bull trout at Chiwawa Weir, Twisp Weir and Methow FH if operations are extended to allow coho trapping.	No change in current conditions; existing traps at Dryden Dam and Wells FH are operated part of the time solely for coho trapping.
Trapping of fish at juvenile traps	Incidental take of spring Chinook or bull trout is possible at a potential new trap on the Little Wenatchee R.; impacts would be evaluated when location is proposed.	No change in current conditions; existing traps are operated with or without coho project. No new traps proposed.
Coho predation on ESA-listed fish	Studies show that approximately 0.28% of hatchery coho smolts and 2.7 % of naturally produced coho prey on listed species, with less than 1% of the Chinook fry population consumed. Listed populations would be monitored and changes evaluated to determine if increasing numbers of coho increase predation with adverse effects on listed species.	Minimal predation by hatchery smolts as in existing program. Minimal predation by naturally produced smolts, as significant numbers of naturally produced coho are unlikely to be established.
Competition between naturally produced coho and ESA-listed species	Studies show species use different microhabitats, so competition is not expected at low densities. Listed species would be monitored to determine if adverse effects occur with increasing densities.	Without the expanded program, naturally produced coho numbers and densities would remain low, so potential competition with listed species would be limited or non-existent.
Effects on ecological balance	The addition of coho carcasses at the onset of winter might provide an increased marine-derived source of nutrients and improve over-winter survival for all species. Juvenile and adult coho provide prey for fish-eating predators including bull trout, bald eagles, mergansers, otters, and bears. Ecological balance could improve with coho occupying a critical niche in the natural environment	Current conditions would continue; e.g., in Nason Creek, there is very little carcass production, leaving a potential void in the nutrient balance prior to the onset of winter. Little potential for improvement in ecological balance.
Habitat reductions for ESA-listed wildlife	Slight reduction in potential spotted owl habitat possible at Tall Timber (w/in 1 mi. of management circle, w/ suitable forest habitat); qualified biologist would confirm presence or absence of nests in any trees needing removal. Critical habitat not affected.	No change in current conditions.
Habitat reductions for state-listed wildlife	No noticeable reductions in available habitat for any species listed under WDFW Priority Habitat and Species program. Slight increase in aquatic habitat due to new ponds.	No change in current conditions.
Disturbance to wildlife	Construction noise could cause certain species to avoid 8 sites for 1-60 days, May-October of 2012 or 2013. Operations, including use of noise-baffled generators, would not noticeably disturb wildlife because all primary sites currently experience human activity.	No change in current conditions.
Effects on wetlands	No construction would occur in wetlands at any primary project sites so wetlands would not be affected.	No change in current conditions.
Changes to floodplain function	Construction would occur in floodplains, requiring permits at 3 primary acclimation sites in the Wenatchee and 2 primary acclimation sites in the Methow, and at the proposed new hatchery. Flood elevations are not expected to change. New ponds could add a small amount of flood storage. Excavated material would be disposed outside of floodplains and not change grade that could divert flood flows to nearby properties.	No change in current conditions.
Effects on aesthetic/visual quality	Dryden Hatchery could reduce the contrast of the site with the surrounding area and add to the aesthetic appeal for viewers. Acclimation sites would not change visual quality.	No change in current conditions.

Table 3-1 (continued)

Impact	Proposed Action	No Action Alternative
Effects on recreation	No interference with current recreation uses. Generators at noise-sensitive acclimation sites would be enclosed in noise-muffling structures to meet state noise standards.	No change in current conditions.
Economic effects	Minimal increase in employment, temporary and permanent. No new infrastructure or services required.	No change in current conditions.
Effects on harvest	Potential terminal, mainstem, and ocean tribal, commercial, and sport harvest by 2028.	No harvest of naturally produced fish; potential harvest of hatchery fish if program changes to harvest augmentation.
Effects on cultural resources	No cultural resources were found in the vicinity of project sites; no effect.	No effect.
Noise effects	Construction noise at residences or properties near acclimation sites 8 a.m. – 5 p.m. M-F, for 1 day to 4 months in 2012 or 2013. Construction noise likely not noticeable for the 5-month hatchery construction period due to noise from surrounding uses at Dryden. Noise from generators would be muffled to meet state standards.	No change in current conditions.
Effects on air quality	Minor short-term increases in dust during spring and summer of 2012 or 2013 from construction activities. Undetectable increases in greenhouse gases.	No change in current conditions.
Consistency with comprehensive plans	Proposed activities would be consistent with goals and policies in Chelan County and Okanogan County comprehensive plans.	Current program is consistent with comprehensive plans in Chelan and Okanogan counties.

3.3 Overview of Wenatchee and Methow Basins and Project Sites

3.3.1 General Characteristics of the Basins

The **Wenatchee basin** is located within Chelan County in north central Washington. It consists of five sub-watersheds (the Chiwawa, White, Little Wenatchee, and Wenatchee rivers and Nason Creek), which drain a combined total of approximately 1,300 square miles (NPCC 2004a). The headwaters of the basin are in the Cascade Mountains and include portions of the Glacier Peak and Alpine Lakes wilderness areas. The Wenatchee River joins the Columbia River at river mile (RM) 470 between Rocky Reach and Rock Island dams. The majority of the basin is forested; the composition of forest species changes as distance from the Cascade crest increases and elevations decrease. Vegetation and wildlife habitat types consist of wet mixed-coniferous forests (mountain hemlock, silver fir and western hemlock), dry mixed coniferous forests (subalpine fir, grand fir, Douglas-fir, and/or ponderosa pine), grasslands, shrub steppe, herbaceous wetlands (sedges and rush), montane coniferous wetlands, and riparian wetlands (willow, black cottonwood, alder and red osier dogwood, with quaking aspen and bigleaf maple at the edges) (NPCC 2004a). These diverse habitats support an estimated 341 species of fish and wildlife (NPCC 2004a). Topography in the basin varies from mountainous alpine slopes (10,541 feet elevation at Glacier Peak in the White River watershed) to wide river valleys (600 feet elevation at the town of Wenatchee).

Land uses in the Wenatchee basin consist of commercial forest (86 percent areal coverage), commercial agriculture (1 percent), rural (12 percent), urban (0.5 percent), and open water (0.3 percent). Approximately 76 percent of the lands in the basin are managed by the U.S. Forest Service (USFS). Approximately 18.5 percent of the basin is privately owned. Private lands border almost two-thirds of the mostly lower-gradient streams that support anadromous (sea-run) fish such as salmon and steelhead. Agriculture consists primarily of orchards (93 percent) with some production of hay, grains and row crops (6.5 percent) (NPCC 2004a).

The **Methow basin** is in Okanogan County in north central Washington. It consists of five sub-watersheds (the Methow, Twisp, Chewuch and Lost rivers and Early Winters Creek), which drain a combined total of approximately 1,825 square miles (NPCC 2004b and 2004c). The Methow River joins the Columbia River at the town of Pateros. Vegetation and wildlife habitat types consist of mixed coniferous forests (upper-montane and mid-montane), lodgepole and ponderosa pine woodlands, upland aspen forests, grasslands, shrub-steppe, herbaceous wetlands, montane coniferous wetlands, riparian wetlands, agriculture and urban/mixed use. These diverse habitats support well over 300 species of fish and wildlife. Topography in the basin varies from mountainous alpine slopes with elevations greater than 8,500 feet, to wide river valleys with elevations of approximately 800 feet. Land use in the basin consists of forest land (86.5 percent), rangeland (9.6 percent), other land uses (2.3 percent), and cropland (1.6 percent). More than 80 percent of the basin is managed by the USFS. Grazing and croplands are primarily in the lower and middle reaches of the basin. Agriculture consists of orchards, alfalfa and other irrigated crops.

3.3.2 Land Use at Proposed Project Sites

Figures 2-5 through 2-8 in Chapter 2 show the general locations of project sites in each basin. Large-scale maps of each proposed and backup site can be found in Appendix 4. The specific map number for each site is identified in the descriptions below.

3.3.1.1 Hatchery Sites

Dryden (Primary): The site is on property that contains an existing adult trapping facility adjacent to Dryden Dam at the mouth of Peshastin Creek (Figure 10c). The Washington State Department of Transportation (WSDOT) currently uses the site for gravel storage. Highway 2 passes by the site. The majority of the site is disturbed bare ground with small patches of grass and weedy species. Land use in the vicinity is dominated by light industrial development associated with the dam, residential and commercial development associated with the community of Dryden, and agricultural use. The hills south of Highway 2 contain second growth coniferous forest.

George (Backup): The George site (also known as Natapoc) is an undeveloped property consisting of multiple parcels totaling 150 acres along a large bend in the Wenatchee River (Figure 10ad). The site is accessed via gravel roads from State Route (SR) 207 and Beaver Valley Road. The topography is relatively flat; a majority of the site is below the base flood elevation for the Wenatchee River. Habitat is diverse and includes forested, shrub-scrub, emergent and open-water wetland and mixed deciduous and coniferous upland forest. Land use in the vicinity of the George site includes recreational areas, residences, farms and ranches, and private and federal forest lands. The landscape is dominated by mature forest, wetland systems, and riparian habitat associated with the Wenatchee River.

3.3.1.2 Primary Wenatchee Basin Acclimation and Adult Plant Sites

Beaver: This site contains a pond currently used by the project for coho acclimation (Figure 10h). The pond is on property owned by a recreation-oriented guest facility. An un-surfaced road extends 1,000 feet from the guest lodge to the pond. Chiwawa Loop Road is also within about 1,000 feet of the site but is not visible from it.

Brender: The Brender site includes an existing pond on an undeveloped parcel in the community of Cashmere (Figure 10b). Brender Creek flows through the site and an unpaved road provides access. Land use in the vicinity is dominated by residential and commercial development associated with the community of Cashmere. Highway 97 is about a quarter mile to the north.

Butcher: The Butcher site includes an existing pond currently used by the project for coho acclimation (Figure 10e). Highway 2 is a few hundred feet to the south and visible from the site. A paved access road from Highway 2 runs along the north side of the site and provides access to it. Butcher Creek flows into the pond and Nason Creek flows adjacent to the east side of the pond. Additional land use near the site includes a vacation home, an electrical transmission corridor, and a highway rest stop about a mile west of the site.

Chikamin: The Chikamin site, on the same property as the Minnow site (described below), is in a rural undeveloped area more than 15 miles from Highway 2 (Figure 10l). Chiwawa River Road provides access to the site. There is no existing pond. Timber has been harvested on the property and on the surrounding parcels.

Clear: The Clear site includes several existing ponds on property with a private campground, small cabins, and mowed lawns. The site is about 10 miles from Highway 2 (Figure 10i). Public roads provide access.

Coulter: The Coulter site is less than a mile from Highway 2 and includes an existing pond currently used by this project for coho acclimation (Figure 10e). Coulter Creek flows into and out of the pond. A vacation home that is part of a community of vacation homes is located near the site. An unpaved road associated with the vacation homes provides access.

Dirty Face: The Dirty Face site includes creeks that flow through an open field before entering the White River. The mouth of the creek is in the Chelan Wildlife Area - White River Unit and is owned and managed by the Washington Department of Fish and Wildlife (Figure 10k). A vacation home is on adjacent property. The property is about 10 miles north of Highway 2. White River Road provides access.

Leavenworth National Fish Hatchery: The Leavenworth National Fish Hatchery (NFH), operated by the U.S. Fish and Wildlife Service (USFWS), is on Icicle Creek Road, about 2 miles south of the city of Leavenworth (Figure 10d). The coho program currently acclimates and releases coho in Icicle Creek on hatchery property.

Minnow: The site, with no existing pond, is on the same undeveloped property as the Chikamin site, from which timber was harvested in the past (Figure 10l).

Rohlfing: The Rohlfing site is less than a mile from Highway 2 and includes an existing pond fed by a seasonal creek where the project currently acclimates coho (Figure 10g). A vacation home is at the site; an unpaved road associated with a community of vacation homes provides access. An electrical transmission corridor and railroad tracks are nearby.

Tall Timber: The site is on the Tall Timber Ranch more than 15 miles from Highway 2 (Figure 10j). A church camp is operated at the ranch. White River Road provides access.

Two Rivers: The Two Rivers property, about a mile from Lake Wenatchee, contains an operating gravel mine (Figure 10ak). The site includes an existing acclimation pond with a connection to the Little Wenatchee River that the coho project has used in the past. Little Wenatchee Road provides access. There is no public power at the site.

White River Springs: Beaver dams created ponds from springs that flow into the White River (Figure 10k). The site is on property with residential structures about 11 miles north of Highway 2.

3.3.1.3 Backup Wenatchee Basin Acclimation Sites

Allen: The Allen pond is in the Valley Hi residential community, in open space used for recreation by the community (Figure 10a).

Coulter/Roaring: The Coulter/Roaring site includes a pond system created by beaver dams on Yakama Nation property (Figure 10e). While the wetland is owned by the Yakama Nation, access to potential acclimation sites is through private property on an unpaved road. The site is less than a mile from Highway 2. Land use on YN property is habitat preservation; on adjacent properties it is recreation and rural residential.

McComas: The site includes existing ponds located near the White River about 5 miles north of Highway 2 (Figure 10ak). Land use is habitat preservation and rural residential. Little Wenatchee Road provides access.

Scheibler: The Scheibler site includes an existing pond associated with Chumstick Creek (Figure 10ab). Chumstick Highway provides access to the site.

Squadroni: The Squadroni site is on residential property near Highway 2, which is visible from the site (Figure 10f). If the site is used, a pond would be constructed that would connect to an existing ditch that connects to Nason Creek. An electrical transmission corridor and railroad tracks are located on the south side of Nason Creek.

3.3.1.4 Primary Methow Basin Acclimation and Adult Plant Sites

Goat Wall: A residence is adjacent to an existing pond; access is via Lost River Road (Figure 10y). The property includes a Methow Conservancy conservation easement.

Gold: The site contains a series of small, man-made ponds adjacent to the South Fork of Gold Creek (Figure 10n). It is in a rural residential area, with several homes adjacent to the acclimation site. Walking trails and benches are located along the ponds and the creek.

Hancock: The Hancock site is a parcel of rural residential property associated with Hancock Spring, which flows into the Methow River (Figure 10t). A farm house is on the property, the majority of which is comprised of grass hay or pasture.

Heath: The Heath site includes existing ponds associated with springs that flow into the Methow River. The site is a ranch located near Highway 20 (Figure 10w). The highway provides access to the site and is visible from it. Structures associated with the ranch occupy part of the site, but the majority of the property is comprised of grass or hay/pasture. The adjacent upstream property is the Big Valley Unit of the Methow State Wildlife Area, owned and managed by WDFW for riparian habitat protection and wildlife conservation. The site is expected to include a Methow Conservancy conservation easement.

Lincoln: The Lincoln site includes existing ponds adjacent to the Twisp River (Figure 10ai). The property includes a conservation easement purchased by the Methow Conservancy. A farm and residence is adjacent to the ponds.

Lower Twisp: The Lower Twisp site is owned by the Methow Salmon Recovery Foundation and includes several ponds used for steelhead acclimation and one pond used for coho acclimation for this project. The site is less than a mile from the center of the town of Twisp and is adjacent to the Twisp River (Figure 10q). Twisp River Road provides access. A building associated with the Methow Salmon Recovery Foundation occupies part of the site.

Mason: The Mason site includes three man-made ponds near the mouth of Eightmile Creek; the ponds were used for coho acclimation in 1998. The site is about 10 miles north of the town of Winthrop; West Chewuch River Road provides access (Figure 10z). A vacation home is located at the site and it has a Methow Conservancy conservation easement.

MSWA Eightmile: The site is in the Methow State Wildlife Area (MSWA), which is owned and managed by WDFW for wildlife conservation and public recreation (Figure 10z). The well proposed for the site would be on private land in a field near the existing side channel; the side channel is on property owned by WDFW.

Newby: Newby is a small high-gradient tributary of the Twisp River just upstream of the Twisp trap. The site is recreation property. Access is via the Twisp River Road and the Newby Creek Road (Figure 10p).

Parmley: The Parmley site includes an existing farm pond adjacent to Beaver Creek, about 6 miles from the community of Twisp (Figure 10m). Beaver Creek Road provides access to the site, which also contains a rural home with several farm structures.

Pete Creek Pond: The Pete Creek site includes a pond on a disconnected side channel of the Chewuch River about 4 miles north of the town of Winthrop (Figure 10v). An unpaved road off of the West Chewuch River Road provides access to the site. A rural home with several building structures and a nine-hole golf course is located adjacent to the pond. The MSRF Chewuch site (a backup site) is about 2,000 feet to the south.

Twisp Weir: The site is on the south side of Twisp River Road approximately 5.5 miles from Highway 20 (at Twisp) (Figure 10p). It includes an existing man-made acclimation pond for spring Chinook salmon, a salmon weir, and a smolt trap owned by Douglas County PUD and operated by WDFW. The existing acclimation pond and weir are accessible from Twisp River Road via existing gravel roads. A residence is located on the portion of the Twisp Weir site north of Twisp River Road. The western portion of the site, south of Twisp River Road, is a fenced mowed grassy field, with a shed covering a camping trailer close to the Twisp River.

Winthrop National Fish Hatchery: Winthrop NFH, about half a mile from the center of the town of Winthrop, is operated by USFWS; it has ponds associated with a back channel of the Methow River (Figure 10s). The coho project currently uses the hatchery facilities for broodstock collection, incubation, rearing, and acclimation.

3.3.1.5 Backup Methow Basin Acclimation Sites

Balky Hill: The site includes an existing pond near Beaver Creek about 3 miles north of Highway 20 (Figure 10r). Land use is agriculture. Structures associated with the farm are adjacent to the pond. The site is accessed via Beaver Creek Road.

Biddle: The site contains two existing ponds; a rural vacation home overlooks the ponds. Access is via Wolf Creek Road (Figure 10x).

Chewuch Acclimation Facility: The Chewuch AF site, on the east side of the Chewuch River, is on a parcel occupied by a recreational vehicle campground (Figure 10u). An existing acclimation pond operated by WDFW is adjacent to the site. Access is via the Eastside Chewuch Road bridge.

Methow Salmon Recovery Foundation - Chewuch: The mission of MSRF, which owns the site, is to enhance and preserve salmon habitat. A large estate is adjacent to the site (Figure 10v).

Poorman: The site includes four large ponds near the Twisp River located about 3 miles from the community of Twisp (Figure 10o). Twisp River Road provides access to the site. A rural home with several farm structures is on the site.

Utley: The site contains a large pond fed by spring water adjacent to the Twisp River. A rural home is adjacent to the ponds. Access is via a 1,200-foot gravel road from Twisp River Road (Figure 10ah).

3.4 Coho Status, Life Cycle and Distribution in Wenatchee and Methow Basins

Timing of project activities and their impacts depends on the coho life cycle, abundance, and expected distribution. This section summarizes current conditions for coho in the two basins.

3.4.1 Coho Population Status

Historically 120,000-166,500 coho were attributed to the mid- and upper Columbia tributaries (Yakima, Wenatchee, Entiat, Methow, and Spokane rivers) (Mullan 1984). Mullan (1984) estimated that the Wenatchee River supported adult returns of approximately 6,000 – 7,000 coho and the Methow River supported 23,000 – 31,000.

By the 1930s, coho populations in the mid-Columbia region were considered extirpated. As discussed in Chapter 1, Section 1.4.1, although no one knows for sure why natural populations of spring Chinook and steelhead persisted when coho did not, possible reasons include:

- Very high harvest rates on coho in the lower Columbia River;
- Unscreened irrigation diversions on small tributaries in mid-Columbia basins;
- The fixed three-year coho life cycle versus the variable life cycles of spring Chinook and steelhead which provide more adaptability to changes in the environment.

Before the current coho reintroduction program began in the Wenatchee and Methow basins, two attempts were made to rebuild coho populations. Between the early 1940s and the mid-1970s, the USFWS raised and released coho as part of the mitigation for the construction of Grand Coulee Dam (Mullan 1984). Chelan PUD also had a coho hatchery program until the early 1990s. While some natural production might have occurred from these releases, fish were not released in natural habitats in the watersheds. The programs overall were not designed or intended to re-establish naturally spawning populations—they were for harvest augmentation—so coho populations in mid-Columbia basins continued to be considered extirpated.

The Yakama Nation, funded by BPA, began a feasibility study in 1996 to evaluate coho reintroduction in mid-Columbia tributaries. Since the reintroduction of coho to the Wenatchee River in 1999, the number of adult returns has ranged between an estimated 350 to 5,031 (C. Kamphaus, YN Fisheries Biologist, personal communication, Feb. 28, 2011). A portion of these fish are taken into the hatchery for broodstock development; the remainder are allowed to spawn naturally. The first generation of naturally produced coho smolts emigrated from the Wenatchee River basin in 2002 with an estimated population size of 17,000 (Murdoch et al. 2004). In 2003, approximately 36,700 naturally produced coho smolts emigrated from the Wenatchee River (T. Miller, WDFW, unpublished data).

Since 1999, adult returns to the Methow River have ranged from 140 to 1,680 (C. Kamphaus, YN, personal communication, Feb. 28, 2011). Similar to the Wenatchee, a portion of the coho returning to the Methow River are used for broodstock development. At this point in the reintroduction process, neither population could sustain itself without hatchery supplementation.

3.4.2 Coho Life Cycle

Because the historical stocks of coho salmon were decimated near the turn of the 20th century, most life history information was obtained through affidavits from older residents of the Wenatchee and Methow basins. The historical information suggests that these fish were probably early-returning-type adults, ascending the mid-Columbia tributaries in August and

September (Mullan 1984). The coho currently occupying these basins that were developed from lower Columbia River stocks spawn from October to mid-December. Coho are reported to use a varied size range of substrate for spawning, from fine gravel to coarse rubble; the material typically is 6 inches (15 cm) in diameter or smaller (Groot and Margolis 1991).

In general, coho salmon emerge from eggs February through April. They rear in their natal tributaries. A portion of juvenile coho migrate downstream during the fall, presumably seeking over-winter habitat (Sandercock 1991). Some juvenile coho may also migrate upstream to overwinter in small tributaries (Tripp and McCart 1983). In studies done in the Wenatchee basin, the diets of both hatchery and naturally produced juveniles were dominated by insects (Murdoch et al. 2005); to a lesser extent juveniles prey on crustaceans and other juvenile fish (Groot and Margolis 1991, Murdoch et al. 2005). Typically, Columbia River coho spend a year in freshwater before out-migrating as yearling smolts in the spring (April and May). After out-migrating, coho spend approximately 18 months at sea before returning to their natal tributaries to spawn. Sexually precocious males (jacks) return to spawn after six months at sea.

3.4.3 Coho Distribution

Historically, many of the two basins' tributaries supported coho production, although little is known about their spatial distribution. Since the YN's program of coho feasibility studies began, coho have been found to spawn in the mainstem Wenatchee River (near the Wenatchee River confluence to Lake Wenatchee); in Nason, Beaver, Icicle, Peshastin, Chumstick and Mission creeks; and possibly in the Chiwawa River. In 2004, coho also returned to the Little Wenatchee River to spawn. Coho returning to the Methow basin are spawning in the mainstem Methow, Chewuch and Twisp rivers and in small tributaries such as Gold, Libby, and Beaver creeks.

3.5 Surface Water Quality

The analysis of water quality impacts is extensive due to the concerns raised during scoping by agencies and citizens. Consultants were hired to evaluate discharges from existing coho acclimation sites and current water quality in the vicinity of proposed new sites and to assess project impacts to water quality in both basins using several methods, including modeling based on the QUAL-2K model developed by Washington State Department of Ecology (WDOE). The consultants provided two detailed reports which were appended to the Draft EIS (Appendix 6 Water Quality Data and Appendix 7 Water Quality Impacts). A third analysis, evaluating the water quality effects of coho rearing at Leavenworth NFH, was done for the final EIS and is included in this document as Appendix 13. Their methods, data, analyses, and conclusions are incorporated by reference and summarized in this section. Please consult the appendices if more detail is desired.

3.5.1 Affected Environment

Washington's water quality standards are the basis for protecting and regulating the quality of the state's surface waters. The standards identify designated and potential uses of water bodies, such as aquatic life, swimming, fishing, domestic and agricultural water supplies, etc.; they set water quality criteria to protect those uses; they contain anti-degradation policies to protect high quality waters; and in many cases they specify how criteria are to be implemented, for example in permits (Washington Dept. of Ecology website: http://www.ecy.wa.gov/water.html).

Under section 303(d) of the 1972 federal Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters, known as 303(d) lists. The listed impaired waters do not meet water quality standards that regulatory entities have set for them. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs (Total Maximum Daily Loads) for them. TMDLs determine the amounts of pollutants that a given water body (river, marine water, wetland, stream, or lake) can receive and still meet water quality standards (EPA website: http://www.epa.gov/lawsregs/laws/cwa.html).

In the Wenatchee watershed, the lower section of the Wenatchee River below the city of Leavenworth, portions of Icicle Creek, Mission Creek, and Brender Creek are on the State of Washington’s 303(d) list of impaired water bodies for several parameters, including dissolved oxygen (DO), acidity/alkalinity (pH), and temperature. In other words, at times, especially during the low-flow summer and fall period, these waters have too little dissolved oxygen, have high pH levels, and are too warm for designated uses including aquatic life. WDOE has determined that the most critical impairments are in the lower Wenatchee River downstream of the City of Leavenworth, and in Icicle Creek below the Leavenworth NFH (Carroll et al. 2006, Carroll and Anderson 2009).

Water quality deterioration in the Wenatchee River and the lower portion of Icicle Creek more severely affects aquatic life compared to Mission and Brender Creeks because of the volume of water carried and the fact that these water bodies provide important travel pathways for salmonids during their migration to spawning grounds in the upper portions of the watershed. Therefore, to improve the water quality in the lower sections of the Wenatchee River and Icicle Creek, WDOE produced load allocations for total phosphorus originating from point and non-point sources that affect the water quality of the lower Wenatchee River. The WDOE TMDL study recommended load allocations to Mission and Brender creeks to reduce the phosphorus loading to the lower Wenatchee River (Carroll and Anderson 2009). Given the importance of water quality in the lower Wenatchee River and WDOE’s focus on it in this TMDL study, water quality analyses for this EIS emphasize the water quality impacts of discharges in this section of the Wenatchee River.

The Wenatchee River upstream of Leavenworth is not included in the State’s 303(d) list for DO and pH violations (Carroll and Anderson 2009). However, the WDOE TMDL document has recommended a limit for the total phosphorus (TP) loads entering the lower Wenatchee River from sources upstream of Leavenworth to help alleviate water quality degradation in the lower section of the Wenatchee River where the TMDL is in effect.

The Methow River is not listed in the State’s 303(d) list of impaired water bodies for pH or dissolved oxygen violations. However, it is currently listed for temperature.

Aquatic organisms are very sensitive to reductions in DO levels in the water. The health of aquatic species depends on maintaining an adequate supply of oxygen dissolved in the water. Oxygen levels affect growth rates, swimming ability, susceptibility to disease, and the relative ability to endure other environmental stressors and pollutants (Carroll and Anderson 2009).

The pH value is a measure of the relative acidity or alkalinity of water (hydrogen ion concentration); it both directly and indirectly affects the ability of waters to have healthy populations of fish and other aquatic species. A lower pH value (below 7) indicates that an acidic condition is present, while a higher pH (above 7) indicates a basic or alkaline condition. A pH of 7 is considered to be neutral. Since the pH scale is logarithmic, a water sample with a pH of 8 is ten times more basic than one with a pH of 7 (Carroll and Anderson 2009).

Aquatic organisms, including fish and the food they eat, are at times exposed to high pH levels in parts of the lower Wenatchee watershed. High pH stresses aquatic organisms by impairing their salt and water balancing processes and increasing the toxicity of some contaminants. Anadromous (sea-run) species of fish encounter this stress in their adult upstream migration, and as juveniles in rearing areas and during downstream migration. In addition, salmonid eggs in the substrate are exposed to the high pH as surface water flows through spawning gravels (Carroll and Anderson 2009).

Nutrients such as phosphorus and nitrogen are essential for plant growth and aquatic community health. However, as in the lower Wenatchee River, too much of one or both of these nutrients (phosphorus in the lower Wenatchee and Icicle Creek) can cause excessive aquatic plant growth (Carroll and Anderson 2009).

In streams affected by eutrophication, natural re-aeration processes cannot compensate for plant and bacterial respiration, and DO levels become too low at night. Additionally, pH becomes high at night and too low during the day. These 24-hour (day to night) swings in DO and pH can be harmful, and even fatal, to fish and aquatic insects (Carroll and Anderson 2009).

Nutrients can also create nuisance conditions in streams by choking them with excessive plant and algae growth. These conditions may interfere with water intake structures, water conveyance in irrigation canals, and fishing, boating, and swimming (Carroll and Anderson 2009).

Washington state law provides protection for surface water quality through an anti-degradation policy (WAC 173-201A-300 of Washington Administrative Code; WAC 2006). Under this law, three levels of protection are provided: Tier I protection extends to all water bodies and maintains the current and designated uses for a given water body and prevents any further pollution; Tier II does not allow degradation of surface waters that are of exceptional quality (that exceed the water quality standards) through new or proposed actions unless such degradation is necessary and in the overriding public interest; and Tier III protection applies to water bodies classified as outstanding resource waters.

Much of the upper Wenatchee subbasin and nearly the entire Methow basin exceed the water quality standards for temperature, DO, and pH. Thus, these waters are protected by the Tier II anti-degradation policy. The lower Wenatchee River and portions of Icicle Creek where the TMDL is in effect (to prevent pH and DO violations) are protected under the Tier I policy.

Most of the existing and proposed acclimation-related sites are located in waters protected by the Tier II anti-degradation policy. Washington State requires the permit applicant to perform a Tier II anti-degradation evaluation if the proposed activity has the potential to cause a measureable change in water quality. The measurable change criteria relevant to this project are defined in the Washington Administrative Code (WAC 2006) as:

- temperature increase of 0.3 degree Celsius (C) or greater;
- DO decrease of 0.2 milligrams per liter (mg/L) or greater;
- pH change of 0.1 unit or greater.

For Tier I waters, human-caused discharges must not affect the existing and designated uses.

The analysis that follows evaluates the changes to existing water quality that would be caused by the proposed hatchery and acclimation sites and provides an estimate of whether each of the measurable change criteria is met or exceeded as a result of the alternatives.

3.5.2 Types of Impact

Project activities could cause the following kinds of impacts to water quality.

Construction

- Construction can increase sediment levels where construction activity is in the stream or in riparian areas, with resulting effects on fish and other aquatic species. See analysis and impact avoidance measures in Section 3.7 Fish.
- Construction equipment operating in or near streams can leak petroleum products and other pollutants. Such leakage would be minimized by proper equipment maintenance, use of absorbents, and refueling away from the water body.

Operation

- Discharges from the proposed hatchery and acclimation sites could increase nutrient levels in streams.
- Carcasses from returning adult coho could increase the nutrient content of the waters in which they spawn. Because this is part of a natural ecological process, it is presumed to be on balance a desirable condition and was not a factor in the analysis of water quality impacts. See discussions in Section 3.7 Fish.
- Chemicals used at the proposed new hatchery could affect water quality if not properly handled or disposed. This issue is addressed in Chapter 4, Section 4.11.

Discharges from coho rearing and acclimation facilities might contain nutrients (phosphorus and nitrogen) at levels that promote growth of algae. Algal photosynthesis and respiration cycles can induce changes in pH and DO beyond the ranges found under natural conditions. Such changes may violate water quality standards and can negatively impact the designated uses of water bodies in the basins, which include swimming; domestic, industrial, and agricultural water supply; aesthetic values; wildlife habitat; harvesting of aquatic life; and spawning, rearing, and migration for ESA-listed fish.

The analysis of potential water quality impacts in this EIS focuses on increases in pH and DO attributable to nutrients added from the proposed coho rearing and acclimation sites in the Wenatchee and Methow basins. WDOE determined that phosphorus is the primary nutrient causing growth of algae in the lower river and therefore is the primary concern for water quality degradation. For that reason, phosphorus was the primary nutrient considered in the analysis.

Whether discharges from acclimation sites contribute measurably to phosphorus loads depends not only on the amount of nutrients discharged but on the amount of flow in the receiving stream, the stream's temperature, the bioavailability of the nutrient form,[20] and the amount of time the nutrients remain in the system. Cooler water is less conducive to algae growth than warm water. Higher volumes of water tend to flush the nutrients through the system more quickly and thus reduce concentrations, which reduces the potential for algae to grow. All these factors were considered in the analysis.

[20] Phosphorus is an essential nutrient for algal growth. However, not all forms of phosphorus can be taken up by algae. Any form of phosphorus that is readily available for biological uptake is said to be bioavailable (i.e., available for ready assimilation by algae).

3.5.3 Impacts of the Proposed Action

The following process was used to assess the local and combined impacts of the acclimation sites:

- For discharges from existing project sites that are in waters protected by the Tier II policy, compare the phosphorus levels to existing background conditions to assess whether acclimation-related discharges produce algal blooms that could cause a change in DO and pH beyond the mixing zone of the discharge that would violate the measureable change criteria defined in Section 3.5.1.
- For discharges from proposed sites in waters protected by the Tier II policy, compare estimated phosphorus load from those sites to existing background load to assess the likelihood of change in DO and pH that would violate the criteria defined in Section 3.5.1.
- For the lower Wenatchee River (currently protected by Tier I policy), determine whether proposed activities are likely to cause a measurable change in DO and pH, as defined in Section 3.5.1, that is sufficient to affect the existing and designated uses.

In order to assess the impacts of proposed coho acclimation activity on water quality, analysts measured nutrient loading (total phosphorus [TP]) at two operating coho acclimation sites in the Wenatchee basin, Rohlfing and Butcher. In this analysis, the terms "nutrient," "phosphorus" and "total phosphorus" are used interchangeably. While phosphorus can be categorized in various ways, for this analysis, distinctions between the forms of TP are not made unless relevant to this analysis (such as whether or not the phosphorus is bioavailable).

Measurements from the operating Nason Creek sites were used to forecast the amount of nutrients that could be contributed to downstream waters by proposed new sites in both basins. To estimate these loads, data were collected in 2009 and 2010 on stream flow and water quality both upstream and downstream of the two operating sites. Where appropriate, water quality modeling was used to facilitate the evaluation.

Using data from active coho acclimation sites as a way to assess water quality impacts of the proposed sites is reasonable because: 1) the sites would be used to acclimate the same species; 2) feeds are expected to be similar or identical to those used in the operating Nason Creek sites; 3) climatic conditions are similar, which would result in similar metabolism; and 4) the majority of the acclimation sites are small, natural ponds that are fed by small tributary streams.

Table 3-2 shows estimates of TP loads from the Rohlfing and Butcher sites. Based on these data, the TP load contributed to the receiving stream was estimated to be 0.32 milligrams (mg) per day per fish (Table 3-2). To estimate the contribution of each proposed site, this average per-day figure was multiplied by the number of fish to be acclimated at that site. This contribution was evaluated against the phosphorus loads calculated at the mouth of the major creeks that carried these loads into the Wenatchee and Methow rivers in order to assess the significance of the loads relative to the background loads in the system.

Table 3-2. TP loads from two existing acclimation sites in Nason Creek

	Rohlfing			Butcher[a]			Total		
	2009	2010	Overall	2009	2010	Overall	2009	2010	Overall
Total number of fish acclimated	101,000	85,656	186,656	136,000	144,632	280,632	237,000	230,288	467,288
Average TP load (g/d)	35.72	38.53	74.25	51.35	22.66	74.02	87.07	61.19	148.27
TP load per fish acclimated (mg/d/fish)	0.35	0.45	0.40	0.38	0.16	0.26	0.37	0.27	**0.32**

a. Coulter is also an existing site, to be used alternately with Butcher in the Proposed Action. Number of fish acclimated would be the same as Butcher; therefore TP loads would be the same.
g/d = grams per day
mg/d/fish = milligrams per day per fish

Table 3-3 summarizes the maximum number of smolts that would be released from each proposed site beginning in 2013. These release numbers are proposed only through 2015. As discussed in Section 2.2.1.2, beginning in 2016, release numbers would be reduced by 30%, and by another 50% beginning in approximately 2022. Therefore, the analysis of nutrient loads that follows is the maximum nutrient load expected from the sites for a period of three years.

The subsequent analysis might show different release numbers from Table 3-3 in a few cases, but in those cases the analysis always used higher release numbers than this table, so the maximum impact is identified.

Table 3-3. Maximum smolt release numbers beginning in approximately 2013

Wenatchee	Smolts Released	Methow	Smolts Released
Leavenworth NFH	100,000	Winthrop NFH	100,000
Beaver	100,000	Lower Twisp	30,000
Butcher	105,000	Goat Wall	50,000
Clear	150,000	Gold	50,000
Coulter	used in alternate years with Butcher	Heath	200,000
Rohlfing	105,000	Lincoln	110,000
Brender	50,000	Mason	50,000
Chikamin	100,000	MSWA Eightmile	125,000
Minnow	100,000	Newby	50,000
Tall Timber	100,000	Parmley	50,000
Two Rivers	120,000	Pete Creek	125,000
White River Springs	50,000	Twisp Weir	60,000
Annual total	**1,085,000**	**Annual total**	**1,000,000**

3.5.3.1 Wenatchee Basin Acclimation Sites (Primary)

Table 3-4 shows the estimated TP loads at the primary sites proposed in the Wenatchee basin. The estimates for each site are discussed in the following subsections. Sites are grouped according to the rivers or streams into which discharge from the sites empties.

Table 3-4. TP loads estimated for proposed acclimation sites: Wenatchee basin

Proposed Site	No. of Fish	TP Load[a] (kg/d)	Receiving Stream[b]	No. of Days[c]	No. of Sampling Events[d]	Record Start Date	Record End Date	Receiving Stream Load[e] (kg/d)	Relative Contribution (%)
Tall Timber	110,000	0.035	White River	84	14	3/15/2009	4/12/2010	19.1	0.18
White River Springs	50,000	0.016	White River	84	14	3/15/2009	4/12/2010	19.1	0.08
Two Rivers	120,000	0.038	Little Wenatchee	83	12	3/23/2009	5/9/2010	11.8	0.33
Chikamin	100,000	0.032	Chiwawa	71	7	4/4/2009	5/9/2010	7.3	0.44
Minnow	100,000	0.032	Chiwawa	71	7	4/4/2009	5/9/2010	7.3	0.44
Clear	150,000	0.048	Chiwawa	71	7	4/4/2009	5/9/2010	7.3	0.66
Beaver	100,000	0.032	Beaver	N/A	N/A	N/A	N/A	N/A	N/A
Leavenworth NFH[f]	100,000	0.032	Icicle	N/A	N/A	N/A	N/A	1.5	2.21
Brender[g]	50,000	0.016	Brender	N/A	11	3/10/1997	5/3/2004	1.2	1.39

Notes:

a. Estimated from average load of 0.32 mg per fish per day calculated from measured data at active discharges in Nason Creek.
kg/d = kilograms per day

b. Nearest stream for which estimation of TP load at the downstream end of the receiving stream was possible.

c. Number of days in the acclimation period over which interpolation of loads was possible with available flow and concentration data.

d. Number of water quality sampling events during the acclimation period (3/10/2009 through 5/10/2009 and 3/23/2010 through 5/9/2010). To maximize data coverage, this period was extended to include additional samples. Some events included collection of duplicates.

e. TP load estimated at the mouth of the receiving stream was based on nutrient data collected during the acclimation period.

f. Loads for the receiving stream (Icicle Creek) represent the total load at the mouth of Icicle Creek for 2002 as determined in WDOE TMDL.

g. Average TP load for receiving stream (Brender) was calculated over the acclimation months (March through May) based on historical flow and TP data reported by WDOE for Brender Creek near Cashmere Station (45D070).

White River (3 sites)

Two acclimation ponds and an adult plant site are proposed in the White River watershed. The White River flows into Lake Wenatchee (Figure 2-6 in Chapter 2). Flows in the White River were estimated based on the WDOE gauge near Plain. Water quality data were derived from multiple sources, including data collected by the Yakama Nation (Appendix 6, Water Quality Data), supplemented by monitoring data collected in Lake Wenatchee by Grant County Public Utility District (Grant PUD 2009) and Chelan PUD (2009 – unpublished data).

Tall Timber: This site is the most upstream of the three proposed acclimation ponds and does not flow directly into the White River, but it is located close to the confluence of the Napeequa and White rivers. The estimated TP load from this acclimation site is 19.1 g/d, which is less than one fifth of a percent of the average TP loads delivered by the White River to Lake Wenatchee during the acclimation periods in 2009 and 2010 (Table 3-4). This level is well within the natural variability of the TP loads in the White River. Moreover, loads released at this site would have to travel more than 10 miles before entering Lake Wenatchee. Nutrient loading in Lake Wenatchee is of concern because it can promote growth of algae. In-stream processes between Tall Timber and the lake, such as dilution, settling, or use by organisms, would reduce the load downstream from the discharge. Downstream phosphorus data collected from active sites in Nason Creek suggest that concentrations can be expected to return to background levels within a few miles downstream of the discharge. Given this evidence and the distance of the discharge from Lake Wenatchee, it is reasonable to conclude that loads from the Tall Timber discharge are unlikely to cause a measurable change at the mouth of White River when it enters Lake Wenatchee.

White River Springs: This is one of the smallest proposed ponds, with acclimation of 50,000 coho. Loads from this site are expected to be quite small, at less than one-tenth of a percent of the average White River loads.

Dirty Face: Data from Nason Creek are not applicable to the Dirty Face site because the project proposes to enclose adult fish at this site. Adult fish are not fed, so water quality impacts associated with the acclimation and feeding of juvenile fish are not relevant here.

Little Wenatchee River – Two Rivers

The Two Rivers site is upstream of the Little Wenatchee River's confluence with Lake Wenatchee (see Figure 2-6, Chapter 2). This is one of the larger sites, with an estimated 120,000 coho proposed for acclimation. The site was used to acclimate coho during feasibility studies as part of the coho/Lake Wenatchee sockeye predation study, but is not currently in use by the program.

WDOE's gauge at Little Wenatchee River below Rainy Creek was used to estimate flows. As with White River, water quality data came from data collected for this project, as well as from the Grant and Chelan PUD monitoring programs (Grant PUD 2009; Chelan PUD 2009 – unpublished data).

The estimated loads contributed by this proposed site are higher than for individual White River sites because of the greater number of fish proposed for acclimation. Nevertheless, the TP loads from acclimation activity are estimated to be about one-third of a percent of the average TP loads carried by Little Wenatchee River during the acclimation period (Table 3-4).

Chiwawa River (3 sites)

Three sites are proposed in the Chiwawa River watershed. The Chiwawa flows directly into the Wenatchee River near Plain, Washington. Flow data for this site were obtained from the U.S. Geological Survey (USGS) gauge at the Chiwawa River near Plain. Water quality data were collected by the Yakama Nation near the mouth of the Chiwawa River.

Minnow: This is the most upstream of the three proposed acclimation ponds and enters the Chiwawa River through Chikamin Creek. TP contributions from this site are expected to be less than one half of a percent of the load carried by the Chiwawa River during the acclimation period (Table 3-4). Also, given its distance from the mouth of the Chiwawa River (Figure 2-6), loads from this site are likely to be reduced by in-stream processes and are unlikely to impact the Wenatchee River.

Chikamin: The Chikamin site is close to the Minnow site and similarly enters the Chiwawa River through Chikamin Creek. Because the number of fish acclimated at this site is the same as at the Minnow site, the TP contributions from this site are expected to be similarly less than one half of a percent of the load carried by the Chiwawa River during the acclimation period. As with the Minnow site, TP loads would be assimilated in-stream due to the distance from the confluence with the Wenatchee River, and therefore are unlikely to impact its water quality.

Clear: Discharge from the Clear Creek site would enter the Chiwawa River through Clear Creek close to the confluence with the Wenatchee River. This is the largest site proposed in the Wenatchee basin, with 150,000 coho planned for acclimation. Therefore, this site has the highest estimated TP load of all the sites. However, in terms of relative magnitude, this load is about two-thirds of a percent of the average TP loads carried by the Chiwawa River. This site on its own therefore is not expected to significantly alter loads to the Wenatchee system.

Beaver

Water quality data for this site are limited and not sufficient to estimate background TP loads in the stream. Beaver Creek drains a watershed that is smaller but geographically similar to nearby streams where it was possible to compare TP loads from acclimation ponds to background TP loads (for example Chiwawa and Chumstick). Assuming background TP concentrations in Beaver Creek are comparable to nearby streams, where water quality impacts from acclimation discharges with similar numbers of fish were estimated to be negligible, a similar impact can be expected for TP loads from the proposed facility on Beaver Creek.

Brender Creek

Discharge from the Brender site would reach the Wenatchee River through Mission Creek, which is on the state’s 303(d) list for violating several parameters, including DO and pH under low-flow conditions. The water quality surveys for this EIS focused on the upper watersheds where the majority of the sites are proposed and did not include Mission or Brender creeks. A comparison to historical water quality and flow data available for this site from WDOE suggests that TP loads discharged from the acclimation site could contribute up to two percent of the loads carried by the creek, indicating that loads from this site could exacerbate the local water quality problems. However, most of the nutrients would be discharged during spring high flow, so dilution and flushing of the nutrients through the system would play a major role in mitigating the local impacts. Further, the estimated average contribution of 16 g/d of TP is a negligible proportion of the loads carried by the Wenatchee River. Thus impacts in the critical portions of the lower Wenatchee River are also likely to be negligible.

Icicle Creek – Leavenworth National Fish Hatchery

Facilities at the Leavenworth NFH currently are being used for acclimation as part of this project. The coho currently reared at the hatchery are part of its NPDES permit. Discharges from this facility flow through the main hatchery outfall that dominates the Icicle Creek flow during low-flow season. Leavenworth NFH provided nutrient data collected at the hatchery's main outfall, the pollution abatement pond outfall, and at the hatchery intake. Data were collected from 2009 through 2011. The hatchery also provided Chinook production data for the same period, and the YN provided production data for ongoing coho acclimation over this period.

An approach was developed to quantify the increase in TP load from the proposed coho acclimation using the hatchery effluent nutrient data and the fish production data. The details of this analysis are presented in Appendix 13. Water quality impacts on Icicle Creek were assessed using a modified version of the Icicle Creek QUAL-2K model developed by WDOE for Wenatchee River and Icicle Creek TP TMDL (Carroll and Anderson 2009). The model was adapted for April conditions. The summer low-flow conditions used for developing load allocations in the WDOE model were used for April to provide a conservative estimate of critical flow conditions. In addition, conservative estimates of air and headwater temperatures were applied for April such that water temperatures simulated in the model were much higher than those typically encountered in April. Because coho are not present at the hatchery during the July-September low-flow period, the hatchery's discharges for that period were not modeled.

The Icicle Creek TMDL allocation for Leavenworth NFH is 520 g/d (Carroll and Anderson 2009). The total hatchery effluent TP load in April 2011 was calculated to be 307 g/d, which is approximately 40 percent below the target load limit. When the TP loads at the hatchery intake are removed, the hatchery contributed a net TP load of 238 g/d. Of this, the approximately 500,000 coho currently being acclimated at the hatchery was estimated to contribute approximately 27 percent. This number is five times the number proposed for acclimation beginning in 2013. Therefore, if all other hatchery loads remain the same in 2013, the estimated contribution to the net hatchery effluent TP load from the proposed coho acclimation is approximately 7 percent (see Appendix 13).

Changes in Icicle Creek water quality were simulated by adding the estimated average TP load increase from coho acclimation from the analysis of 2011 data presented above to the allocated levels in the WDOE TMDL; this resulted in an increase of approximately 9 percent over the TMDL allocation. However, model simulations indicated that the load increase did not produce a measurable change in DO and pH for the critical conditions employed. Further, a sensitivity analysis showed that for the critical conditions simulated in April, a measurable change required a hatchery load increase of 22 percent or greater, which is more than twice the load increase expected from coho acclimation.

Given the analysis above and in Appendix 13, it is unlikely that the proposed acclimation program would increase hatchery loads enough to result in measureable changes in water quality conditions in Icicle Creek. However, proposed new hatchery load limits are calculated based on gross values; incoming river loads are not subtracted from hatchery contributions to calculate the facility's load limits. Under these conditions, coho acclimation combined with upstream loads would contribute to violations of the permit conditions.

3.5.3.2 Wenatchee Basin Acclimation Sites (Backup)

Table 3-5 shows TP loads estimated for acclimation activity at backup sites in the Wenatchee basin. One or more of these sites might be used if any of the proposed sites cannot be used. Each site is discussed separately in the following subsections.

Table 3-5. TP loads estimated at backup acclimation sites: Wenatchee basin

Proposed Site	No. of Fish	TP Load[a] (kg/d)	Receiving Stream[b]	No. of Days[c]	No. of Sampling Events[d]	Record Start Date	Record End Date	Receiving Stream Load[e] (kg/d)	Relative Contribution (%)
McComas	50,000	0.016	White R.	84	14	3/15/2009	4/12/2010	19.1	0.08
Squadroni	105,000	0.034	Nason Cr.	112	22	3/14/2009	5/9/2010	6.3	0.53
Coulter/ Roaring	105,000	0.034	Nason Cr.	112	22	3/14/2009	5/9/2010	6.3	0.53
Allen[f]	50,000	0.016	Peshastin Cr.	N/A	N/A	N/A	N/A	0.2	10.46
Scheibler	65,000	0.021	Chumstick	23	2	4/11/2009	5/3/2009	2.7	0.77

a. Estimated from average load of 0.32 mg per fish per day calculated from measured data at active discharges in Nason Cr. kg/d = kilograms per day
b. Nearest stream for which estimate of TP load at the downstream end of the receiving stream was possible.
c. Number of days in the acclimation period over which interpolation of loads was possible with available flow and concentration data.
d. Number of water quality sampling events during the acclimation period (3/10/2009 through 5/10/2009 and 3/23/2010 through 5/9/2010). To maximize data coverage, this period was extended to include nearby samples. Some events included collection of duplicates.
e. TP load estimated at the mouth of the receiving stream was based on nutrient data collected during the acclimation period.
f. There were no data available for the receiving stream. Loads from the WDOE TMDL model for the 7Q10 natural conditions simulation (summer low stream flows) are used here for comparison. 7Q10 conditions are defined as the lowest or highest stream flow for 7 consecutive days that occurs on average once every 10 years.

McComas

The McComas site is on the White River; it might be used to acclimate up to 50,000 juvenile fish. The corresponding phosphorus loads are expected to be less than one-tenth of a percent of the loads carried by White River (Table 3-5). Therefore, the impacts are not expected to adversely affect water quality.

Squadroni

The Squadroni site is located on Nason Creek. If used, 105,000 fish are expected to be acclimated at this site. Based on the active Nason Creek sites, the TP load due to acclimation activity is expected to be 34 g/d (see Table 3-2). This is about half a percent of the TP loading from Nason Creek to the Wenatchee River. Moreover, as discussed previously, analysis of loads shows that the active acclimation sites at Rohlfing and Butcher, with more than twice the number of fish (237,000 in 2009 and about 230,000 in 2010), did not adversely affect water quality in Nason Creek. Thus, the Squadroni site, if developed, is not likely to adversely affect water quality.

Coulter/Roaring

The Coulter/Roaring site is part of a wetland complex owned by the Yakama Nation. As with Squadroni, if used, up to 105,000 fish could be acclimated here; impacts are likely to be similar to those at Squadroni. However, because this site is in a wetlands complex, the TP loads from ponds probably could be assimilated within the marsh environs. Thus, impacts from acclimation activity are expected to be minimal.

Allen

The Allen site, if used, would acclimate up to 50,000 fish, which could result in phosphorus loading of up to 16 g/d to Peshastin Creek. No nutrient or flow data were available for Peshastin Creek for the month of March; however, flow records from the Wenatchee River at Monitor (several miles downstream from the mouth of Peshastin Creek) were used to estimate the difference between summer and spring flows. To obtain a general idea of the relative contribution of nutrients from this site to the total phosphorus load in the stream, the loading estimate for the site was compared to the loads specified in the WDOE TMDL summer natural conditions model (Carroll and Anderson 2009). The model specifies a TP load of 200 g/d under 7Q10 low-flow conditions in Peshastin Creek. At summer flow levels, acclimation activity at the Allen site could contribute about 10 percent of the total phosphorus load carried by the stream during the summer season. Summer flows are substantially lower than typical spring flows when acclimation would actually occur. For example, based on 1990 – 2010 flow records from the USGS gauge on the Wenatchee River at Monitor, average flow in August-September is roughly 16% of the average flow in April-May. Thus, even if background concentrations of phosphorus remain at 4.7 micrograms per liter as estimated in WDOE TMDL study (Carroll and Anderson 2009), one can expect that loads in spring would be roughly 5 times higher. Based on this calculation, it can be expected that the acclimation-related loads would be less than 2% of the background loads carried by the stream. With the flushing effect from higher flows, this small proportional increase in phosphorus loading is unlikely to produce a measurable change in the water quality.

Scheibler

The Scheibler site is 8.1 miles upstream of the confluence of Chumstick Creek with the Wenatchee River. Water quality data collected by the Yakama Nation at the mouth of Chumstick Creek and flow estimated by WDOE near the river mouth were used to calculate background nutrient loads (Appendix 6 Water Quality Data). Even though nutrient data were collected in 2010, the loading calculations used data from 2009 only, due to lack of flow measurements in 2010 (WDOE has suspended the gauge operation). The loads from acclimation pond activity are estimated to be less than one percent of the average background load carried by Chumstick Creek (Table 3-5). Therefore, the water quality impacts are expected to be negligible.

3.5.3.3 Hatchery Sites

Dryden (Primary)

The Dryden site is proposed for year-round rearing. Therefore, it was necessary to evaluate impacts during low-flow conditions when water quality is most vulnerable to increases in nutrient loading.

The QUAL-2K model was used in the WDOE TMDL process (Carroll et al. 2006; Carroll and Anderson 2009) to allocate nutrient loading of point and non-point sources to bring DO and pH into compliance with existing state regulations. A phased implementation of load reductions has been recommended in the TMDL. Based on discussion with WDOE (November 12, 2009, meeting with Ryan Anderson, Yakima Regional office, Yakima), it is assumed for this evaluation that the load reduction measures will be implemented as recommended in the TMDL.

The QUAL-2K model was set up for 7Q10 low-flow conditions, with publicly owned treatment works (POTW) discharging at design flow and a phosphorus concentration of 90 micrograms per liter. Other sources were set to the estimated maximum natural condition values as determined in the WDOE TMDL (Carroll and Anderson 2009).

Nutrient loading for the proposed hatchery was estimated based on rearing approximately 220,000 smolts, with about 110,000 smolts removed in November and 110,000 removed the following March. Table 3-6 shows the details on the nutrient loading expected from hatchery operation. The average flow for the month of September, estimated at about 0.06 cubic meter per second (m^3/s) (about 1,000 gallons per minute), was specified for the QUAL-2K model. Hatchery discharge was assumed to be immediately upstream of Dryden Dam at river kilometer (RKM) 56.5 (RM 35.1).

The Skretting Nutra Fry feed proposed for use at the hatchery contains about 1.42% phosphorus by weight. Tipping and Shearer (2007) report a phosphorus retention range of 29% to 36% for coho fed commercial diets with similar phosphorus content (range 1.1% to 1.3%). Similar research on rainbow trout estimated phosphorus retention at 50% (Flimlin et al. 2003). This analysis assumed the average of these values, 39% phosphorous retention. The effluent from the hatchery would be treated prior to discharge to the Wenatchee River. For analysis purposes, a treatment efficiency of 50% was assumed, which is the minimum requirement for any treatment system.

The phosphorus loads estimated for the month of September (see Table 3-6) were specified as a point source in the QUAL-2K model. Other water quality parameters were set to the same values as those used for Leavenworth NFH in the Icicle Creek water quality model used in the WDOE TMDL analysis (Carroll et al. 2006). This is appropriate because the level of treatment at Dryden Hatchery is expected to be similar to or better than what is being implemented at Leavenworth NFH. All other settings remained unchanged from the 7Q10 simulations in the WDOE TMDL analysis (Carroll and Anderson 2009).

Model simulations for flow, TP, DO, pH, and temperature for the length of the Wenatchee River are shown in graphs in Appendix 7, Section 4.2.9. The modeling shows that effluent from the hatchery is unlikely to significantly change flows and water quality in the lower Wenatchee River due to the relatively small flows out of the proposed Dryden Hatchery. Indeed, DO remains in compliance downstream of the hatchery discharge, and the change in minimum DO meets the "no measurable change" criterion in state standards. Hatchery effluent would not affect temperature.

The model predicts that pH could exceed the upper limit of 8.5 units downstream of the Cashmere public treatment works (POTW) discharge. After about RKM 60 (RM 37.3), there is little difference in the model predictions with and without the proposed hatchery discharge. This suggests that the pH excursion[21] does not result from the hatchery loads, but is rather a consequence of the Cashmere treatment works loads. This interpretation is reinforced by the WDOE TMDL, which acknowledges that Cashmere POTW discharge should release phosphorus at less than 90 micrograms per liter to prevent pH excursion downstream of the city of Cashmere.

In the vicinity of the hatchery as well as downstream of the Cashmere POTW, the difference in the pH range marginally exceeds the measurable change criterion (by much less than 0.1 unit which is well below the limits of instrument accuracy—see Chapter 5 in Appendix 6) and is well within the typical ranges encountered within a day (Figure 3-1).

Based on the analysis provided here, it is expected that the discharges from the Dryden Hatchery would have minimal impacts on the water quality of the lower Wenatchee River even under critical low-flow conditions.

[21] Excursion is the word used to indicate that a water quality limit has been exceeded.

Table 3-6. Estimation of effluent phosphorus loads for proposed hatchery at Dryden

Month	Number of Fish[a]	Flow (m^3/s)	Total Weight of Fish (kg)	Feed Rate (g feed/ g fish/d)	Phosphorus Feed Rate[b] (g/d)	Phosphorus Concentration (mg/L)			Effluent Phosphorus Load (g/d)
						Feed	Untreated Effluent[c]	After Treatment[d]	
Mar	236703	0.010	106.5	2.9%	43.86	0.051	0.016	0.008	6.69
Apr	235135	0.015	190.5	2.8%	75.73	0.060	0.018	0.009	11.55
May	233578	0.020	315.3	2.7%	120.90	0.069	0.021	0.010	18.44
Jun	232031	0.028	511.6	2.6%	188.89	0.078	0.024	0.012	28.81
Jul	230495	0.033	663.8	2.6%	245.08	0.085	0.026	0.013	37.38
Aug	228968	0.041	906.7	2.5%	321.88	0.091	0.028	0.014	49.09
Sep	227452	0.060	1627.4	2.4%	554.62	0.106	0.032	0.016	84.58
Oct	225946	0.079	2420.8	2.2%	756.27	0.111	0.034	0.017	115.33
Nov	224449	0.089	2929.1	2.0%	831.85	0.108	0.033	0.016	126.86
Dec	112963	0.048	1626.7	1.9%	438.87	0.106	0.032	0.016	66.93
Jan	112215	0.049	1666.4	1.9%	449.59	0.107	0.033	0.016	68.56
Feb	111472	0.049	1705.5	1.9%	460.15	0.108	0.033	0.017	70.17
Mar	110733	0.052	1843.7	1.9%	497.43	0.111	0.034	0.017	75.86

Notes:

a. Numbers back-calculated to produce 220,000 smolts, and assuming mortality of 0.7 percent per month, with 110,000 fish removed in November and the remaining 110,000 removed in March.

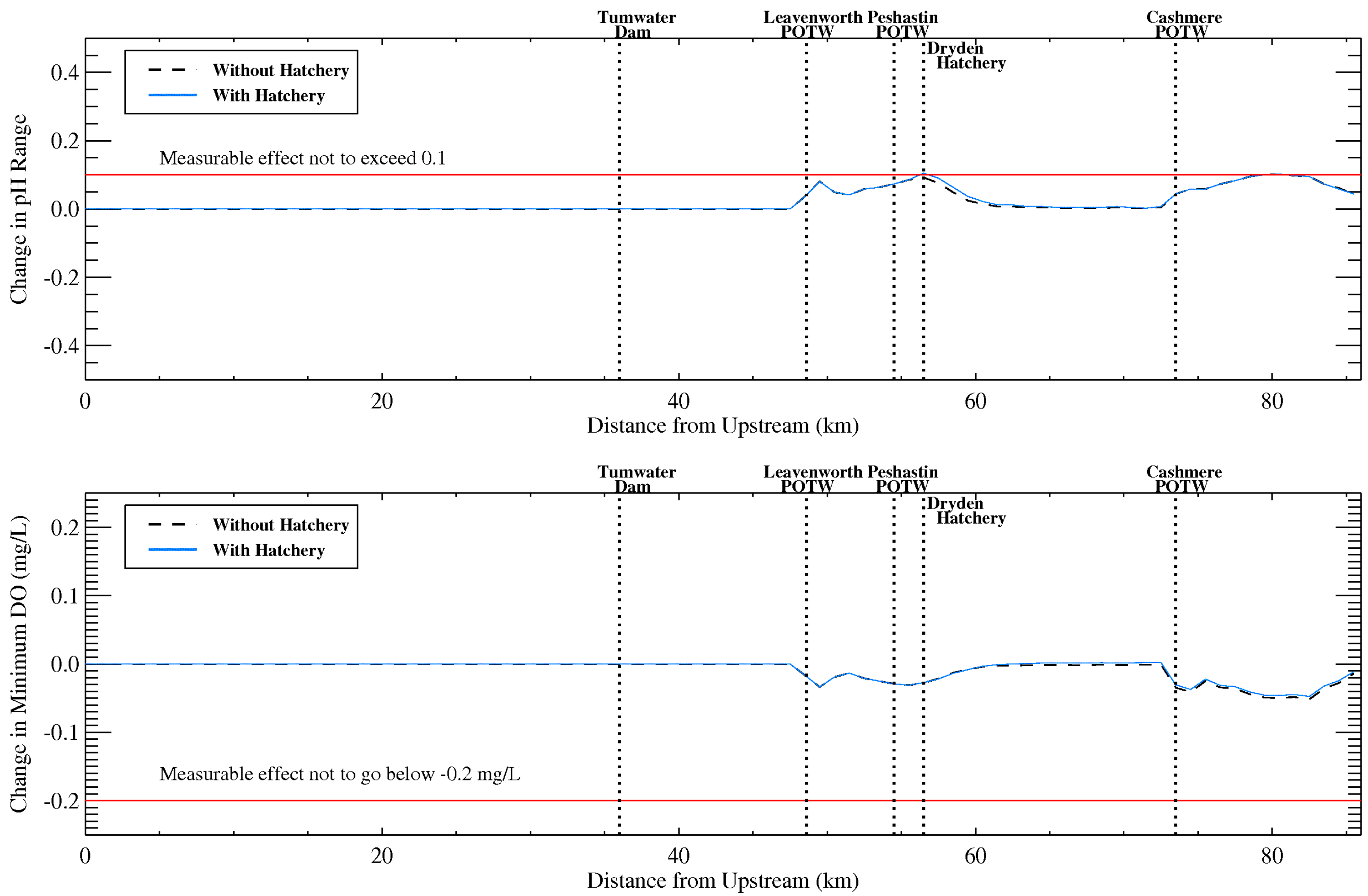
b. Skretting Nutra Fry diet contains 1.42 percent phosphorus by weight.

c. Assumes assimilation of 39 percent based on a highly digestible diet.

d. Assumes treatment efficiency of 50 percent.

mg/L = milligrams per liter
m^3/s = cubic meters per second
kg = kilograms
g feed/g fish/d = grams of feed per gram of fish per day
g/d = grams per day

Figure 3-1. Difference from natural conditions in range of pH (top graph) and minimum DO (bottom graph) at permissible POTW loading with and without proposed hatchery at Dryden



Hatchery operating procedures are an important part of nutrient discharge control. Clear Springs Foods, the operator of large Idaho trout farms, has developed a best management practices (BMP) plan that relies in part on optimization of feeding practices and use of feeds that minimize phosphorus concentrations in discharges (MacMillan et al. 2003). These practices have resulted in a 40% reduction in phosphorus loads from their hatcheries. Hatchery procedures based on these BMPs that are proposed as part of the Dryden Hatchery discharge treatment plan are summarized in Section 3.5.5.

The effectiveness of these measures in reducing phosphorus loads was evaluated after the analysis of water quality impacts was done for the Draft EIS. The DEIS analysis reported above estimated that the proposed Dryden Hatchery would contribute 84.6 g/d of phosphorus to the Wenatchee River in September; this number assumed that the proposed treatment system would remove 50% of the phosphorus in the discharge water. After the analysis of treatment system effectiveness summarized below, the estimated discharge would be 7.6 grams per day, for a total yearly addition of phosphorus from the hatchery to the river of less than 2.8 kg.

The amount of phosphorus removed from the raceways and ponds by vacuuming is assumed to be equal to the amount of phosphorus in the fecal portion of fish waste. Flimlin et al. (2003) calculated this to be 21%. Stewart et al. (2006) measured the reduction in phosphorus levels in a trout hatchery as settled wastes were being brushed from raceways and as they passed through an on-line settling basin. This system removed 61% of the phosphorus. The Dryden off-line basins would be at least this effective because the settling time would be much longer than that described in Stewart et al. 2006.

The Stewart et al. (2006) work also measured the reduction in phosphorus as hatchery flow passed through settling basins during periods when the raceways were not being cleaned. Phosphorus was reduced by 23% at these times. True et al. (2004) states:

> *Our investigation has revealed that the majority of discharged P[phosphorus] is currently in the untreatable, dissolved portion; however, the remaining 37% of TP at Farm 2 and 40% at Farm 4 were in the solid phase. This solid phase P percentage represents the theoretical maximum P discharge reduction if all effluent solids were captured. These values are consistent with other reports.*

The Dryden on-line settling basin effectiveness may be higher due to the proposed use of added bottom sediments with phosphorus assimilative capacity and because river solids that deposit on the basin bottom may also have some assimilative capacity. The proposed on-line settling basins will also remove some dissolved phosphorus. The estimated effectiveness of the basins is 30%.

The final treatment component is the wetland. Studies that evaluated the effectiveness of wetlands in removing phosphorus from hatchery flow after treatment in settling basins were reviewed. Michael (2003) ran vacuumed wastes from the Dungeness Hatchery discharge through an off-line settling pond and a constructed wetland. This system removed 90% of the phosphorus. Discharge from a catfish farm was passed through a wetland (Schwartz and Boyd 1995), which removed 67% of the phosphorus; however, this was a new wetland that may not have reached saturation levels. A subsurface flow wetland that had been in operation for over 2 years (Sindilariu et al. 2008) removed 37% of the phosphorus from trout pond effluent. This system included no settling basin.

Based on these studies, it is estimated that the wetland will remove 10% of the phosphorus that remains in the hatchery flow after passing through the on-line settling basins. This estimate is predicted because of the accumulation of un-decomposed vegetation (and some net transport of vegetation out of the wetland) and regular deposition from the river of solids with absorption capacity. Assuming a 10% removal rate for the wetland produces an estimate of the overall treatment efficiency for the proposed system of approximately 40%. This is a conservative value, at the low end of the range of phosphorus removal efficiencies described in the literature.

As stated in the Wenatchee River Watershed Dissolved Oxygen and pH Total Maximum Daily Load Water Quality Improvement Report (Carroll and Anderson 2009), most water quality violations for DO and pH occur in August and September. Because of the timing of low flows, September was chosen as the month when impacts due to additional phosphorus loads in the river are at a maximum.

For the Draft EIS water quality analysis, Anchor QEA (Appendix 7) used a value of 84.6 g/d for a phosphorus load in September to estimate hatchery impacts using the Department of Ecology QUAL-2K model. Figure 3-1 above shows that at these loads, mass balance modeling does not indicate a measurable change in the range of DO and pH downstream of the hatchery. The subsequent analysis of the discharge treatment system reported above includes a new estimate of loads from the hatchery with updated hatchery growth profiles, and that also includes phosphorus loads from the river. The estimate is that the hatchery load will average 7.6 g/d. This is less than 1/10th of the value used in the Anchor QEA analysis. Therefore, the hatchery impacts are expected to be significantly less than those shown in Figure 3-1.

George (Backup)

The George site is being considered as an alternative to the Dryden site if a small hatchery at Dryden is determined to be infeasible. Discharge from the George facility would enter the Wenatchee River 1.8 miles downstream of the Lake Wenatchee outlet. Discharges from this hatchery, if operated, would either be piped back to the river at a discharge near the intake, or flow through an existing flood overflow side channel for about a mile before entering the Wenatchee River. Water used for egg incubation and adult holding would be discharged to the river near the intake without passing through the wetland side channel. Water used for rearing would pass through the side channel.

The hatchery is expected to be operated under the same conditions as Dryden, so the same QUAL-2K modeling approach was used to evaluate the discharge impacts. The impact of hatchery operation was evaluated for 7Q10 summer low flow conditions. The only difference between this model setup and the one employed for Dryden is the location of the discharge.

Most of the time the rearing water discharge from the facility would enter a channel that is vegetated significantly and flows only during flood events. Therefore, it is unlikely that the entire hatchery discharge would enter the Wenatchee River during critical summer conditions, due to infiltration losses to the underlying aquifer. Also, nutrients would be assimilated in the 20 acres of side-channel habitat between the hatchery discharge and the river. However, for the purposes of this evaluation it is assumed that the entire discharge would reach the Wenatchee River without any assimilation of phosphorus and without any loss in flow. This is likely a substantial overestimate of the loading to the Wenatchee River but provides a worst-case scenario.

Analysis shows that changes to flow are minimal given the small quantity of flow expected from the discharge, and the predicted temperature range showed negligible change over the simulation of natural conditions. Phosphorus concentration was predicted to increase downstream of the discharge, but the differences over natural conditions are imperceptible past Tumwater Dam, approximately 35 kilometers (km) (22 miles) downstream. In the same section of the river, both dissolved oxygen and pH show significantly wider ranges compared to the natural condition predictions. Graphs in Section 4.2.10 in Appendix 7 demonstrate these differences.

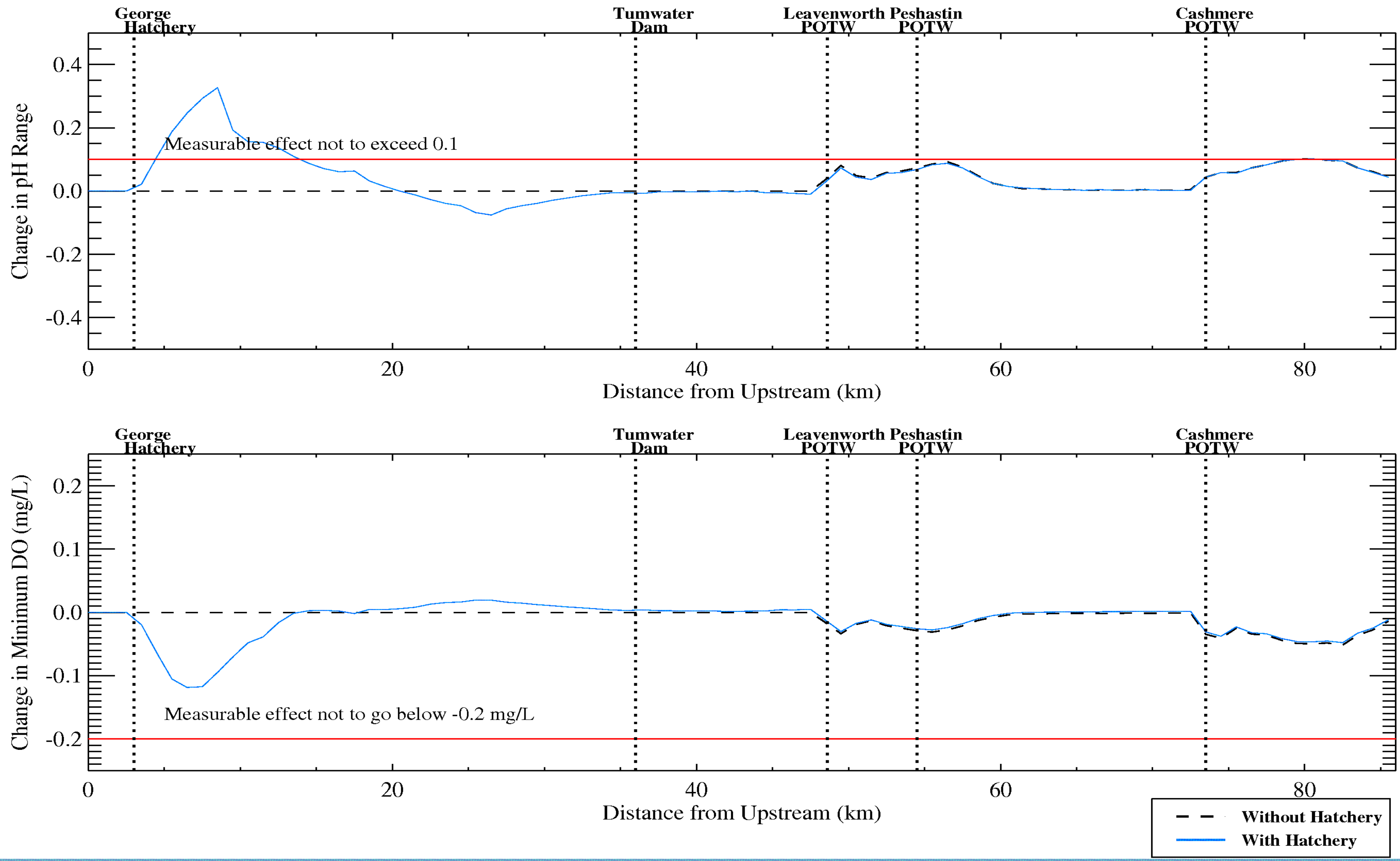
Figure 3-2 shows the difference from maximum natural conditions when hatchery discharges are included. In the section of the river upstream of Tumwater Dam, the hatchery discharge noticeably changes the existing condition, particularly between RKM 5 through 15 (RM 3.1 through 9.3). In that reach, the change to the pH level is predicted to exceed the threshold for measurable (a change of 0.1 unit or greater). The change in DO would not exceed the criterion for measurable change (a decrease in DO of 0.2 milligrams per liter (mg/L).

These local effects are larger than those at Dryden, differences that can be explained from the context of the hatchery loading relative to the background phosphorus load. The hatchery loading would contribute about 9% of the phosphorus load as calculated for the section of river upstream of the George site. In comparison, the relative contribution for the Dryden Hatchery was calculated to be about 3% of the predicted background load immediately upstream of the hatchery's discharge. Thus, because a hatchery at the George site would contribute a greater percentage to the total phosphorus concentration downstream of its discharge than Dryden would, the George hatchery could produce a measurable change locally in DO and pH.

These measurable local effects are not likely to actually occur at George. The model assumed that all rearing water would re-enter the Wenatchee at the exit of the side channel. However, infiltration of water in the side channel to the shallow water aquifer is estimated to be 100% (GeoEngineers 2012). This ground water would re-enter the Wenatchee River over a broad area at undetermined locations downstream of the hatchery. The impact of infiltration will be to limit the local effects of the discharge.

Because a very conservative estimate was used for specifying the load (i.e., the entire hatchery discharge and all phosphorous would reach the Wenatchee River); and because in the downstream reaches, particularly in the TMDL domain (i.e., downstream of the city of Leavenworth), the water quality changes resulting from the hatchery loads are imperceptible from the background condition; it is concluded that, while localized impacts are possible due to the hatchery, impacts farther downstream are unlikely.

Figure 3-2. Difference from natural conditions in range of pH (top graph) and minimum DO (bottom graph) at permissible POTW loading with and without George Hatchery discharge



3.5.3.4 Combined Impacts of Wenatchee Basin Hatchery and Acclimation Sites

The combined impact of the proposed coho restoration activities on water quality in the Wenatchee basin is expected to be negligible for the reasons listed below. The analysis supporting these conclusions follows the list.

- The nutrient load is small. The maximum total addition of phosphorous due to the project, at peak production levels, is estimated to be 0.38 kilogram per day during the acclimation period, which is about 1% of average Wenatchee River load when acclimation activity is ongoing.
- Despite the conservative modeling assumptions used, impacts to DO and pH due to upstream acclimation are estimated to be negligible in the TMDL domain (the lower Wenatchee River downstream of the city of Leavenworth).
- Lower water temperatures during the acclimation period limit in-stream biological activity.
- An analysis of travel times suggests that the residence times of any nutrients discharged to the system would be small during spring high flows that are prevalent when feed rates are highest. Therefore, most of the loads would be removed during spring high flows and impacts are not expected later in the year, including the summer low-flow period.
- In-stream data collected from the Wenatchee basin showed that most of the phosphorous being discharged is not in a readily bio-available form. Even the travel times calculated under low-flow conditions were not expected to provide a sufficiently long residence of the total phosphorus loading in the system, thereby keeping it largely unavailable for biological uptake during transport through the basin.

The QUAL-2K model developed by WDOE for the purpose of establishing load allocations (Carroll et al. 2006; Carroll and Anderson 2009) was applied to assess both the combined and cumulative impacts for the Wenatchee River (referred to as the lower Wenatchee subbasin). The portion of the Wenatchee basin composed of Lake Wenatchee and its tributaries, the White River and the Little Wenatchee River (referred to as the upper Wenatchee subbasin), was evaluated based on mass balance analyses using existing water quality and flow data.

Upper Wenatchee Subbasin to Lake Wenatchee

Lake Wenatchee is a deep water lake (maximum depth of nearly 100 feet) that is fed by the Little Wenatchee River and the White River and discharges to the Wenatchee River. Three of the proposed acclimation sites discharge to this receiving water system: the Two Rivers site in the Little Wenatchee River and the Tall Timber and White River Springs sites in the White River. While the Dirty Face site is in the White River system, it is an adult plant site. Adults are not fed, so nutrients would not be added to the river from feed at that site.

Given the relatively large size of the lake and its associated long hydraulic retention period, it is unlikely that loads entering the lake would reach the Wenatchee River directly; instead, they are likely to be cycled within the lake. Data comparing pH levels flowing into and out of the lake show that pH levels are substantially lower when leaving the lake. The lake likely buffers the upstream phosphorus loads and transmits only a fraction of the upstream loads to the Wenatchee River. Therefore, the water quality impact of concern within the upper Wenatchee subbasin is Lake Wenatchee proper.

To estimate the combined impact of the three proposed locations, the total phosphorus loads anticipated from acclimation activity were calculated based on the proposed number of coho to be acclimated. Table 3-7 shows the relative contribution of the loads from combined acclimation activity in the White River and the Little Wenatchee River. In 2009, these loads were estimated to contribute less than 0.25% of the total background loads that entered the lake over the acclimation period (March through May) from these two tributaries. This calculation does not account for in-stream assimilation, which, if considered, would further reduce the relative contribution from acclimation activity.

Table 3-7. Estimated contribution of TP loads from 50 days of acclimation activity in the three upper Wenatchee acclimation sites

Location	No. of Fish	TP Loading from Acclimation[a] (kg)	TP Load In System[b] (kg)	Contribution to Total
Little Wenatchee River	120,000	1.92	604.50	0.32%
White River	160,000	2.56	1242.86	0.21%

kg = kilograms
a. Assumes 0.32 mg/d/fish (derived from active sites in Nason Creek; see Table 3-2)
b. Loads calculated using 2009 flows and TP measurements from 3/23/2009 to 5/10/2009

Lower Wenatchee Subbasin – Wenatchee River

The WDOE TMDL model was used with minimal changes to determine the Wenatchee River and Icicle Creek phosphorus load allocations (Carroll and Anderson 2009) and to assess the potential impacts of the proposed acclimation sites on water quality in the lower Wenatchee subbasin. Changes to the model focused on representing conditions for the month of March, as represented by the assumptions listed below. Modifications were also made to air and water temperature functions to reflect March conditions. Using these assumptions to set up the evaluation model ensured that the maximum potential impact was identified in the results.

1. March was chosen as the critical period for evaluation. All the proposed acclimation sites would be operational at this time. Flows later in the spring increase significantly, diluting nutrient loads and scouring attached algae from the system. Even if half the sites were operated through the winter (only 4 in each basin are proposed), due to the smaller number of fish being acclimated, low water temperatures, and low feed rates, water quality impacts in winter are expected to be lower than during March.
2. Flows in March were specified as the 7Q10 summer low flow calculated by WDOE for the TMDL evaluation (typically, March flows are somewhat higher).
3. Phosphorus discharged due to acclimation activity was considered to be 100% bioavailable (i.e., phosphorus discharges are all in the orthophosphate form such that they can be readily taken up by algae during photosynthesis).
4. Phosphorus released from the acclimation ponds is not assimilated in the receiving stream before it reaches the Wenatchee River. This assumption ensures that, in the model, the entire phosphorus load discharged from the ponds reaches the Wenatchee River; normally, however, some phosphorus would be assimilated before reaching the Wenatchee River.
5. Average phosphorus loads from the proposed acclimation ponds that were developed based on the data collected from the active ponds in Nason Creek from late March through early May are applicable in March, even though feed levels in March are lower than later in the acclimation period because fish are smaller in March.

To assess the combined impacts, TP loads were estimated for the active sites (Table 3-2) and proposed sites (Table 3-4). This analysis includes the Scheibler site on Chumstick Creek, which is now a backup site. However, the program hopes to have a site on Chumstick Creek at some point, so the analysis continues to include the effects of an acclimation site on Chumstick Creek to ensure that the maximum potential effects are identified. Dryden facility inputs for the month of March (Table 3-6) were also used. The estimated TP loads from the discharges were included with the background orthophosphate load in the model. The final orthophosphate concentrations were calculated using the flows used in the model and the combined load estimate.

Even though a separate analysis was done for upper Wenatchee subbasin sites in White River and Little Wenatchee River (see previous subsection), and given that Lake Wenatchee would buffer TP loads originating from the upper subbasin sites, discharges from these sites were represented in the model as being 100% available at the outlet of Lake Wenatchee. These assumptions provide an estimate of the maximum potential impacts in the Wenatchee River.

Figure 3-3 presents predictions for combined TP impacts and compares them to background conditions. TP is higher in the upper reaches (upstream of Leavenworth) and declines steadily after an initial increase. The increase in the first 10 kilometers (6 miles) of the river reflects inputs from the Nason Creek, the upper Wenatchee subbasin, and the Chiwawa River sites. Much of the phosphorus appears to be assimilated around RKM 27 (RM 16.8), which is upstream of Tumwater Canyon.

Differences in the range of DO simulated with and without the project-related loads are negligible; the maximum difference is less than 0.1 milligram per liter (mg/L). The threshold for adverse effect is a decrease of 0.2 milligrams per liter (mg/L) or greater. These results indicate that in the absence of other nutrient sources, the project alone is not expected to adversely impact DO resources within the Wenatchee River.

The range of pH with the project is generally equal to the range simulated for the natural conditions (Figure 3-4). At approximately RKM 27 (RM 16.8), the upper bound of the pH appears to be somewhat higher than the pH simulated for background conditions. This is a consequence of the higher algal levels simulated in this reach over background conditions.

Finally, there is no appreciable difference in the range of the temperature simulated with and without the project loads.

The measurable change criteria defined in Section 3.5.1 were used to determine potential water quality impacts of the proposed project. The range of pH evaluated against the measurable change criterion of 0.1 unit is presented in Figure 3-5. The model simulations are generally well below the criterion. The minor increase in the difference in range near RKM 27 (0.05 unit) can be attributed to induced biological activity associated with project loads. Nonetheless, these increases are well below the criterion. Figure 3-5 also shows that the DO concentrations simulated by the model do not produce any deficit that exceeds 0.2 mg/L. The only deviation from the background conditions appears to be at RKM 27 and is associated with algal activity.

The differences in TP, DO, and pH simulated by the model with and without the loads from the proposed project show that the majority of the project's phosphorus load enters in the upstream reaches, and much of it is assimilated in the Wenatchee River before entering the reaches below the city of Leavenworth. These results indicate that even under the worst-case flow and project loads, the proposed project would not adversely impact water quality. The model simulations demonstrate that the maximum predicted impact from the proposed project, including discharges from the proposed hatchery at Dryden, is far below the measurable change criteria.

Figure 3-3. Maximum (top line) and minimum (bottom line) total phosphorus concentrations simulated by QUAL-2K model compared for cases with and without the proposed project for 7Q10 low-flow and March climatic condition with maximum background loadings determined in WDOE TMDL

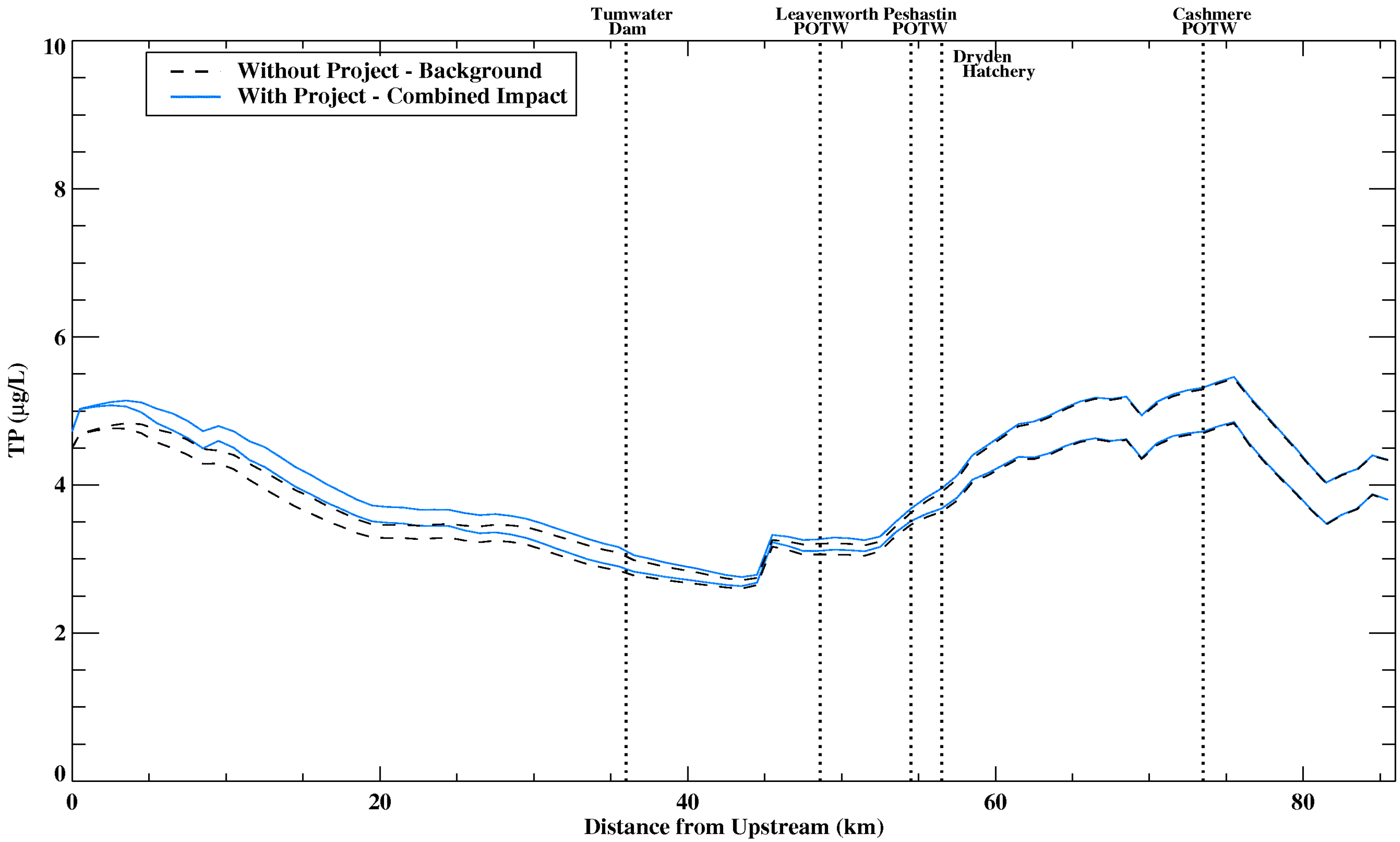


Figure 3-4. Maximum (top line) and minimum (bottom line) pHs simulated by QUAL-2K model compared for cases with and without the proposed project for 7Q10 low-flow and March climatic condition with maximum background loadings determined in WDOE TMDL

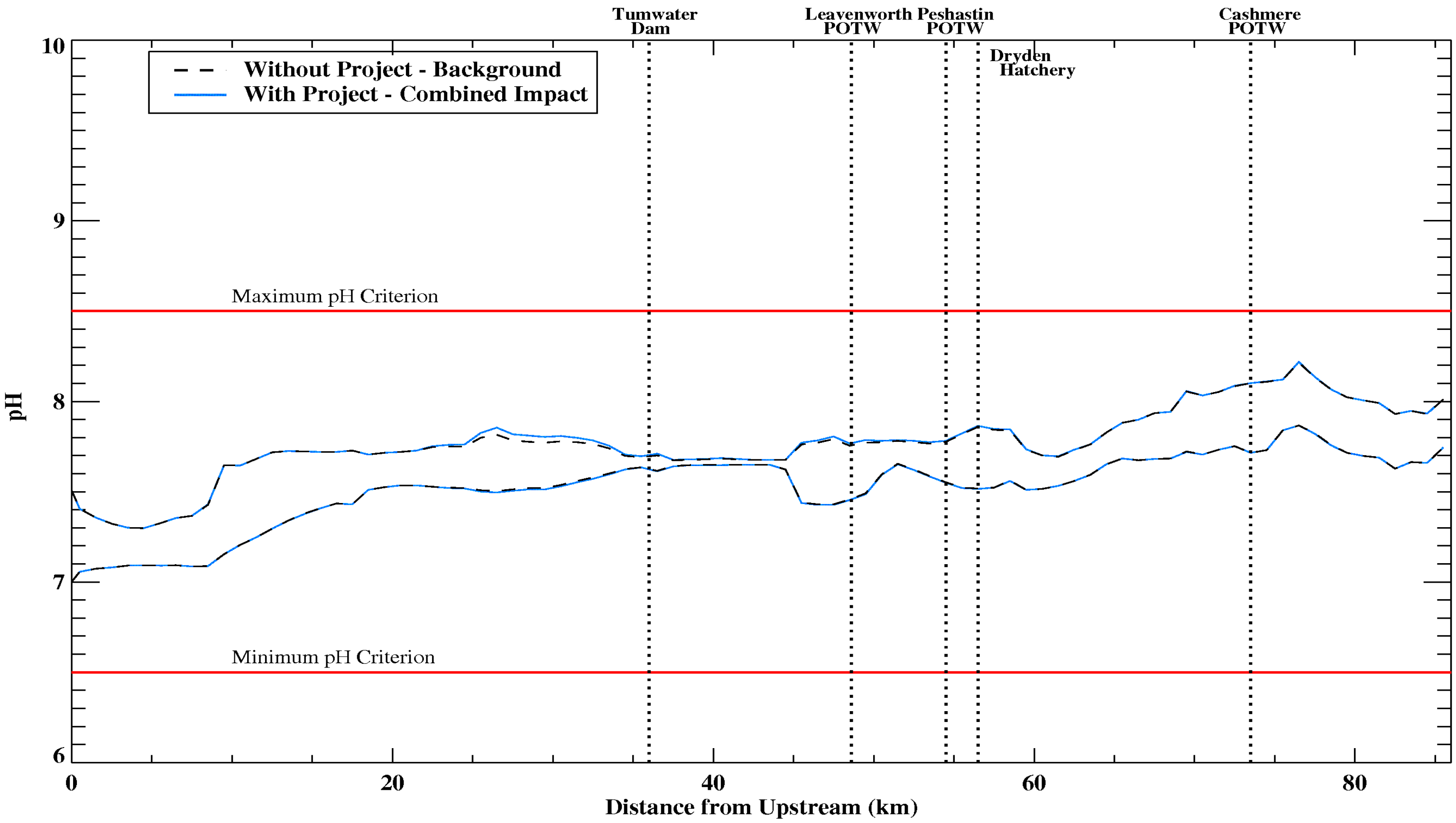
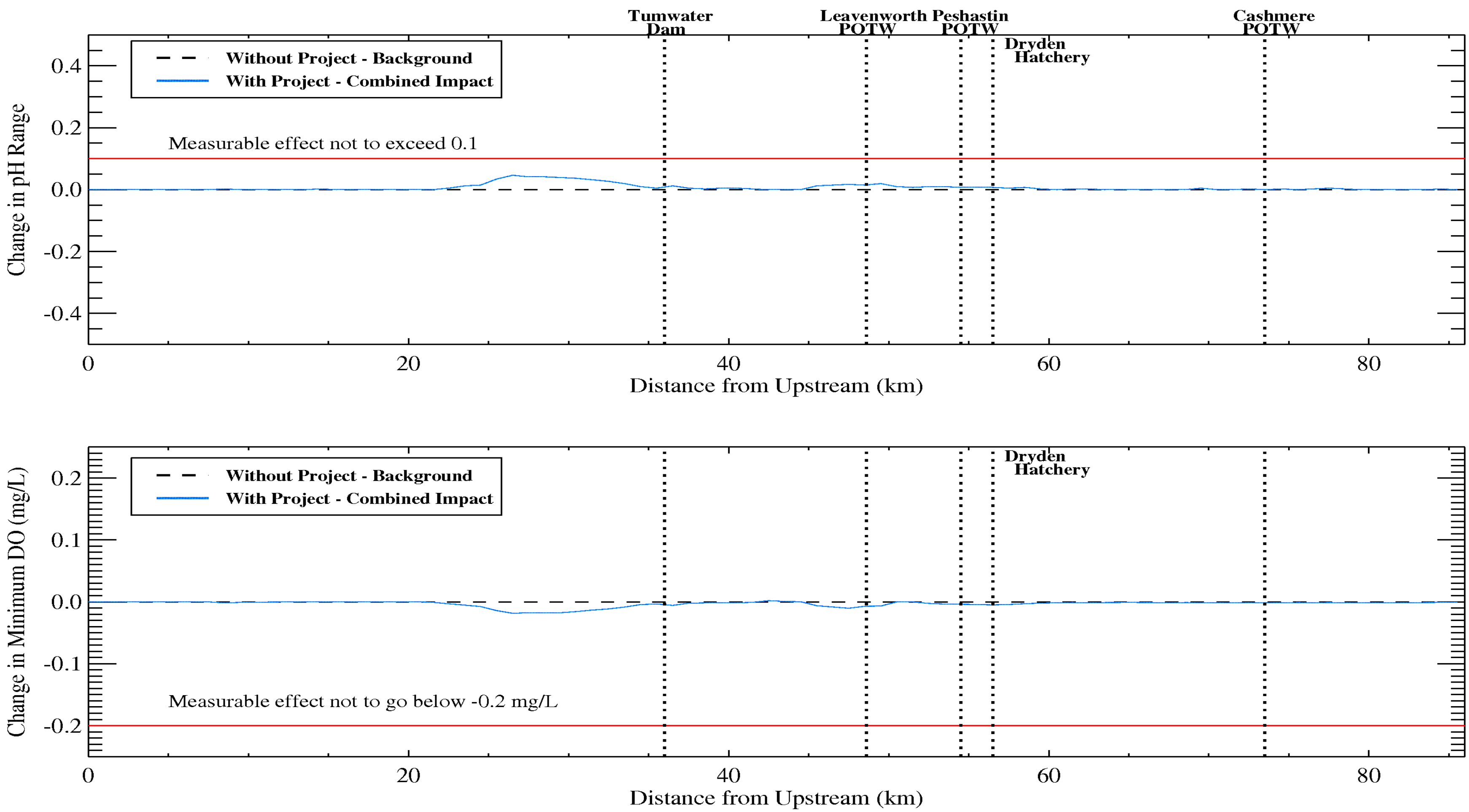


Figure 3-5. Difference from March background conditions in the range of pH (top graph) and minimum DO (bottom graph) with and without the proposed project in the Wenatchee basin



3.5.3.5 Methow Basin Sites (Primary)

The site-specific acclimation-related nutrient loads for the Methow sites were calculated using an approach similar to that of the Wenatchee sites. Total phosphorus loads estimated from measured data at active acclimation sites in Nason Creek (Table 3-2) were used for this analysis. The TP loads estimated for the proposed sites in the Methow basin are shown in Table 3-8.

Table 3-8. TP loads estimated for proposed acclimation activity: Methow basin

Proposed Site	No. of Fish	TP Load[a] (kg/d)	Receiving Stream
Goat Wall	50,000	0.016	Methow
Heath	200,000	0.064	Methow
Winthrop NFH	100,000	0.032	Methow
MSWA Eightmile	125,000	0.040	Chewuch
Mason	87,500	0.028	Chewuch
Newby	83,000	0.027	Twisp
Pete Creek	125,000	0.040	Chewuch
Lincoln	110,000	0.035	Twisp
Twisp Weir	110,000	0.035	Twisp
Lower Twisp	30,000	0.010	Twisp
Parmley	50,000	0.016	Beaver
Gold	50,000	0.016	Gold

a. Estimated from average load of 0.32 mg per fish per day calculated from measured data at active discharges in Nason Creek
kg/d = kilograms per day

Methow River Mainstem (3 sites)

Goat Wall: This is the most upstream site proposed that would discharge directly into the Methow River. For the relatively small number of smolts (50,000) acclimated, the TP loading to the Methow River is expected to be about 16 g/d. The average flow from 1990 through 2010 for the months of March through May in this section of the Methow River (USGSG Gage 12447383, Methow River near Goat Creek) is about 900 cfs, which is comparable to the flow at the mouth of the White River in the Wenatchee basin (WDOE Station 45K090, March through May average from 2003 through 2010 is about 1,000 cfs). Given the predominantly forested nature of the upper portions of the Wenatchee and Methow basins, the background phosphorus concentrations are likely to be similar. It was shown that a TP load of up to 35 g/d (see Table 3-4) from individual acclimation-related discharges in the White River would comprise only a very small fraction (less than a fifth of a percent) of the background load. Given the similarity in the flows and land type between the two watersheds, the impacts of discharges from Goat Wall are expected to be similarly negligible in this reach of the Methow River.

Heath: About 200,000 smolts are expected to be acclimated in a large pond at the Heath site. The TP loads from this site are estimated to be four times that of Goat Wall at about 64 g/d. This site is located upstream of the city of Winthrop in the same section of the river as Goat Wall (although farther downstream). Therefore, the assessment applied for Goat Wall can be applied here. Even though the load would be quadruple that of Goat Wall, it is still expected to be a small fraction of the background conditions and comparable in magnitude to the largest load expected for the White River sites. Similar to Goat Wall, the impacts are expected to be negligible.

Winthrop National Fish Hatchery: Discharges from this public hatchery are covered by a discharge permit. The loads from acclimation activity are expected to be about 32 g/d. Some level of treatment of the discharge that is associated with hatchery operations is expected. Thus, the loads from this site would be even smaller. Therefore, potential impacts related to acclimation activity are expected to be negligible.

Chewuch River (3 sites)

Methow State Wildlife Area (MSWA) Eightmile: The MSWA Eightmile site is the most upstream proposed site on the Chewuch River, located in a side channel above the confluence with Eightmile Creek. About 125,000 smolts are proposed to be acclimated, for which the estimated TP load to the system is 40 g/d. The watershed for the Chewuch is similar to the upper portions of the Methow River (predominantly forested with very little human influence). Thus, a similar approach as that used for the upper Methow sites (Goat Wall and Heath) was used here. The long-term (1991 through 2010) average flow for March through May reported at the USGS Gage in Winthrop is about 700 cfs, which is lower than but comparable to the upper Methow River flows. Given the similarity in the subbasin characteristics, background loads, and acclimation-related nutrient loads, water quality impacts from acclimation activity are expected to be negligible.

Mason: Discharges from Mason would enter the Chewuch River through Eightmile Creek. The number of smolts to be acclimated at this site is 87,500. Given Mason's proximity to the MSWA Eightmile site, their similar in-stream conditions, and the lower number of smolts to be acclimated there, impacts are also expected to be negligible.

Pete Creek Pond: Approximately 125,000 smolts are expected to be acclimated at this site, corresponding to a TP load of 40 g/d. This site is proposed on the lower Chewuch River where the watershed and background loads would be comparable to the other two Chewuch River sites. Therefore, acclimation-related impacts on the receiving stream are expected to be similarly negligible.

Twisp River (4 sites)

Lincoln: This site is the most upstream among the proposed sites on the Twisp River. The TP load in the discharge associated with the proposed acclimation of 110,000 smolts is expected to be about 35 g/d.

The primary human influence in the Twisp River occurs near the city of Twisp, which is at the confluence of the Twisp and Methow rivers, leaving much of the Twisp River watershed as forest—similar to the upper section of the Methow River and the Chewuch River. Therefore, background phosphorus concentrations in the Twisp River likely would be similar. The Twisp River flows are smaller than those in the upper Methow River and Chewuch River (average flow at the USGS Gage 12448998 on the Twisp River near the city of Twisp for March through May in 1990 through 2010 is about 440 cfs). Therefore, background loads in the Twisp River would be smaller, and the acclimation-related loads could be a larger proportion of the background loads than what would be encountered in the Chewuch River and upper Methow River sites. Even if the proportion is double what is expected at the upper Methow River and Chewuch River sites, it is still expected be a small fraction of the background conditions (see proportions calculated for the upper Wenatchee River sites in Table 3-4 for an order of magnitude estimate). Impacts on the receiving stream are therefore expected to be negligible.

Newby: The Newby site is downstream of the Lincoln site on a small tributary that feeds into the Twisp River. Up to 83,000 smolts would be acclimated at the site. For those 83,000 smolts, the TP loads are expected to be about 27 g/d. The number of fish would be less than at Lincoln and Twisp Weir on the Twisp River, which are projected to have negligible impacts, so this site would also be expected to have a negligible impact.

Twisp Weir: This site is approximately midway between the Lincoln site and the confluence of the Twisp River with the Methow. As with Lincoln, the TP load in the discharge associated with the proposed acclimation of 110,000 smolts is expected to be about 35 g/d. Given that in-stream conditions are similar to the Lincoln site and the same number of fish is proposed, impacts resulting from the Twisp Weir site are expected to be negligible.

Lower Twisp: The site is close to the Twisp River confluence with the Methow River. For the 30,000 fish proposed at this site, the acclimation-related TP loads are expected to be similar—less than 10 g/d. Given the site's proximity to the Methow River, greater dilution of the TP load can be expected downstream of the confluence. Therefore, impacts for this site would likely be lower than for the Lincoln site.

Beaver Creek – Parmley

The Parmley site is expected to acclimate 50,000 smolts. The TP load associated with this site is an estimated 16 g/d. Beaver Creek is smaller than the other streams considered thus far; however, the number of fish proposed for acclimation at this site is proportionally smaller. Consequently, the nutrient loading that could occur as a result of acclimation at this site is also expected to be smaller than the other sites previously discussed. Impacts are therefore likely to be negligible.

Gold Creek – Gold

This proposed site is located in the lower Methow basin. About 50,000 smolts would be acclimated here, with a corresponding TP load of about 16 g/d to Gold Creek. Gold Creek is similar in size to Beaver Creek. Also, because this is the only acclimation site proposed on Gold Creek with the same number of fish as proposed for the Parmley site on Beaver Creek, localized impacts are expected to be similarly negligible.

3.5.3.6 Methow Basin Sites (Backup)

Six backup sites are being considered for the Methow basin, one or more of which would be used if one or more of the proposed sites is determined to be infeasible. The TP loads estimated for these sites are presented in Table 3-9 and discussed in the following sections.

Chewuch Acclimation Facility

This existing acclimation facility might be expanded if other sites on the Chewuch River are not developed. About 125,000 smolts would be acclimated at the site. The TP loads associated with this activity would be about 40 g/d. The assessments from the other Chewuch River sites would apply here due to the similar location and number of fish. Impacts are expected to be negligible.

Table 3-9. TP loads estimated for backup sites: Methow basin

Proposed Site	No. of Fish	TP Load[a] (kg/d)	Receiving Stream
Chewuch AF	125,000	0.040	Chewuch
MSRF Chewuch	125,000	0.040	Chewuch
Biddle	50,000	0.016	Wolf
Utley	83,000	0.027	Twisp
Poorman	83,000	0.027	Twisp
Balky Hill	50,000	0.016	Beaver

a. Estimated from average load of 0.32 mg per fish per day calculated from measured data at active discharges in Nason Creek.
kg/d = kilograms per day

Methow Salmon Recovery Foundation (MSRF) Chewuch

The number of fish acclimated at the MSRF site would be the same as for the Chewuch Acclimation Facility (about 125,000). Given the site's proximity to the confluence with the Methow River and the similarity of the estimated TP loads to the other Chewuch sites, localized impacts to the Chewuch River due to TP loading from this site are expected to be negligible.

Biddle

This site is on Wolf Creek. About 16 g/d of TP would be discharged due to acclimation of about 50,000 smolts. This site is on a relatively small creek, and the impacts are likely to be similar to those estimated for the Parmley and Gold Creek sites. Lack of data prevented a detailed evaluation of localized impacts associated with this site.

Balky Hill

This site is located on Beaver Creek, and impacts are expected to be similar to those at the Biddle and Parmley sites. As with the Biddle site, due to lack of sufficient data, a detailed evaluation of localized impacts was not possible.

Utley

The Utley site would acclimate 83,000 smolts, if used. The number of fish acclimated, the TP loads, and the impacts are expected to be similar to the Newby site (a primary site downstream of Utley), impacts from which are expected to be negligible.

Poorman

This acclimation site is the farthest downstream of all backup sites on the Twisp River. Because the site would acclimate the same number of fish as the Utley site, Poorman would also be expected to have a negligible impact.

3.5.3.7 Combined Impacts of Methow Basin Acclimation Sites

A rigorous mass balance model, such as the one developed by WDOE for the Wenatchee basin, was not undertaken for the Methow basin due to the lack of data for model development and calibration. The evaluation for the Methow basin applied existing data. Historical information on phosphorus concentrations for the acclimation months was limited. Therefore, the evaluations of the potential for the acclimation-related TP loads to dominate the background conditions are based on a comparison to the impacts assessed for the Wenatchee basin. This method is possible because the characteristics of the Wenatchee and Methow basins are comparable.

Both watersheds are predominantly forested. Both have the high peaks of the Cascade Mountains that contribute the majority of flows through snowmelt in spring. In both basins, much of the precipitation occurs during the months of October through March, and this precipitation is predominantly in the form of snow (Andonaegui 2001; Konrad et al. 2003).

Although the Methow basin is somewhat drier than the Wenatchee, the flow patterns are consistent between the two basins, with similar peak-flow and low-flow periods. This indicates that flow-driven processes such as mobilization of particulates, dilution of nutrients, in-stream re-aeration, and habitat conditions for attached algae are likely to be similar in the two basins.

The Methow basin is sparsely populated, even between Winthrop and Pateros.[22] Konrad et al. (2003) concluded, based on an analysis of water quality data collected throughout the basin, that human-caused impact is generally low. The major human sources of water pollutants in the basin are the publicly operated treatment works (POTWs) at Twisp and Winthrop and the Winthrop NFH.

Based on data collected by WDOE for March, April, and May 2005-2009, the average TP load over the 3-month period was estimated to be approximately 39 kg/d. As with the Wenatchee basin, the loads generally followed the flow, with peaks in May that were much larger than March and April.

To estimate the combined impact of the proposed project, the TP loads from POTWs were separated from the overall loads to provide an estimate of background conditions. Based on discharge monitoring reports (DMR), the average daily loads from the POTWs were estimated and subtracted from the average loads calculated for the Methow River at Pateros. A DMR was not available for Winthrop NFH. Thus, the loads from this facility could not be differentiated.

Acclimation activity may contribute about 0.9% of the average background loads (Table 3-10). Noting that loads from Winthrop NFH and other minor point sources were not included, this is likely an overestimate of the relative contribution of the acclimation activity loads. In addition, discharge monitoring report data from fall were used for estimation of the loads due to lack of data for spring periods. Despite these limitations, the estimate of loads is considered reasonable, because loads from municipal POTWs generally do not show strong seasonal variability and basin flows in October through February are generally comparable to flows in early spring.

As a check on the load estimates for the Methow basin, a similar loading calculation was performed for the Wenatchee basin, where point source discharge data were available for spring, and the results for the two basins were compared. Once the human influences were subtracted from the loads, the background TP load at the downstream reaches of the Wenatchee and Methow basins are 25.6 kg/d and 37.3 kg/d respectively (see Table 15 in Appendix 7 Water Quality Impacts and Table 3-10). The similarity in the characteristics of the two basins is further supported by the fact that the geographic areas and the background TP loads are proportional between the two basins; i.e., the background TP load in the Wenatchee basin is 69% of the Methow basin load, and the Wenatchee basin covers an area 73% the size of the Methow basin.

[22] Population of less than 5,000, based on 2000 census.

Table 3-10. TP loads estimated for the Methow basin with and without POTW loads

Source	TP Load (kg/d)
Methow River at Pateros [a]	39.20
Twisp POTW [b]	1.30
Winthrop POTW [c]	0.58
Estimated Background Load	37.31
Acclimation Activity Loads [d]	0.32

a. Average over March - May calculated from paired TP and flow data collected respectively by WDOE (48A070) and USGS (12449950) in the Methow River at Pateros in 2005 through 2009.
b. Estimated average based on NPDES discharge monitoring report information from October 2009 through February 2010.
c. Estimated average based on NPDES discharge monitoring report information from November 2009.
d. Sum of the loads estimated for the individual sites in Table 3-8.

Project sites in the Wenatchee basin contribute approximately 1.5% of the background load. This is higher than the Methow basin estimate of 0.9%. This difference is expected because a larger number of fish are proposed for acclimation in the Wenatchee basin (about 1.15 million versus 1 million in Methow) and because of the contribution of TP loads from the proposed year-round rearing activities at the Dryden facility in the Wenatchee basin.

The modeling for the Wenatchee basin suggests that, even for critical conditions, acclimation-related phosphorus loads are not expected to produce a measurable change in DO and pH (see discussion in Section 3.5.3.4 “Combined Impacts to Water Quality of Wenatchee Basin Acclimation Sites”). Based on the analysis in this section and considering the similarities between the two basins, it is concluded that the TP loads introduced to the Methow basin from this project are unlikely to produce a measurable change in DO and pH (DO decrease of 0.2 milligrams per liter [mg/L] or greater; pH change of 0.1 unit or greater. See Section 3.5.1).

3.5.4 Impacts of the No Action Alternative

3.5.4.1 Wenatchee Basin

The mechanistic modeling approach used for estimating the combined and cumulative impacts for the Proposed Action (see Section 3.5.3 Impacts of the Proposed Action) was used for the No Action Alternative sites in the Wenatchee basin. The estimated phosphorus loads for the sites in the No Action Alternative (Table 3-11) were used to calculate the phosphorus concentrations of the respective tributaries receiving the discharge in the QUAL-2K model. Loading from any other site in the Proposed Action that is not listed in Table 3-11 was excluded. All other simulation conditions and modeling assumptions remained unchanged from the Proposed Action simulations.

Table 3-11. TP loads estimated for No Action Alternative sites in Wenatchee basin

No Action Site	No. of Fish	TP Load[a] (kg/d)	Receiving Stream
Rohlfing	85,000	0.027	White River
Coulter	65,000	0.021	White River
Butcher	140,000	0.045	Little Wenatchee River
Beaver	110,000	0.035	Beaver
Leavenworth NFH	550,000	0.072	Icicle
Total	**950,000**	**0.2**	

a. Uses an estimate of 0.32 mg/d/fish derived from active sites in Nason Creek for tributary sites; see Table 3-2. LNFH value is based on analysis in Appendix 13.

3.5.4.2 Methow Basin

Under the No Action Alternative, up to 500,000 fish would be acclimated in the Methow basin (Table 3-12), which is half of the maximum number of fish for the Proposed Action (Table 3-3). Therefore, the TP loads for the No Action Alternative are expected to be half those of the Proposed Action. Based on the background and basin loads estimated for the Methow basin in Table 3-10, it is expected that the No Action Alternative would contribute less than 0.4% of the basin loads. Therefore, water quality impacts on the Methow River are expected to be negligible if the No Action Alternative is implemented.

Table 3-12. TP loads estimated for No Action Alternative sites in Methow basin

No Action Site	No. of Fish	TP Load[a] (kg/d)	Receiving Stream
Heath	20,000	0.006	Twisp River
Lincoln	60,000	0.019	Twisp River
Lower Twisp	100,000	0.032	Methow River
Winthrop NFH	325,000	0.104[b]	Methow River
Total	**505,000**	**0.151**	

a. Uses an estimate of 0.32 mg/d/fish derived from active sites in Nason Creek; see Table 3-2.
b. Because this calculation uses the acclimation site TP load, it might be higher than the actual load contributed from Winthrop NFH, depending on the treatment methods used at the hatchery.

3.5.4.3 Combined Impacts

The combined impact simulation showed that the impacts to water quality are negligible if the project were to continue without the changes proposed in the Proposed Action (see Appendix 7, Section 6.1.1). This is to be expected, given that the results discussed in previous sections demonstrated that, even with the greater number of sites in the Proposed Action, impacts would be negligible.

3.5.5 Mitigation for the Proposed Action

The project proposes several practices to reduce nutrient levels, several of which are already incorporated into the design of the project:

- Acclimate and release small numbers of coho smolts from multiple sites to dilute the loads and reduce local effects.
- Select ponds with flow rates that are higher than those used in constructed regional fish facilities so that there is substantial dilution of nutrients in the discharges.
- Acclimate in large, natural ponds; their higher water volumes provide greater dilution of fish feed and wastes and buffer nutrient loading to the receiving stream.
- Feed high-phosphorus-digestibility foods.
- Periodically remove sediments from some acclimation ponds to eliminate potential long-term accumulation of nutrients.

At the proposed Dryden Hatchery, all known, available, and reasonable methods of prevention, control, and treatment of discharge from the hatchery are proposed and described below. Multiple water discharge treatment methods and systems would be used to minimize impacts to the water quality of the Wenatchee River. They represent the most current methodology reasonably required for preventing, controlling, or abating the pollutants associated with hatchery effluent discharge.

Large, settled particles would be regularly vacuumed from rearing unit bottom surfaces and sent to off-line settling basins. The full hatchery flow would pass though large on-line settling basins where smaller particles would settle and where some dissolved phosphorus (P) would be removed. The full flow would be further treated in a wetland where more dissolved phosphorus would be removed. Hatchery operating and feeding procedures would also help reduce nutrient loads. The selection of feeds with highly digestible sources of phosphorus, proper feeding practices, and frequent rearing unit cleaning are part of the treatment plan summarized below.

Raceway Quiescent Zones	A screened area at the end of each raceway that occupies 10% of the raceway area
Rearing Ponds	Settled wastes will be vacuumed directly from the pond bottom
Off-Line Settling Basins	2 basins with a combined retention time of 24 hours
On-Line Settling Basins	2 basins with a combined overflow rate of 42 feet/day
Wetland	1.2 acre
Water Management	Remove incubation and adult holding water from the treatment flow
Feed Conversion Rate	Below 1.2 [a]
P Levels in Feed	Below 1.42% (highly digestible)
Quiescent Zone Maintenance	Vacuum once per week
Off-Line Settling Basins Maintenance	Remove solids when settling times are reduced by 30%
On-Line Settling Basins Maintenance	Monitor P levels monthly and remove solids when P reduction effectiveness is reduced by 30%
Wetland Maintenance	Reconstruct berms as needed

a. A significant source of discharged nutrients is in uneaten and underutilized feed. A measure of feed efficiency is the Feed Conversion Rate (FCR), the ratio of food fed to fish growth. High FCRs mean high levels of phosphorus in the water. The Dryden Hatchery should maintain an FCR of 1.2 or less by following manufacturer recommendations for feeding levels and frequencies.

Although the load from the hatchery is small and the impacts are not expected to be measurable, the lower Wenatchee is an impaired water body and load allocations developed to protect water quality do not include this new nutrient source. However, there is an allocation for diffuse loads carried in Wenatchee basin groundwater. Assimilative capacity for a new source is proposed to be developed through a Water Quality Offset, as described in the Washington Administrative Code (WAC) 173-201A-450. An amount of phosphorus equivalent to that produced by the hatchery would be removed from an upstream well; the hatchery would use this reduction to offset its load. See Appendix 13 for details of this offset proposal.

3.6 Surface and Groundwater and Water Rights

3.6.1 Affected Environment

The potential affected environment for this resource includes surface water flows, surface water temperatures, water quality, local groundwater levels, and existing users (water rights) in the immediate vicinity and downstream of the sites where new groundwater sources are developed. The potential affected environment at individual sites is discussed in Section 3.6.3 Impacts of Proposed Action. Only three sites in the Wenatchee basin (one primary and two backup) would require new groundwater development as part of this project; four sites in the Methow (3 primary and one backup) would require new groundwater sources. Other facilities that could be used by the project use groundwater, but the impacts of their development and use have been or will be evaluated as part of other permitting processes. Only the sites requiring new development are discussed, except in the cumulative impacts section (Section 3.15).

Washington State's Administrative Code establishes stream management units, maximum future allocations, basins that are closed to further water right appropriation, and in-stream flow regulations for the two basins. In the Wenatchee River basin, the Chumstick Creek subbasin is closed to future appropriations (WAC 173-545). Several stream basins and lakes within the Methow River basin also are closed to future appropriations (WAC 173-548).

3.6.2 Types of Impact

New water supplies to acclimation sites and the proposed hatchery that are based on **new groundwater wells** could have the following impacts:

- Reduction in the production capacity of nearby wells
- Reduction or increase in surface water flows
- Reduction in surface water quality

Reduction in the production capacity of nearby wells. Such impacts are considered to be an adverse effect on the existing well-owner's water rights. The criteria used to evaluate the potential impacts of proposed groundwater withdrawals on existing groundwater users are based on the amount of drawdown interference the withdrawal would cause in the existing wells. Drawdown interference of less than one foot likely would not affect the production capacity of existing wells. Drawdown interference of greater than one foot would require case-specific analysis to evaluate whether the drawdown would impact production capacity.

The Washington Department of Ecology (WDOE) is charged with administering state water rights laws. The term "impairment" is used by WDOE as the criterion for assessing impacts to groundwater rights. Washington Administrative Code (WAC) 173-150-060 describes how to determine whether a groundwater right has been impaired. Specifically: "A groundwater right which pertains to qualifying withdrawal facilities, shall be deemed to be impaired whenever:

> 1) there is an interruption or an interference in the availability of water to said facilities, or a contamination of such water, caused by the withdrawal of groundwater by a junior water right holder or holders; and
>
> 2) significant modification is required to be made to said facilities in order to allow the senior groundwater right to be exercised."

Reduction in surface water flows. The criterion for surface water flow impacts (local, downstream, in-stream, and low-flow) used in this analysis is any measurable or theoretical reduction in surface water flow rates.

Reduction in surface water quality. Water quality criteria are established in Washington State by WAC 173-200 for groundwater and WAC 173-201A for surface water. The criterion for assessing potential impacts to surface water quality is any measurable or theoretical change to surface water quality resulting from groundwater usage.

Groundwater withdrawals can affect surface water levels depending on the degree to which the groundwater source is in hydraulic continuity with surface water. Hydraulic continuity is a scientific term that describes how easily water flows between groundwater and surface water (streams, rivers, lakes, and wetlands). When hydraulic continuity is high, water flows easily between groundwater and surface water. This impacts how water should be managed because anything done to the groundwater (such as pumping from wells or pollution seeping into the groundwater) will affect the surface water, and vice versa (Chehalis Basin Watershed Planning Issue Paper, accessed at www.crcwater.org/cbp).

New water supplies to acclimation sites and the proposed hatchery that are based on **new surface water withdrawals** could reduce surface water flows.

3.6.3 Impacts of the Proposed Action

Three primary sites and one backup site in the Wenatchee basin (Tall Timber, Chikamin, Dryden [primary] and George [backup]); and two primary sites in the Methow basin (Twisp Weir and Newby) require new surface water intakes. The stream reaches between the intakes and outlets would have slightly lower total flow when water is diverted, but these distances are generally 1,500 feet or less. Because the water used would be returned close to the intakes, the withdrawals are essentially water neutral and would have no regional impact on flows. In-stream flows required by WDOE would be maintained. For these reasons, surface water withdrawals will not be discussed further.

Table 3-13 summarizes potential impacts from new groundwater withdrawals at **primary** sites. The site-specific discussions following the table discuss only sites where the project proposes new wells or increased withdrawals, but also discusses impacts at backup sites if they were to be developed.

Table 3-13. Summary of potential impacts in the Wenatchee and Methow basins from new groundwater withdrawals at primary acclimation and hatchery sites

Site	Proposed Groundwater Withdrawal (gpm)[a]	Potential Groundwater Level Impacts	Potential Surface Water Flow Impacts	Potential Groundwater Right Impacts
Wenatchee River Basin Primary Sites				
Dryden Hatchery	1,485	Local: depends on amount and type of withdrawal; no regional impacts	Slight reduction within drawdown cone; no impacts downstream	Potential impacts to nearby groundwater rights
Basin Total	**1,485**			
Methow River Basin Primary Sites				
MSWA Eightmile	800	Potential local: no regional impacts	Slight reduction within drawdown cone; no impacts downstream	Potential impact to existing on-site well
Twisp Weir	225	Potential local: no regional impacts	Slight reduction within drawdown cone; no impacts downstream	Low potential for impact to existing on-site well and off-site well
Lower Twisp [b]	225	Potential local: no regional impacts	Slight reduction within drawdown cone; no impacts downstream	Low potential for impact to existing on-site well and off-site well
Basin Total	**1,250**			

a. gpm = gallons per minute
b. Water supply would come from an existing well but additional withdrawals might be required for the project.

3.6.3.1 Wenatchee Basin Acclimation Site

Squadroni (Backup Site)

The site is within the northwest-southeast trending basin occupied by Nason Creek and underlain by Quaternary alluvium or alpine glacial drift. The underlying bedrock is tonalite of the Mount Stuart batholith of Cretaceous age. The groundwater source at the Squadroni site, located near the confluence of Nason and Gill creeks, would be the unconsolidated alluvium or glacial deposits overlying the bedrock. The lateral extent of the aquifer is generally restricted to the valley floor adjacent to Nason Creek.

There is an existing domestic well and residence at the site. If the site is used, a new well or wells would terminate in the unconsolidated alluvium composed of sand, gravel, silt and clay layers. It is likely that multiple wells would be needed to meet the proposed demand of 720 gpm (1.6 cfs). Several water-bearing layers of sand and gravel appear to have the potential to be moderately productive based on nearby well log descriptions. Although the thickness, lateral extent and other characteristics of the aquifer at the site are not known, the aquifer is likely to be in hydraulic continuity with Nason Creek.

Groundwater Levels. Groundwater withdrawals could cause localized impacts to groundwater levels, with specific water level reductions in the existing domestic well at the site. Based on existing information on the source aquifer, the drawdown cone, defined by drawdown greater than 1 foot, would reach approximately 500 to 1,500 feet depending on aquifer characteristics and the degree of confinement of the source aquifer.[23]

[23] A confined aquifer has limited continuity with other aquifers and surface waters.

Surface Water Flows. Groundwater withdrawals could cause localized impacts to stream flows due to the potential that the source aquifer is in hydraulic continuity with surface water (Nason and Gill creeks). A change in groundwater levels would reduce stream flow, the magnitude of which depends on the degree of hydraulic continuity between aquifer and surface water. However, any reduction in stream flow would be completely offset and balanced by return flows from the acclimation pond and would result in no regional impact to stream flow in the Wenatchee River basin.

Water Rights. The development at the Squadroni site could impact groundwater water rights. Logs of eight wells were located within the radius of influence of the proposed Squadroni point of withdrawal (500 – 1,500 feet), plus the Squadroni domestic well; these wells could be impaired by the proposed well. There are two known groundwater rights within the potential groundwater source area of the Squadroni site.

The activities at the Squadroni site would not impact surface water rights. Because of the water-balance neutrality of the potential withdrawal of groundwater from an aquifer in hydraulic continuity with the stream and discharge of the groundwater back into the stream, there would be no regional impacts to stream flow upstream or downstream of the Squadroni site.

3.6.3.2 Methow Basin Acclimation Sites

MSWA Eightmile (Primary Site)

In order to supply the site's proposed water need of 800 gpm (1.8 cfs), multiple new wells could be required.

The surface geology of the MSWA Eightmile site is recent Chewuch River alluvium and older Quaternary alluvium underlain by orthogneiss bedrock of Cretaceous-Jurassic age. The unconsolidated alluvium is composed of sand, gravel, silt and clay layers. Water-bearing layers of sand and gravel may have the potential for groundwater supply based on well log descriptions.

An existing 6-inch-diameter well is located approximately 300 feet west of the proposed acclimation pond on the alluvial terrace with an elevation of approximately 2,120 feet mean sea level (MSL). The well, referred to as Mason Well 1, was drilled in August 1999 to 60 feet below the ground surface (bgs). Unconsolidated materials interpreted to be the Quaternary alluvium deposits were encountered to 60 feet bgs. No bedrock was encountered. An existing 6-inch well, referred to as Mason Well 2, is located near the residence approximately 1,400 feet south of the Mason Well 1.

The depth to bedrock and the thickness of the unconsolidated deposits are unknown at this time. Bedrock is exposed locally along Eightmile Creek and in the hills surrounding the MSWA Eightmile site. The aquifer in which the existing Mason Well 1 is completed is assumed to be unconfined and at least 30 feet thick based on the well log information. Most likely the local alluvial aquifer is in direct continuity with the Chewuch River. Groundwater levels are expected to fluctuate in elevation, magnitude and timing similar to the nearby surface water elevations.

Groundwater Levels. Groundwater withdrawals at the site could cause localized impacts to groundwater levels. Based on existing information on the source aquifer, the drawdown cone, defined by drawdown greater than 1 foot, would reach approximately 500 to 1,500 feet depending on aquifer characteristics, the degree of confinement of the source aquifer and the degree of hydraulic continuity with the Chewuch River. The production capacity of the existing

Mason Well 1 could be affected by drawdown interference. The amount of the effect is unknown until the well is drilled and tested, although it might be on the order of 1 to 5 feet.

Surface Water Flows. Due to the potential that the source aquifer is in hydraulic continuity with the Chewuch River, groundwater withdrawals at the site could cause localized impacts to stream flows. A preliminary analysis of the theoretical drawdown within the aquifer at 300 feet from the pumping well indicates that the drawdown would be between 1 and 5 feet, depending on the amount of confinement of the aquifer. This change in groundwater levels would result in minimal reduction in stream flow (perhaps hundreds of gallons per day), which depends on the degree of hydraulic continuity between aquifer and surface water. This minor reduction in stream flow (the Chewuch has a daily flow on the order of tens of millions of gallons per day) would be completely offset and balanced by return flows from the facility; there would be no regional impacts to stream flow in the Methow River basin.

Water Rights. The Mason Wells 1 and 2 are the only known groundwater supply wells close enough to be affected by a new well near the proposed MSWA Eightmile acclimation pond. There is less potential for impacting the Mason Well 2 because a new well or wells would be located more than 1,500 feet from Mason Well 2 (outside the zone of influence). Also, the proposed wells would be close to the Chewuch River, a recharge boundary[24] that would reduce drawdown interference at distances of greater than 100 feet from the proposed wells. Drawdown interference at Mason Well 1 could be on the order of 1 to 5 feet assuming a distance of 300 feet and a conservative transmissivity[25] of 40,000 gallons per day per foot (gpd/ft). However, Mason Well 1 currently is not used. Discussions with the landowner would determine whether mitigation is needed, and if so, what would be done. The drawdown at Mason Well 2 would be effectively unmeasurable under the same assumptions.

The proposed activities at the MSWA Eightmile site would not impact surface water rights. Because of the water-balance neutrality of the proposed withdrawal of groundwater from an aquifer in hydraulic continuity with the stream and discharge of the groundwater back into the stream, there would be no regional impacts to stream flow upstream or downstream of the site.

Twisp Weir (Primary Site)

The proposed groundwater source at the Twisp Weir site would be one new 8-inch diameter well. The well would be adjacent to the Twisp River in order to use a shallow aquifer in hydraulic continuity with the Twisp River.

The acclimation site is located within an east-west trending basin occupied by the Twisp River and underlain by Quaternary alluvium or alpine glacial drift. The underlying bedrock is volcanic and sedimentary rocks. The groundwater source at the Twisp Weir site is the unconsolidated alluvium or glacial deposits overlying the bedrock. The lateral extent of the aquifer is generally restricted to the valley floor adjacent to the Twisp River.

Groundwater Levels. Groundwater withdrawals could affect groundwater levels locally. Based on available information on the source aquifer, the drawdown cone, defined by drawdown greater than 1 foot, would reach approximately 300 to 1,000 feet, depending on the degree of

[24] The **recharge boundary** is where the drawdown cone intersects a stream. The drawdown cone cannot spread beyond the recharge boundary.
[25] **Transmissivity** is a measure of the ability of groundwater to flow in a horizontal direction.

confinement of the source aquifer. There is an existing domestic supply well adjacent to the existing residence.

Surface Water Flows. Groundwater withdrawals could locally affect stream flows due to the potential that the source aquifer is in hydraulic continuity with the Twisp River. This change in groundwater levels would minimally reduce stream flow (by perhaps hundreds of gallons per day), depending on aquifer characteristics and the degree of hydraulic continuity between aquifer and surface water. This minor reduction in stream flow (the Twisp River has a daily flow on the order of tens of millions of gallons per day) would be completely offset and balanced by return flows from the facility, with no regional impacts to stream flow in the Twisp River or the Methow River basin.

Water Rights. At least two known wells, including the on-site well, near or within the groundwater source area of the Twisp Weir site could be affected by the proposed well development. Although well logs are incomplete or unrecorded, the expected drawdown at the existing wells is not expected to be great enough to impair them, or even measurably impact their production capacity.

The proposed activities at the Twisp Weir site would not impact surface water rights because of the water-balance neutrality of the proposed withdrawal.

Lower Twisp (Primary Site)

The geology of the Lower Twisp site is the same as that for the Twisp Weir site. The proposed groundwater source at Lower Twisp is an existing 12-inch-diameter well drilled to a depth of 51 feet. It is adjacent to the existing side-channel ponds and approximately 300 feet south of the main channel of the Twisp River. On August 25, 2010, the well was tested at rates up to 600 gpm; results indicate that it is capable of producing the desired flow of 1 cfs. The need for an additional groundwater right is uncertain at this time.

Effects. Effects on groundwater levels, surface water flows, and water rights would be the same as for the Twisp Weir site.

MSRF Chewuch (Backup Site)

The surface geology of the MSRF site is recent Chewuch River alluvium and older Quaternary alluvium deposits underlain by sedimentary rocks. A north-south trending fault occurs along the Chewuch River at the site; the fault is concealed under the alluvial deposits.

No groundwater quality information is available for the MSRF site. However, water quality information for two nearby water systems indicates high water quality, with no violations of state drinking water quality standards.

A number of well logs for wells in the vicinity of the site were examined. Some wells were completed in unconsolidated alluvium and some in bedrock. The logs indicate that water levels in the wells that were completed in the unconsolidated alluvium aquifer range from 8 to 39 feet below the top of the well casings. This alluvial aquifer is likely in hydraulic continuity with the Chewuch River.

The bedrock aquifer is not likely to be a potential source for groundwater for this project due to low production capacity and presumed lower water quality. It is possible that multiple wells would be needed to meet the proposed demand of 850 gpm (1.9 cfs).

Groundwater Levels. There is potential for localized impacts to groundwater levels due to groundwater withdrawals at the MSRF site. Based on existing information on the source aquifer, the drawdown cone, defined by drawdown greater than 1 foot, would reach approximately 500 to 1,500 feet depending on aquifer characteristics, the degree of confinement of the source aquifer and the degree of hydraulic continuity with the Chewuch River. It is unlikely that the production capacity of the existing wells could be impacted by drawdown interference.

Surface Water Flows. Groundwater withdrawals could affect stream flows locally due to the potential that the source aquifer is in hydraulic continuity with the Chewuch River. A preliminary analysis of the theoretical drawdown within the aquifer at 300 feet from the pumping well indicates that the drawdown would be between 1 and 5 feet, depending on the amount of confinement of the aquifer. This change in groundwater levels would minimally reduce stream flow (by perhaps hundreds of gallons per day); the magnitude depends on the degree of hydraulic continuity between aquifer and surface water. This minor reduction in stream flow given the daily flows in the Chewuch would be completely offset and balanced by return flows from the facility.

Because of the water-balance neutrality of the potential withdrawal of groundwater from an aquifer in hydraulic continuity with the stream and discharge of the groundwater back into the stream, there would be no regional impacts to stream flow within the Methow River basin.

Water Rights. If the MSRF site is used, the activities are not likely to impact groundwater rights. The nearby wells are not close enough to be impaired by a new well near the potential MSRF acclimation pond. Groundwater drawdown from pumping would largely be mitigated by proximity to the Chewuch River (a recharge boundary that would reduce drawdown interference at distances of greater than 100 feet from the proposed wells). Drawdown interference at the other wells would be on the order of less than 0.1 foot (effectively unmeasurable) assuming a distance of 1,000 feet and a conservative transmissivity of 40,000 gpd/ft.

The activities at the MSRF site would not impact surface water rights. Because of the water-balance neutrality of the withdrawal of groundwater from an aquifer in hydraulic continuity with the stream and discharge of the groundwater back into the stream, there would be no regional impacts to stream flow upstream or downstream of the MSRF site.

3.6.3.3 Hatchery Sites

Dryden (Primary Site)

A water supply of up to 2,775 gpm (7.4 cfs) is proposed for the Dryden Hatchery facility from a combination of surface water and groundwater sources. Groundwater sources originally considered were either an infiltration gallery adjacent to Peshastin Creek or production well(s). A preliminary investigation indicated that the shallow soils would not support an infiltration gallery along the Wenatchee River in the area explored. Two test pits showed low permeability and a relatively deep groundwater table (GeoEngineers 2010a). Therefore, only wells are proposed as the groundwater source for this site.

The Dryden site is located at the confluence of Peshastin Creek and the Wenatchee River and is underlain by Quaternary alluvium and terrace deposits. The underlying bedrock is a sandstone that is exposed on the valley wall immediately opposite of the Dryden site and in the hills to the east and west. The groundwater source at the Dryden site is the unconsolidated alluvium or terrace deposits overlying the bedrock. The lateral extent of the aquifer is generally restricted to the valley floor adjacent to the Wenatchee River and Peshastin Creek. A preliminary depth-to-bedrock analysis indicates that the unconsolidated deposits are 45 to 130 feet thick based on information from logs of wells located on the terraces to the west of the Dryden site. Only a few wells in the immediate vicinity were drilled to bedrock. Wells in the area penetrate the alluvium and terrace deposits, described by drillers as sand, sand and gravel, "rocks," and cemented sand and gravel with cobbles. The bedrock is described in the logs as sandstone. In addition to the alluvial deposits of the Wenatchee River, Peshastin Creek deltaic deposits of coarse gravel, cobbles and boulders occur along the banks of Peshastin Creek and along the west bank of the Wenatchee River downstream of the mouth of the creek.

Water levels in the wells near the Dryden site are at elevations that generally correspond to the stage heights of the nearby Wenatchee River. This implies that the shallow unconsolidated aquifer is in hydraulic continuity with the Wenatchee River and/or Peshastin Creek. Groundwater levels are expected to fluctuate with the same timing as the changes in stage heights of the Wenatchee River and Peshastin Creek. Groundwater levels are expected to occur at 5 to 15 feet below ground surface (bgs) beneath the Dryden site, depending on the adjacent surface water levels.

Groundwater Levels. Groundwater withdrawals at the Dryden site could cause local impacts to groundwater levels. Well logs from 27 nearby wells with depths ranging from 50 to 150 feet indicate there are several water bearing zones within the alluvial deposits. The bottoms of three of the 27 wells in the vicinity are completed within the sandstone bedrock. Only one well has limited pumping test data available. This well was pumped at 60 gpm with 1.7 feet of drawdown after 4 hours. Other wells in the area produce from 7 to 12 gpm from the bedrock wells and 15 to 60 gpm from wells completed in the unconsolidated deposits based on the well logs. Specific capacities (pumping rate divided by drawdown) of the wells completed in unconsolidated deposits range from 6 to 35 gpm/foot of drawdown. Specific capacities of bedrock wells range from 0.2 to 0.6 gpm/foot of drawdown. The impacts to groundwater levels in the vicinity of the site would depend on the amount of production.

The bedrock is not a potential source for groundwater for this project because of its low yield and presumed relatively lower quality water (e.g., higher levels of dissolved solids and lower dissolved oxygen levels).

Surface Water Flows. Groundwater withdrawals could affect stream flows near the site due to the likelihood that the alluvial source aquifer is in hydraulic continuity with surface water (Wenatchee River and Peshastin Creek). Depending on the percentage of the proposed 7.4 cfs demand that is derived from groundwater sources, drawdown within the source aquifer might be significant. This change in groundwater levels would result in a local reduction in stream flow, the amount of which depends on the degree of hydraulic continuity between aquifer and surface water. This localized reduction in stream flow would be completely offset and balanced by return flows from the facility; thus, there would be no regional impacts to stream flow within the Wenatchee River basin.

Water Rights. The proposed activities at the Dryden site could affect groundwater water rights. Active irrigation wells are known to exist in the area. If high-capacity production wells are constructed, the expected drawdown from pumping at the Dryden site could impair production at existing wells near the property boundaries.

The proposed activities at the Dryden site would not impact surface water rights. Because of the water-balance neutrality of the proposed withdrawal of groundwater from an aquifer in hydraulic continuity with the stream and discharge of the groundwater back into the stream, there would be no regional impacts to stream flow upstream or downstream of the Dryden site.

George (Backup Site)

The George site is located within the east-west trending basin occupied by the Wenatchee River and underlain by Quaternary alluvium, terrace deposits or alpine glacial drift. The underlying bedrock is sedimentary rocks of the Chumstick Formation of Eocene age. The potential groundwater source at the George site, located adjacent to the Wenatchee River, is the shallow unconsolidated alluvium overlying the bedrock. The lateral extent of the aquifer is generally restricted to the valley floor adjacent to the Wenatchee River.

There are no existing wells or structures at the George site. A new well or wells would provide the groundwater; it is likely that multiple wells would be needed to meet the demand of 1,500 gpm (3.3 cfs). The wells would be completed in the shallow unconsolidated alluvium in hydraulic continuity with the river. Several water-bearing layers of sand and gravel appear to have the potential to be moderately productive based on nearby well log descriptions. Although the thickness, lateral extent and other characteristics of the shallow aquifer at the site are not known, the aquifer is likely to be in hydraulic continuity with the Wenatchee River.

Groundwater Levels. Groundwater withdrawals could cause local impacts to groundwater levels. Based on existing information on the source aquifer, the drawdown cone, defined by drawdown greater than 1 foot, would reach approximately 500 to 1,500 feet depending on aquifer characteristics and the degree of confinement of the source aquifer. There are no known wells within 1,500 feet of the likely well sites.

Surface Water Flows. Groundwater withdrawals could affect stream flows locally due to the potential that the source aquifer is in hydraulic continuity with surface water (Wenatchee River). A change in groundwater levels would reduce stream flow; the magnitude depends on the degree of hydraulic continuity between aquifer and surface water. Reduction in stream flow is likely to be minor and would be completely offset and balanced by return flows from the hatchery.

Because of the water-balance neutrality of the withdrawal of groundwater from an aquifer in hydraulic continuity with the stream and discharge of the groundwater back into the stream, there would be no regional impacts to stream flow within the Wenatchee River basin.

Water Rights. Groundwater development at the George site would not affect groundwater rights. No wells are known to be within the radius of influence (1,500 feet) of the likely points of withdrawal for the facility. There are no known groundwater rights within 1,500 feet of the likely withdrawal source area. Groundwater development at the George site would not affect surface water rights because of the water-balance neutrality of the potential withdrawal.

3.6.3.4 Combined Impacts

A total increase of 1,485 gpm in groundwater production is proposed for the one primary site (Dryden Hatchery) in the Wenatchee basin; and a combined total increase of 1,250 gpm in groundwater production is proposed for the three primary acclimation sites (MSWA, Twisp Weir, and Lower Twisp) in the Methow basin. The backup Squadroni and George sites in the Wenatchee and the backup site at MSRF Chewuch in the Methow also would increase groundwater withdrawals if the sites are used, but they are not included in this evaluation of combined impacts. If one or more of the backup sites replaces one or more primary sites, the combined effects could be locally different but would not noticeably change effects basin-wide.

Surface water use for the acclimation ponds is balanced by return flows except for short reaches between the intakes and outfalls, and groundwater use for the proposed acclimation ponds would be water-budget neutral for the Wenatchee and Methow basins.

The discharge of groundwater into the surface waters of the Wenatchee and Methow river basins may increase or decrease the water temperature locally depending on the season. Groundwater temperature would be relatively constant and stable compared to the surface water temperature, which fluctuates on a daily and seasonal basis. The amount of temperature impact would depend upon the stream-flow rate at the point of discharge and relative temperature difference; the larger the stream-flow rate and the smaller the temperature difference, the smaller the impact.

Surface water quality may be affected by a discharge of groundwater into the stream. The shallow groundwater is expected to be of similar quality to the nearby surface water because the aquifer is in hydraulic continuity. Deeper groundwater typically contains higher levels of dissolved solids and lower dissolved oxygen levels than shallow groundwater. However, groundwater quality is expected to be more stable in parameters such as temperature, turbidity and total suspended solids as compared to surface water.

Impacts to other users of the unconsolidated aquifers are not likely to occur at distances more than 2,000 feet from new points of groundwater withdrawal.

Due to the continuity of the shallow aquifers with local surface streams and relatively high transmissivity of the subsurface alluvial aquifers, withdrawal impacts to the aquifers are limited to areas near the proposed sites. Impacts are not expected to extend between sites; therefore, the combined impact of all the withdrawals is equal to the sum of the individual impacts.

3.6.4 Impacts of the No Action Alternative

Because new groundwater supplies would not be developed under the No Action Alternative, the alternative would have no direct or indirect adverse effects on groundwater, surface water, or water rights in the basins.

3.6.5 Mitigation for the Proposed Action

The following actions have been incorporated into the project design where feasible.

- For sites with enough room or access, the groundwater source would be placed downstream of the discharge into the acclimation pond to offset local impacts to surface water caused by groundwater level changes in aquifers in hydraulic continuity with surface water.
- Groundwater withdrawals would be located as close as possible to the surface water body and as far away from existing senior groundwater users as feasible to reduce the size and magnitude of the drawdown cone at distance from the site.
- As little as possible of the stream or side channel bottom would be disturbed to reduce the potential impacts to the hydraulic continuity between the surface water and shallow groundwater.

3.7 Fish

This section discusses impacts to fish species in the basin, focusing on effects to fish listed under the Endangered Species Act (ESA) and Washington Department of Fish and Wildlife's (WDFW's) Priority Habitats and Species (PHS) Program.

The Endangered Species Act of 1973 and its amendments (16 U.S.C. 1531 *et seq*.) require federal agencies to ensure that their actions do not jeopardize endangered or threatened species or adversely modify or destroy designated critical habitat. NMFS identifies marine wildlife, including anadromous fish, determined to be at risk; U.S. Fish and Wildlife Service (USFWS) is responsible for the listing status of non-marine fish and wildlife and of plants.

Under the PHS Program, WDFW catalogs habitats and species as priorities for conservation, preservation, and management. Priority species require protective measures for their survival due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance.

3.7.1 Affected Environment

Table 3-14 lists all species of fish found in waters of the Wenatchee and Methow basins, including those on ESA and PHS lists.

ESA-listed fish that are likely to be present at some hatchery and acclimation sites in both basins include spring Chinook (*Oncorhynchus tshawytscha)* (Endangered), summer steelhead (*O. mykiss)* (Threatened), and bull trout (*Salvelinus confluentus)* (Threatened).

Under ESA, an Endangered Species is any species which is in danger of extinction throughout all or a significant portion of its range; a Threatened Species is any species which is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range.

- NMFS listed the Upper Columbia River spring-run Chinook salmon Evolutionary Significant Unit (ESU) as endangered on March 24, 1999 (64 FR 14308), and its status was reaffirmed on June 28, 2005 (70 FR 37160). The ESU includes all naturally spawned populations of spring-run Chinook salmon (spring Chinook) in Columbia River tributaries upstream of the Rock Island Dam as well as six artificial propagation programs.
- NMFS originally listed the Upper Columbia River steelhead distinct population segment (DPS) as endangered on August 18, 1997 (62 FR 43937) and subsequently upgraded it to threatened status in 2009 (74 FR 42605). The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and man-made impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, as well six artificial propagation programs.
- USFWS listed Columbia River bull trout as threatened on June 10, 1998 (63 FR 31647).
- Critical Habitat was designated in the Wenatchee and Methow basins for both Chinook and steelhead in 2005 (70 FR 52630). The Wenatchee, Entiat, and Methow Rivers have been identified as core bull trout habitats for the Upper Columbia Recovery Unit, and designated as Critical Habitat October 18, 2010 (75 FR 63898).

Table 3-14. Fish species documented in the Wenatchee and Methow basins

Family & Species	Scientific Name	Wenat-chee[a]	Met-how[b]	Habitat	Origin
Lamprey Family	**Petromyzontidae**				
Pacific Lamprey	*Entosphenus tridentatus*	X	X	Larvae found in backwater silt	Native
Salmon Family	**Salmonidae**				
Mountain Whitefish	*Prosopium williamsoni*	X	X	Riffles in summer, pools in winter	Native
Pygmy Whitefish	*Prosopium coulteri*	X	X	Deep water, primarily lakes	Native
Brown Trout	*Salmo trutta*		X	Streams up to 75 degrees F.	Introduced
Cutthroat Trout	*Oncorhyncus clarki*	X	X	Cold water lakes and streams	Native
Rainbow/Steelhead	*O. mykiss*	X	X	Cold water lakes and streams	Native
Chinook Salmon	*O. tshawytscha*	X	X	Larger rivers and streams	Native
Sockeye/kokanee	*O. nerka*	X	X	Primarily lake rearing	Native
Coho Salmon	*O. kisutch*	X	X	Recently re-introduced	Native
Brook Trout	*Salvelinus fontinalis*	X	X	Cold water lakes and streams	Introduced
Bull Trout	*S. confluentus*	X	X	Cold water streams and pools	Native
Minnow Family	**Cyprinidae**				
European Carp	*Cyprinus carpio*	X	X	Shallow quiet water with dense vegetation	Introduced
Peamouth	*Mylocheilus cauinus*	X[c]		Lakes and slow stretches of rivers	Native
Chiselmouth	*Acrocheilus alutaceus*	X		Faster, warmer streams and rivers, and lakes	Native
Longnose Dace	*Rhinichthys cataractae*	X	X	Among stones at the bottom of swift streams	Native
Speckled Dace	*R. osculus*	X		Small clear well oxygenated streams	Native
Northern Pikeminnow	*Ptychocheilus oregonensis*	X	X	Lakes and slow streams	Native
Redside Shiner	*Richardsonius balteatus*	X	X	Warmer ponds, lakes, streams	Native
Sucker Family	**Catostomidae**				
Bridgelip Sucker	*Catostomus columbianus*	X	X	Bottom feeder in river backwaters and pools	Native
Largescale Sucker	*C. macrocheilus*	X	X	Bottom feeder in lakes, and pools in rivers	Native
Mountain Sucker	*C. platyrhynchus*	X		Bottom feeder in cool mountain streams	Native
Longnose Sucker	*C. catostomus*	X		Bottom feeder in lakes and streams	Native
Sunfish Family	**Centrarchidae**				
Smallmouth Bass	*Micropterus dolomieui*		X	Warm streams and lakes	Introduced
Largemouth Bass	*M. salmoides*		X	Shallow, warm weedy lakes and backwaters	Introduced
White Crappie	*Pomoxis annularis*	X	X	Lakes and streams with dense vegetation	Introduced
Catfish Family	**Ctaluridae**				
Brown Bullhead	*Ctalurus nebulosus*		X	Warm-water ponds, lakes, sloughs	Introduced
Sculpin Family	**Cottidae**				
Mottled Sculpin	*Cottus bairdi*	X[c]	X	Cold rivers	Native
Shorthead Sculpin	*C. confusus*	X[c]	X	Cold rivers	Native
Torrent Sculpin	*C. rhotheus*	X[c]	X	Cold rivers and lakes	Native
Perch Family	**Percidae**				
Stickleback	*Gasterosteus aculeatus*	X[c]		Lakes, sloughs, and slow moving streams	Native
Walleye	*Stizostedion vitreum*		X	Large lakes and streams	Introduced
Yellow Perch	*Perca flavescens*	X		Warm to cool clear lakes; slow weedy streams	Introduced

[a] Source: Wenatchee Subbasin Plan (NPCC 2004a) except where noted otherwise.
[b] Source: Methow Subbasin Plan (NPCC 2004b).; [c] Source: ISEMP database.

Table 3-15 shows fish species listed under PHS that might be found in the project area. Their status is defined under the following criteria:

Criterion 1. State-Listed and Candidate Species:

State-listed species are native fish and wildlife species legally designated as Endangered, Threatened, or Sensitive. State Candidate species are fish and wildlife species that will be reviewed by WDFW for possible listing as Endangered, Threatened, or Sensitive.

Criterion 2. Vulnerable Aggregations:

Vulnerable aggregations include species or groups of animals susceptible to significant population declines, within a specific area or statewide, by virtue of their inclination to aggregate. Examples include heron rookeries, seabird concentrations, marine mammal haulouts, shellfish beds, and fish spawning and rearing areas.

Criterion 3. Species of Recreational, Commercial, and/or Tribal Importance:

Species listed under this criterion are native and non-native fish and wildlife species of recreational or commercial importance, and recognized species used for tribal ceremonial and subsistence purposes, whose biological or ecological characteristics make them vulnerable to decline in Washington or that are dependent on habitats that are highly vulnerable or are in limited availability.

Table 3-15. PHS fish species

Species	State Status	Wenatchee Basin	Methow Basin
Pacific Lamprey *Lampetra tridentata*	PHS 3	X	
Mountain Sucker *Catostomus platyrhynchus*	PHS 1 Candidate	X	
Pygmy Whitefish *Prosopium coulteri*	PHS 1 and 2 Sensitive	X	X
Sockeye salmon *Oncorhynchus nerka*	PHS 1, 2, and 3 Candidate	X	X
Westslope Cutthroat *Oncorhynchus clarki lewisi*	PHS 3	X	X

3.7.2 Types of Impact

Potential impacts to fish from construction and operation of hatchery and acclimation facilities fall into two categories: effects from construction or use of project facilities and effects of increased coho numbers in the basins.

Facility effects:

- **Sedimentation from construction**. Construction activities can increase sediment in waterways, causing fish to avoid the area or temporarily stop feeding, or causing mortality of eggs and alevins in spawning gravel.
- **Reduced access to habitat**. Barrier nets or seines used to enclose juvenile coho during rearing and acclimation could temporarily exclude fish from existing habitat or could prevent some adults from migrating upstream. Weirs placed across streams at two sites proposed for planting adult coho could prevent larger adults of other species from migrating upstream during October and November.
- **Surface water withdrawals.** Withdrawing water during low flow periods could slow or prevent fish migration and could reduce the availability and quantity of habitat. Withdrawing water during high flow periods can improve habitat by reducing depth and velocities that are greater than optimal for fish.
- **Fish entrainment in water intake facilities.** If allowed to pass through the intake screens, juvenile fish of a small enough size could be subject to predation by coho in the acclimation ponds, and all entrained fish could have free migration delayed by the pond discharge fish screens. NMFS guidelines (NMFS 2008b) would be used for all intakes; therefore, entrainment of listed and other species is not expected and will not be discussed further.
- **Trapping of fish in juvenile and adult traps.** Traps to collect adult coho for broodstock or to monitor numbers and condition of migrating juveniles can also trap individuals of other species.

Effects of increased numbers of coho on fish:

- **Predation**. Coho juveniles could prey on smaller fish during rearing and acclimation in the ponds or during their downstream migration.
- **Competition.** Naturally produced coho smolts could compete with other fish species for habitat and food.
- **Redd disturbance**. Coho could disturb or destroy other species' redds when spawning in the natural environment.
- **Ecological balance.** Reintroducing coho in these basins could help restore the ecological balance of the system: carcasses from spawned coho could add ocean-derived nutrients to the system at a critical period—the onset of winter.
- **Harvest effects.** Implementing a harvest on coho could cause listed fish, primarily steelhead, to be caught as by-catch, since the coho and steelhead fisheries would occur at the same time.

3.7.3 Impacts of the Proposed Action

The analysis is divided into two major subsections: the effects of the development and use of facilities (Section 3.7.3.1) and the effects of increased numbers of coho in the basins (Section 3.7.3.2).

The impact analysis focuses on effects to ESA-listed fish; they are considered the most vulnerable due to their low numbers. The analysis assumes that project effects on ESA-listed fish represent the worst-case potential for effects on all fish species. Therefore, effects on other fish species are addressed only if impacts have come into question in the past as being different from those to ESA-listed fish. Effects to PHS-listed fish are summarized in Section 3.7.3.3.

3.7.3.1 Impacts of Facilities

Increased sedimentation from construction

Various construction or excavation activities are planned for 7 of the 24 primary juvenile acclimation sites in both basins and 6 of the 12 backup sites. Both the primary and backup new hatchery sites would require construction. See details in Chapter 2.

Construction required for primary acclimation sites:

- New ponds at 4 sites (Minnow, Chikamin, Twisp Weir, Newby)
- Expansion of existing ponds at 1 site (Gold)
- New wells at 2 sites (MSWA Eightmile, Twisp Weir)
- New water delivery systems at 5 sites (Tall Timber, Chikamin, MSWA Eightmile, Newby, Twisp Weir)
- New buried power lines at 1 site (MSWA Eightmile)
- New road at 2 sites (Minnow, Twisp Weir)

Construction required for backup acclimation sites:

- New ponds at 4 sites (Dryden, Squadroni, Chewuch AF, MSRF Chewuch)
- Expansion of existing pond at 1 site (Scheibler)
- New water delivery systems at 5 sites (Dryden, Squadroni, Chewuch AF, MSRF Chewuch, Utley)
- New wells at 3 sites (Dryden, Squadroni, MSRF Chewuch)
- New buried power lines at 3 sites (Dryden, Chewuch AF, MSRF Chewuch)

Construction required for hatchery sites:

Proposed Dryden Hatchery: New facility occupying 1.5 acres: hatchery building, 4 raceways, 2 rearing ponds, water pipelines, wells, waste treatment tank and wetland; 4 acres total construction disturbance.

Backup George Hatchery: New facility occupying 1.5 acres: similar facilities to proposed Dryden Hatchery except no waste treatment wetland; 2.5 acres total construction disturbance.

Acclimation and hatchery facilities would be constructed during the summer months of one year, probably 2012 or 2013. Excavation and construction of acclimation ponds, water supply and discharge lines or channels, and electrical lines would have the most potential to increase sedimentation, with somewhat less potential from road reconstruction and maintenance, where physical impacts would be limited to road crossings or where fish-bearing streams are close to the road.

Construction at each acclimation site would take from one to 60 days (Tall Timber would take the longest, at 2 months). Hatchery construction would take approximately 5 months.

Table 3-16 lists life stages of ESA-listed fish that could be present during construction activities.

Table 3-16. ESA-listed fish by life stage present during construction of project facilities

		Spr Chinook [a]			Steelhead [a]					Bull trout [a]		
Wenatchee Basin		adults	eggs/alevin	parr	adults	eggs/alevin	fry	parr	smolts	adults	eggs/alevin	sub-adults
Primary Acc. Sites	**Affected stream**											
Chikamin	Chikamin Cr.			P	P	P	P	P	P	P	A	P
Minnow	Minnow Cr.			P				P	P	A		P
Tall Timber	Napeequa	P	P	P	U	U	U	U	U	A		A
Backup Acc. Sites	**Affected stream**											
Scheibler	Chumstick							A	A			
Squadroni	unnamed											
Hatchery Sites	**Affected stream**											
Dryden (primary)[b]	Peshastin/ Wenatchee	A		A	P	P	P	P	P	A		A
George (backup)	Wenatchee R.	P	P	P	P	P	P	P	P	A	U	A
Methow Basin												
Primary Acc. Sites	**Affected stream**											
Gold	S. Fork Gold Cr.				P	A	A	P	P	A		P
MSWA Eight Mile	Chewuch side channel							P	P			
Newby	Newby Cr.							U	U	U		U
Twisp Weir	Twisp R.	P	P	P	P	P	P	P	P	P		P
Backup Acc. Sites	**Affected stream**											
Chewuch AF	Chewuch R.	A	A	A	A	A	A	A	A	A		A
MSRF Chewuch	Chewuch R.	A	A	A	A	A	A	A	A	A		A
Utley	unnamed							U	U			

a. Presence denoted by "P" indicates presence well documented, "A" presence is assumed, "U" presence possible but unlikely, and blanks indicate presence not expected.
b. Dryden is both a primary site for a small hatchery, and a backup overwinter acclimation site.

The physical impacts from construction would be minimal for all fish species. The acclimation sites generally have been modified by humans and are regularly subject to human activity. The potential for impacts to listed fish is expected to be greatest when flow is provided to the site and discharged into the nearest stream. A light plume of suspended fine sediments could be discharged into the stream and dispersed downstream. These events are rarely lethal to fish, but their response can range from avoidance to temporary cessation of feeding activities (Hicks et al. 1991). Large amounts of fine sediment deposited on spawning gravels can reduce interstitial flow and dissolved oxygen levels causing mortality of eggs and alevins (Koski 1966, Meehan and Swanston 1977, Everest et al. 1987).

Construction of new surface water intake and discharge structures at facility sites would remove small amounts of streamside (riparian) vegetation. Vegetation along waterways provides a number of benefits to fish habitat, including shade (temperature control), bank stability (erosion control), woody debris (flow control and refuge), nutrients that provide a basis for the aquatic food chain (e.g., from decaying leaves and grasses), and sources of prey (e.g., insects and benthic invertebrates). The area affected by these activities would be very small (10 linear feet per site), and the number of individual fish adversely affected would be few, if any.

As listed in Section 3.7.5, best management practices for erosion and sedimentation control would be followed during construction to prevent discharging suspended sediments into the stream. For these reasons, construction impacts to any fish, including ESA-listed fish, are expected to be minimal.

Reduced access to habitat

An impact to fish that would result from project facilities is related to access to habitat during rearing and acclimation periods. Acclimation facilities in the natural environment would use nets to enclose coho for a 6-week to 7-month period in the winter and/or spring. Some of this existing natural habitat might currently be used by other fish, which could be temporarily excluded from that habitat during coho acclimation. The amount of area that would be unavailable during rearing/acclimation would be limited to the area enclosed by seine or barrier nets at each acclimation site that is currently accessible to other fish (not all sites are currently accessible). The relative impact on other species from being excluded from this habitat would depend to some extent on the local availability of similar habitat. Section 3.7.5 lists measures that would be used to minimize impacts of reduced access to habitat.

The analysis of impacts focuses on juveniles of listed species. Adults spawn in the channels, streams, and rivers near acclimation sites but generally not in the ponds used for acclimation; however, adult access would not be affected because even the proposed in-channel ponds would retain passage.

In the Combined Effects section, numbers of ESA-listed juveniles potentially displaced from each site are calculated. The analysis assumes that impacts to ESA-listed fish represent the worst-case scenario for effects on all fish due to the low numbers and vulnerability of listed species. Site-specific habitat access effects are discussed later in this subsection, and summarized in Tables 3-18, 3-19, 3-21, and 3-22. Also see Appendix 9.

This analysis does not include habitat at sites used in the existing program unless the period of displacement increases (i.e., a site currently used only in spring is proposed to be used as an overwinter site), because continued use of an existing site for the same period of time would not change the existing availability of habitat for other species during that period. In other words, the current program already makes a small amount of formerly accessible habitat inaccessible at Butcher, Beaver, and Coulter ponds. The cumulative effects of habitat displacement for all sites proposed for use in the program—those in use now and those proposed for use in the future—are discussed in Section 3.15.3.

Wenatchee Basin Primary Sites

Table 3-17 lists life stages and size ranges of ESA-listed fish that could be present at proposed overwinter rearing sites (November through early May) and at spring-only acclimation sites (mid-March through mid-May). Leavenworth NFH is not included in the list because effects of its construction and use have been evaluated in other processes and would not change as a result of the Mid-Columbia Coho Restoration Program.

Table 3-18 lists proposed overwinter sites in the Wenatchee basin where access to existing habitat could be blocked for 6 - 7 months of each year (November-May), and Table 3-19 shows the same information for spring-only acclimation sites (mid-March through mid-May). Both tables show the species potentially affected and the amount of area currently accessible that could be blocked. The tables present the worst-case scenario for potentially affected species. In some cases, data on presence of ESA-listed fish were limited to one or two records, with the possibility that some species were misidentified (e.g., rainbow trout juveniles could have been mistaken for steelhead, or summer Chinook for spring Chinook). However, consultants assumed presence of listed fish even if only one record was found or if they were found elsewhere in the watershed, unless other factors obviously excluded them.

Table 3-17. ESA-listed fish by life stage present during overwinter rearing and spring acclimation in the Wenatchee basin

Site name	Affected stream	Spring Chinook [a]				Steelhead [a]				Bull trout [a]			
		eggs/alevin	fry	parr	smolts	adults	eggs/alevin	parr	smolts	adults	eggs/alevin	young-of-year	sub-adults
Primary Sites													
Beaver	Beaver Creek			U	U	P	P	P	P	U			U
Brender	Brender Creek			U	U			P	P				
Butcher	Butcher Creek		A	A				A	A				
Chikamin	Chikamin Creek			P	P	P	P	P	P	P	A	P	P
Clear	Clear Creek					P	P	P	P				
Coulter	Coulter Creek					A	A	A	A				
Minnow	Minnow Creek			P	P			P	P	A			P
Rohlfing	unnamed							U	U				
Tall Timber	Napeequa	P	P	P	P	U	U	U	U	A			A
Two Rivers	none												
White River Springs	unnamed			A	A			A	A	A			A
Backup Sites													
Allen	Allen Creek												
Coulter/ Roaring	Coulter/ Roaring					P	A	P	P				
Dryden[b]	Peshastin/ Wenatchee			A	P	P	P	P	P	A			A
McComas	White River	P	P	P	P	U		U	U	P		A	P
Scheibler	Chumstick							A	A				
Squadroni	unnamed												

[a] Presence denoted by "P" indicates presence well documented, "A" presence is assumed, "U" presence possible but unlikely, and blanks indicate presence not expected.
[b] Dryden is both a primary site for a small hatchery facility, and a backup overwinter rearing site.

Table 3-18. ESA-listed juveniles potentially displaced from currently accessible Wenatchee basin habitat November - May

Site name	Accessible area excluded (acres)	Juveniles potentially displaced		
		Chinook	Steelhead	Bull trout
Clear	0.24	no	yes	no
Rohlfing	0.17	no	yes	no
Two Rivers		no	no	no
White River Springs	0.08	yes	yes	yes
Total	**0.49**			

Table 3-19. ESA-listed juveniles potentially displaced from currently accessible Wenatchee basin habitat March - May

Site name	Accessible area excluded (acres)	Juveniles potentially displaced		
		Chinook	Steelhead	Bull trout
Brender	0.08	yes	yes	no
Chikamin		no	no	no
Minnow		no	no	no
Tall Timber		no	no	no
Total	**0.08**			

Methow Basin Primary Sites

Table 3-20 lists life stages of ESA-listed fish that could be present at proposed overwinter rearing sites and at spring-only acclimation sites. Tables 3-21 and 3-22 show the amount of habitat excluded from use by listed species for overwinter and for spring-only acclimation sites. Winthrop NFH is not included in the list because effects of its construction and use have been evaluated in other processes and would not change as a result of the Proposed Action.

Table 3-20. ESA-listed fish by life stage present during overwinter rearing and spring acclimation activities in the Methow basin

Site name	Affected stream	Spring Chinook [a]				Steelhead [a]				Bull trout [a]			
		eggs/alevin	fry	parr	smolts	adults	eggs/alevin	parr	smolts	adults	eggs/alevin	young-of-yr	sub-adults
Primary Sites													
Goat Wall	unnamed			U	U			A	P	A			P
Gold	S Fork Gold					P	A	P	P	A			P
Heath	Heath ponds (spring)			P	P			P	P	P			P
Lincoln	Twisp River	P	P	P	P	P	P	P	P	P			P
Lower Twisp	Twisp River	P	P	P	P	P	P	P	P	P			P
Mason	Eightmile			A	A	P	A	P	P	A			P
MSWA Eightmile	Chewuch side chan.			A	A			P	P	A			A
Newby	Newby Creek												
Parmley	Beaver Creek					P	P	P	P	P			P
Pete Cr. Pond	Chewuch River	A	A	P	P	P	P	P	P	A			P
Twisp Weir	Twisp River	P	P	P	P	P	P	P	P	P			P
Backup Sites													
Balky Hill	unnamed							U	U	U			U
Biddle	Wolf Creek	A	A	P	P	P	P	P	P	P			P
Chewuch AF	Chewuch River	A	A	A	A	A	A	A	A	P			P
MSRF Chewuch	Chewuch River	A	A	A	A	A	A	A	A	P			P
Poorman	unnamed			U	U			U	U	U			U
Utley	unnamed							U	U				

[a] Presence denoted by "P" indicates presence well documented, "A" presence is assumed, "U" presence possible but unlikely, and blanks indicate presence not expected.

Table 3-21. ESA-listed juveniles potentially displaced from currently accessible habitat at primary Methow basin sites November - May

Site name	Accessible area excluded (acres)	Juveniles potentially displaced		
		Chinook	steelhead	bull trout
Heath	0.15	yes	yes	yes
Lincoln	0.18	yes	yes	yes
Lower Twisp	0.05	yes	yes	yes
Twisp Weir		no	no	no
Total	**0.38**			

Table 3-22. ESA-listed juveniles potentially displaced from currently accessible habitat at primary Methow basin sites March - May

Site name	Accessible area excluded (acres)	Juveniles potentially displaced		
		Chinook	steelhead	bull trout
Goat Wall	0.08	yes	yes	yes
Gold	0.08	no	yes	yes
Mason		no	no	no
MSWA Eightmile	0.14	yes	yes	yes
Newby		no	no	no
Parmley	0.08	no	yes	yes
Pete Cr. Pond	0.20	yes	yes	yes
Total	**0.58**			

Backup Acclimation Sites

In the Wenatchee basin, two backup acclimation sites are likely to exclude other fish from currently accessible habitat. **Coulter/Roaring** could exclude steelhead from 0.17 acre of an existing 5.8-acre pond for six weeks in the spring. **Scheibler,** if used and the pond is expanded, could exclude steelhead from 0.03 acre of habitat for six weeks in the spring. In the Methow basin, only one backup acclimation site, **Biddle,** is likely to exclude other fish from existing habitat. Based on available data, Chinook fry, parr, and smolts; steelhead parr and smolts; and bull trout sub-adult and adult migrants may be present in the ponds during the acclimation period. If this site is used, these fish would be excluded from the enclosed area (0.08 acre of the 0.17-acre existing pond) for six weeks during the spring.

Adult Plant Sites

Two streams, one in each basin, are proposed as sites to plant adult coho. The **Dirty Face** site (Figure 10k in Appendix 4) is on an unnamed stream in the Wenatchee basin and the **Hancock** site (Figure 10t in Appendix 4) is on Hancock Creek in the Methow basin. Temporary weirs would be installed in these streams from early October through November. Adult coho salmon would be planted upstream of the weir to allow them to spawn in available habitat. Larger adults of other species would be blocked from migrating in and out of these streams when the weirs are in place; smaller fish would be able to pass the weirs. Adults of listed species would not be affected, however, because fall spawning species such as Chinook and bull trout are not known to spawn in these tributaries. Steelhead are known to spawn in Hancock Creek, and 23 spawning redds were counted in the lower 0.7 miles of Hancock in 2007 (Snow et al. 2008). However, adult steelhead are not expected to be present when the weir is in use and any steelhead fry will have emerged from the gravel well before coho spawn.

Combined Effects of Excluding Listed Fish from Incubation/Rearing and Acclimation Sites

Reduced access to existing habitat is a likely impact to ESA-listed fish that would result from newly proposed coho rearing and acclimation activities. Habitat affected would be limited to the amount of area enclosed by seine or barrier nets at each coho acclimation site to which listed fish currently have access. This analysis does not include habitat at sites used in the existing program unless the period of exclusion increases, because continued use of those sites for the same period of time would not change the existing availability of habitat for other species during that period. It also does not include the backup sites. The cumulative effects of habitat displacement for all sites proposed for use in the program—those in use now and those proposed for use in the future—is discussed in Section 3.15.3.

The period of time listed fish would be prevented from using these habitats would range from 6 weeks to 7 months, depending on whether the acclimation site is an overwinter site or spring-only site. Impacts would be offset to some degree by newly constructed habitat.

The relative impact on listed species from being excluded from this habitat depends to some extent on the availability of similar habitats within each basin. Because a comprehensive habitat database was not available for these basins, an alternate method was needed to evaluate the relative magnitude of these impacts to ESA-listed populations. The method used was to estimate the number of juvenile species of listed fish that might be excluded from each site, and then to calculate how many adult fish these juveniles represented. The assumptions that went into these estimates are summarized below.

Cramer and Ackerman (2009) demonstrated that the carrying capacity of habitat for various salmonids can be predicted based on channel units (e.g., pool, riffle, glide) and maximum fish densities based on a species' life-stage and habitat preference. The proposed rearing and acclimation sites are similar to beaver pond and backwater habitats. In the natural environment, coho prefer these slower velocity habitats above other habitats with stronger current (Solazzi et al. 1998). While other salmonid parr use these habitats, many prefer pools in streams or other channel habitats with more velocity (Cramer and Ackerman 2009).

For this analysis, average fish (parr) densities for each species were based on literature values for similar habitats, or average values observed in the Chiwawa watershed (Hillman et al. 2008). A value of 291 Chinook parr per acre was used based on average densities in Chiwawa pool habitats (720/ha) between 1992 and 2007 (Hillman et al. 2008). This assumption is likely high because juvenile Chinook are rarely found in off-channel habitats or beaver ponds (Murphy et al. 1989). In addition, during the winter, Chinook are usually associated with cobble substrate (Hillman et al. 1987, Van Dyke et al. 2009) rather than fine sediments typically associated with backwater habitats. Therefore, juvenile Chinook are unlikely to be found in the acclimation ponds, and the estimate of 291 parr/acre should be considered very conservative. A value of 162 steelhead per acre was based on average winter densities of similar habitat in Oregon (Johnson et al. 1993). Finally, the analysis assumed a density of 7.6 sub-adult or adult bull trout per acre wherever migratory fish were expected to occur, and 23.6 juvenile bull trout per acre wherever spawning and rearing was expected to occur. The bull trout densities were based on sampling in the Chiwawa watershed (Hillman et al. 2008).

The assumptions are made with the knowledge that fish densities vary seasonally and annually depending on environmental conditions and population numbers. Further, excluding ESA-listed fish from these habitats would presumably affect the populations only if the available habitat is fully seeded. If habitats are not at carrying capacity, displaced fish could occupy other underutilized habitat. However, this analysis provides a context to assess the relative magnitude of impacts due to acclimation and rearing.

The analysis suggests that the number of juvenile ESA-listed fish excluded during acclimation and rearing would be relatively small compared to overall basin populations.

Estimates indicate that a total of 134 juveniles of two species, spring Chinook and steelhead, might be excluded annually from proposed new or expanded-use sites in the Wenatchee basin, with the majority being steelhead (91) (Table 3-23). Between the years 2002 and 2007, the range of wild production was estimated to be 55,619 – 311,669 Chinook smolts and 17,499 – 85,443 steelhead smolts annually in the entire Wenatchee basin (Hillman et al. 2008). Using an average smolt-to-adult survival rate of 0.00465 for hatchery spring Chinook and 0.0105 for summer steelhead from the Wenatchee basin (Hillman et al. 2009), the number of juveniles excluded would represent 0.2 Chinook and 0.96 steelhead adult equivalents.

Table 3-23. Juvenile Chinook, steelhead, and bull trout potentially displaced from currently accessible habitat at primary rearing and acclimation sites in the Wenatchee basin

Site name	Overwinter	Accessible area excluded (acres)	Potential juveniles displaced [a]		
			Chinook	Steelhead	Bull trout
Brender		0.08	23	13	0
Clear	Y	0.24	0	39	0
Rohlfing	Y	0.17	0	28	0
White River Springs	Y	0.08	20	11	1
Total		**0.57**	**43**	**91**	**1**
Wenatchee annual smolt production range (2002-2007)[b]			55,619 - 311,669	17,499 - 85,443	not available

[a] Based on assumed fish densities.
[b] Data source: Hillman et al. (2008).

In the Methow basin, approximately 388 juveniles of the two species are projected to be excluded annually from new or expanded-use acclimation and rearing sites, with the majority being spring Chinook (233) (Table 3-24). Between the years 2000 and 2008, the range of wild production was estimated at 15,306 – 33,710 Chinook smolts and 8,809 – 15,003 steelhead smolts annually in the entire Methow basin (data provided by Alex Repp, WDFW, personal communication). Using the same smolt-to-adult survival rates used above, the number of juveniles potentially excluded from acclimation sites in the Methow basin would represent 1.08 spring Chinook and 1.63 summer steelhead adult equivalents.

Table 3-24. Juvenile Chinook, steelhead, and bull trout potentially displaced from currently accessible habitat at primary rearing and acclimation sites in the Methow basin

Site name	Overwinter	Accessible area excluded (acres)	Potential juveniles displaced [a]		
			Chinook	steelhead	bull trout
Goat Wall		0.08	23	13	1
Gold		0.08	0	13	0
Heath	Y	0.15	44	24	2
Lincoln	Y	0.18	52	29	2
Lower Twisp	Y	0.05	15	8	1
MSWA Eightmile		0.14	41	23	1
Parmley		0.08	0	13	1
Pete Cr. Pond		0.20	58	32	2
Total		**0.96**	**233**	**155**	**10**
Methow annual smolt production range (2004-2008)[b]			15,306 - 33,710	8,809 - 15,003	not available

[a] Based on assumed fish densities.
[b] Data source: Alex Repp, WDFW, personal communication.

No estimates of juvenile bull trout abundance are available, but the number of juveniles projected to be excluded from sites in each basin was very small (1 in the Wenatchee and 10 in the Methow).

Effects on the amount of side channel habitat and designated critical habitat at individual coho acclimation sites

Excluding juveniles from rearing and acclimation sites does not necessarily mean these fish would not survive. Juveniles excluded from these habitats would seek out other suitable habitat in the area. Assuming that other habitats are not fully occupied by other fish, these excluded juveniles likely would continue to rear in the other habitat.

However, in some project areas, off-channel habitat is limited, leading to concerns that even a small reduction in available habitat could adversely affect listed fish. In an attempt to quantify the impact of these reductions in accessible habitat in the vicinity of proposed primary acclimation sites, consultants reviewed habitat surveys and aerial photography to identify, if possible, the amount of off-channel habitat within designated stream reaches compared to the amount that program activities would temporarily exclude from use by listed fish. Table 3-25 shows the results.

It should be noted that both basins in their entirety are designated critical habitat for bull trout; designated critical habitat for spring Chinook and steelhead is more tributary-specific.

Wenatchee discussion: Survey data on habitat types in the Wenatchee basin is limited; for proposed acclimation sites in the Wenatchee basin that could reduce access to existing habitat, no habitat-type data based on surveys was available. Conclusions about the effect of the reduced amount of habitat on listed fish are based on other information such as aerial photography and analysts' knowledge of individual sites.

<u>Rohlfing</u> is currently used for coho acclimation, but only during spring. The proposed action would make Rohlfing an over-winter site, thus increasing the amount of time habitat is unavailable to other fish from 6-8 weeks to 6-7 months. This increase is expected to have a negligible effect on listed fish. Table 3-17 shows that Chinook are not known to be present and the presence of steelhead is unlikely. The site is not in designated critical habitat for either species. Although Rohlfing is in designated critical habitat for bull trout, their presence has not been documented (Table 3-17). As well, Rohlfing is dry during summer and early fall so is not considered accessible to fish during most of the off-season.

<u>Clear</u> is one of three proposed acclimation sites, including Chikamin and Minnow, located in the 117,000-acre Chiwawa River watershed. Although the Chiwawa River watershed represents 44% of the Chinook, 12% of the steelhead, and 78% of the bull trout spawning redds counted in the Wenatchee basin, and Clear Creek is designated critical habitat for steelhead and bull trout, only steelhead have been documented in Clear Creek (Table 3-17). Eight steelhead spawning redds were counted in Clear Creek in 2007 (Hillman et al. 2008). Based on available data, steelhead adults, eggs, parr and smolts are expected to be present during the rearing period.

Clear Creek flows directly into a series of three constructed ponds; the upper pond is proposed as an overwinter rearing site with no construction planned. About 0.24 of the 0.52-acre existing pond (46%) would be enclosed by a temporary seine net. Based on aerial photography, this man-made pond makes up nearly all the side-channel habitat in lower Clear Creek (Table 3-25). However, the Chiwawa River watershed has an extensive network of ponds, beaver canals, side channels, abandoned oxbows and other wetlands (NPCC 2004a). Therefore, the effect of excluding 0.24 acre of currently accessible pond would not have a significant adverse effect on steelhead or on critical habitat for steelhead and bull trout.

Table 3-25. Existing side-channel habitat near proposed new Wenatchee and Methow basin acclimation sites compared to amount excluded by acclimation sites

Site Name	Stream	Pond type	Proposed exclusion area (acre)	Existing pond area (acre)	Percent of pond excluded	Percent of reach made up of side-channel habitat	Total side channel habitat in reach (acres)	Reach Length (mi)	Percent of available side-channel habitat in reach excluded	Comment
Wenatchee Sites ***Primary, no Construction***										
Rohlfing	Unnamed	Existing manmade	0.17	0.17	100%	no survey data	no survey data	no survey data	no survey data	Percent side-channel habitat in Nason Creek Reach 5, located approx. 800 feet downstream, is 1.4% (from USFS 2007 Nason Creek Stream Survey Report)
White River Springs	White	Existing beaver pond	0.08	0.20	40%	no survey data	no survey data	no survey data	no survey data	No habitat survey was available for the reach
Clear	Clear Creek	Existing manmade	0.24	0.52	46%	no survey data	no survey data	no survey data	no survey data	Aerial photo analysis suggests this man-made pond makes up nearly all of the side-channel habitat in lower Clear Creek.
Brender	Mission/ Wenatchee	Existing manmade	0.08	0.27	30%	no survey data	no survey data	no survey data	no survey data	No habitat survey was available for the reach
Methow Sites ***Primary, with Construction***										
MSWA Eightmile	Chewuch	Existing side channel	0.14	0.64	22%	10.7%	2.6	2.2	5.4%	Acres of total side-channel habitat in the reach were inferred from data in the USFS 2008 Chewuch Stream Survey Report
Lincoln	Twisp	Existing side channel	0.18	0.31	57%	10.9%	2.48	3.9	7.3%	Acres of total side-channel habitat in the reach were obtained from the USFS 2001 Twisp River Stream Survey Report, amended to include the off-channel pond complex where the acclimation site is proposed.
Gold	Gold	Existing manmade	0.08	0.10	79%	no survey data	no survey data	no survey data	no survey data	Percent side-channel habitat in Reach 2, located 1.7 miles upstream, is 3.3% (from USFS 2009 Stream Survey Report)

Site Name	Stream	Pond type	Proposed exclusion area (acre)	Existing pond area (acre)	Percent of pond excluded	Percent of reach made up of side-channel habitat	Total side channel habitat in reach (acres)	Reach Length (mi)	Percent of available side-channel habitat in reach excluded	Comment
Methow Sites Primary, no Construction										
Goat Wall	Methow	Existing stream channel	0.08	0.63	13%	no survey data	no survey data	no survey data	no survey data	No habitat survey was available for the reach
Pete Creek	Chewuch	Existing side channel	0.20	0.23	87%	2.9%	3.93	3.4	5.1%	Acres of total side-channel habitat in the reach were obtained from the 2008 USFS Chewuch River Stream Survey Report, amended to include the off-channel pond complex where the acclimation site is proposed.
Heath	Methow	Existing manmade	0.15	0.72	22%	41.6%	9.9	1.7	1.5%	Acres of total side-channel habitat in the reach were obtained from the USFS 2006 Methow River (Big Valley) Stream Survey Report
Parmley	Beaver	Existing manmade	0.08	0.11	72%	5.3%	0.11	0.5	72.7%	Acres of total side-channel habitat in the reach were obtained from the USFS 2006 Beaver Creek Habitat Assessment Report
Lower Twisp	Twisp	Existing manmade	0.05	0.05	100%	37.0%	3.8	1.2	3.7%	Acres of total side-channel habitat in the reach were obtained from the 2009 Twisp River Stream Habitat Assessment Report (Inter-fluve 2010) amended to include the connected off-channel pond complex in the reach.

White River Springs is also proposed as an over-winter site, with no construction activity planned. It is an existing beaver pond that is fed by unnamed spring-fed streams. Along with Tall Timber, it is located within the 99,956-acre White River watershed. It is designated critical habitat only for bull trout. The watershed represents 6% of the Chinook, 0.2% of the steelhead, and 10% of the bull trout spawning redds counted in the Wenatchee basin. No sampling data were found for the site itself. This stream is a tributary of the White River which is listed within the spawning and rearing distribution of Chinook, steelhead, and bull trout. Because very few steelhead spawn in the White River drainage and no steelhead have been documented in this tributary, steelhead are not expected at this site. However, Chinook parr and smolts would be present during the acclimation period. Bull trout sub-adult and adult migrants are expected to migrate upstream and be present during the acclimation period. Although bull trout fry are assumed to be migrating down White River, they are not expected to move upstream to this site.

There is approximately 0.2 acre of ponds at the White River Springs site. A seine net would block 0.08 of an acre of this total during acclimation each year from December through early May, through 2028. This blocked area is upstream of the remaining pond area, which would remain accessible during acclimation. It is unclear whether there is accessible habitat upstream of the ponds, but if so, it would be blocked to fish access. As shown in Table 3-23, in the worst case this would affect an estimated 20 juvenile Chinook if there is no other available habitat; and 11 steelhead juveniles and one juvenile bull trout, if they are in the area. Approximately 0.08 of an acre of critical habitat for bull trout would be affected. However, the White River drainage contains high quality, complex habitat with refuge and rearing habitat for multiple life stages and life histories (NPCC 2004a).

Brender is proposed as a spring-only acclimation site and is the only site proposed in the 59,712-acre Mission Creek watershed. Brender Creek flows directly into the existing pond and is designated critical habitat for steelhead. Spawning steelhead recently have been documented in the Mission Creek drainage (K. Murdoch, YN, pers. comm. 12/9/2011). Juvenile Chinook and steelhead rearing also has been documented. SalmonScape lists spring Chinook presence in Brender Creek. One catch record of fish classified as spring Chinook was found for Brender Creek in 1998 (USFS database). A 2007 electrofishing survey conducted in Mission Creek captured 104 rainbow/steelhead but failed to capture any Chinook salmon (ISEMP database). It is likely that Chinook salmon observed in Mission Creek were summer Chinook which are not ESA-listed. However, the possibility that juvenile spring Chinook occasionally rear in the drainage under some conditions cannot be ruled out. Although the site is within bull trout critical habitat, bull trout presence has not been documented in Brender Creek.

Approximately 0.08 of the 0.27-acre existing pond (30%) would be enclosed by a temporary seine net. This type of habitat is limited in the Mission Creek watershed due to development within the floodplain (NPCC 2004a). Based on available data, Chinook parr and smolts and steelhead parr and smolts are assumed to be present during the acclimation period. An estimated 23 juvenile Chinook and 13 juvenile steelhead would not be able to use this portion of the pond annually for 6-8 weeks during the spring through 2028 or until project goals are met.

Methow discussion: Habitat survey data are more available for the Methow basin than for the Wenatchee basin. Table 3-25 shows that most of the proposed new sites that would exclude currently accessible habitat have comparable habitat in the vicinity. For the spring-only acclimation sites of MSWA Eightmile and Pete Creek (both designated critical habitat for spring Chinook, steelhead, and bull trout), only about 5% of the available side channel habitat in the reach would be excluded from use by listed fish. For the over-winter sites of Lincoln (designated critical habitat for all 3 species), Heath (critical habitat for bull trout) and Lower Twisp (designated critical habitat for all 3 species), between 1.5% and 7.3% of available side-channel habitat would be excluded for the 6-7 month rearing period. For these sites, the amount of habitat excluded from use by ESA-listed fish is not expected to noticeably affect individual fish.

<u>Gold</u>: South Fork Gold Creek is a tributary of Gold Creek located in the Lower Methow River. A portion of the South Fork Gold Creek flow at RM 1.6 is diverted into a series of man-made ponds proposed as a spring acclimation site. The proposal is to excavate accumulated sediments to increase the depth of the ponds. During acclimation, approximately 0.08 of the 0.10-acre existing pond (79%) would be enclosed by a temporary seine net.

SalmonScape lists Chinook salmon presence as "presumed" in South Fork Gold Creek. However, sampling data to confirm their presence near the acclimation site was not found. USGS sampling confirmed the presence of rainbow/steelhead adults and juveniles in South Fork Gold Creek near the acclimation site (Pat Connolly, USGS, personal communication). South Fork Gold accounted for an average of 11% of the steelhead redds counted in the Lower Methow River between 2005 and 2007 (Snow et al. 2008). South Fork Gold Creek is designated critical habitat for steelhead and bull trout. Based on available data, steelhead adults, eggs, parr and smolts; and bull trout sub-adult and adult migrants are expected to be present during the acclimation period. The lower 3.5 miles of Gold Creek has had rip-rap placed along the banks. No habitat data were found for the lower 2.1 miles of South Fork Gold Creek where the proposed acclimation site is located. A survey of the stream was conducted on USFS land upstream (RM 2.1-5.5) in 1996 (unpublished data, Gene Shull USFS, personal communication). This survey indicated that off-channel habitat was limited to a small number of old beaver dams scattered throughout that reach.

While these data and Table 3-25 suggest that excluding ESA-listed fish for 6-8 weeks from the 0.08 acre of currently accessible habitat in this area of limited side-channel habitat might be more noticeable than at other sites, some of the effect might be compensated for by the fact that excavating the ponds could increase rearing capacity for native fish by 7,000 cubic feet during periods when coho are not at the site, although the actual surface area would not increase. As well, passage to upstream habitat would not be blocked during coho acclimation. The estimated number of steelhead juveniles affected would be 13. Juvenile bull trout are not expected to be present during the acclimation period and upstream migration of adults or sub-adults would not be blocked.

<u>Goat Wall:</u> A disconnected side channel of the Methow River is fed by groundwater and surface water diverted from Gate Creek. This is designated critical habitat for bull trout only. The Goat Wall site is located in a portion of the Methow River that has no surface flow during some fall and winter months. No construction is planned for this site.

Approximately 0.08 acre (13%) of approximately 0.63 acre of accessible channel would be enclosed by a seine net system for 6-8 weeks in spring. No ESA-listed fish have been documented spawning in this stream. On average, 7% of the Chinook and 8% of the steelhead spawning redds counted in the Upper Methow were upstream of this site (Snow et al. 2008). Based on an onsite snorkel survey, steelhead parr and smolts, and bull trout sub-adult and adult migrants are expected to be present during the spring acclimation period. Habitat survey data were not available for this site; however, because only 13% of the currently accessible 0.63 acre-site would be excluded from use by other fish; and because passage in the existing channel would be maintained during the acclimation period; the effect on steelhead and bull trout of that amount of temporary habitat reduction is expected to be negligible.

At Parmley, a portion of the surface water from Beaver Creek is currently diverted into a farm pond proposed as a spring acclimation site. Beaver Creek represented an average of 9% of the steelhead spawning redds counted in the Lower Methow between 2004 and 2007 (Snow et al. 2008). The percent of steelhead redds counted in Beaver Creek above this site has varied from 4% in 2005 to 50% in 2007. Beaver Creek is designated as critical habitat for steelhead and bull trout.

Based on existing data, steelhead adults, eggs, parr and smolts; and bull trout sub-adult and adult migrants are expected to be present in Beaver Creek during the 6-8 week acclimation period. Approximately 0.08 of the 0.11-acre pond would be enclosed by a temporary seine net. It appears that the existing man-made 0.11-acre pond at the Parmley site constitutes 100% of the side-channel habitat in the half-mile reach of Beaver Creek in the vicinity of the pond (Table 3-25). A habitat assessment of Beaver Creek conducted by the USFS indicated that side channel/off-channel habitat is very limited from RM 5.8 to 9.3 (unpublished data, Gene Shull, USFS, personal communication). The reach of Beaver Creek that includes the Parmley site (RM 6.6 to 7.5) contained some of the best side channel/off-channel habitat surveyed. However, estimates show only 13 steelhead juveniles and 1 bull trout juvenile would be potentially affected at this site (Table 3-24). As described below, a habitat improvement project recently completed near the Parmley site should mitigate some of the impact.

In 2009, the Methow Salmon Recovery Foundation completed a BPA-funded project to increase channel complexity and meander for spawning and improved rearing habitat in a 0.38 mile segment of Beaver Creek. The project is located less than a half mile downstream of the Parmley acclimation site (Figure 3-8 in Section 3.15.3). This project relocated 1,400 feet of riprapped channel into the historic channel through selective removal of rip-rap embankments, and placement of channel-forming structures (log jams, root wad revetments, rock veins). Cattle exclusion fencing and riparian bank plantings were placed to ensure that restored conditions will be maintained. Approximately five acres of riparian vegetation were planted to provide shade, bank stability and future wood recruitment. This project will provide more rearing habitat in the vicinity of the Parmley site that may offset the temporary loss due to the barrier nets, although it is not off-channel habitat.

Tables 3-26 and 3-27 summarize existing spring Chinook, steelhead, and bull trout critical habitat that would be excluded from use by listed fish for periods of 6-8 weeks (6 spring acclimation sites) to 7 months (6 overwinter acclimation sites) annually until 2028.

Table 3-26. Wenatchee basin critical habitat temporarily excluded from access by ESA-listed fish

Site name	Overwinter	Accessible area excluded (acres)	Critical habitat excluded (acres)		
			Chinook	Steelhead	Bull trout
Brender		0.08		0.08	0.08
Clear	Y	0.24	0.24	0.24	0.24
Rohlfing	Y	0.17			0.17
White River Springs	Y	0.08			0.08
Total excluded		**0.57**	**0.24**	**0.32**	**0.57**

Table 3-27. Methow basin critical habitat temporarily excluded from access by ESA-listed fish

Site name	Overwinter	Accessible area excluded (acres)	Critical habitat excluded (acres)		
			Chinook	Steelhead	Bull trout
Goat Wall		0.08			0.08
Gold		0.08		0.08	0.08
Heath	Y	0.15			0.15
Lincoln	Y	0.18	0.18	0.18	0.18
Lower Twisp	Y	0.05	0.05	0.05	0.05
MSWA Eightmile		0.14	0.14	0.14	0.14
Parmley		0.08		0.08	0.08
Pete Cr. Pond		0.20	0.20	0.20	0.20
Total displaced		**0.96**	**0.53**	**0.73**	**0.96**

Surface water withdrawals

Acclimation Sites

Three primary sites in the Wenatchee basin (Dryden, Chikamin, and Tall Timber) and two in the Methow basin (Twisp Weir and Newby) would require new surface water withdrawals; one backup site (George hatchery site in the Wenatchee) would also require new surface water withdrawals. These withdrawals would have local impacts to surface water from the point of withdrawal to the point of discharge—a distance of 1,500 feet or less. The impacts to listed fish would be limited to the affected portion of the stream and would vary depending on stream flow, species and life-stage. In-stream flows established by WDOE would be maintained. Water withdrawals at the sites would cause minor to negligible seasonal decreases or increase in critical habitat for spring Chinook, steelhead, and bull trout at these sites.

Two different models were used to predict impacts to listed fish. The models and methods used are described in Appendix 10.

The maximum amount of water proposed for withdrawal at the Chikamin site would result in a very small reduction in habitat for all species. The reduction due to the withdrawal would be less than one square foot of habitat for all species and life-stages.

The effect of the proposed withdrawal at the Tall Timber site on ESA-listed fish varies with the flow and species. The maximum proposed withdrawal at this site generally results in small decreases in habitat for most species at extreme low flows, and slight increases in habitat at higher flows. However, the modeled withdrawal generally increases habitat for Chinook salmon rearing.

The proposed surface water withdrawal at the Twisp Weir site is projected to decrease habitat for most species during low flows by a small amount.

Newby Creek is a non-fish-bearing, high-gradient, small tributary to the Twisp River (Appendix 9). The Newby acclimation site, including the water intake and discharge sites, would be adjacent to Newby Creek above a series of cascades, which makes the site inaccessible to migratory fish. A habitat survey found natural fish passage barriers throughout the stream and that the substrate was comprised mostly of fines. Therefore, a diversion of flow from Newby Creek into an acclimation pond and return of water to the creek would have no adverse effects on ESA-listed spring Chinook salmon, steelhead or bull trout.

Hatchery Sites

Dryden: The proposed Dryden Hatchery would be on the Wenatchee River near Dryden Dam. A combination of surface and groundwater sources is being explored to supply up to 7.4 cfs (4.5 cfs surface water) to the site. The amount needed changes over the year. The impact of groundwater withdrawals on surface water is expected to be small as discussed in Section 3.6.

Surface water could be diverted either from the Wenatchee River or Peshastin Creek. An intake located on the Dryden fishway is currently the preferred source for surface water. Two options are being considered for the return flow. One is to discharge return water into Peshastin Creek upstream of the fishway, and another is in a pipeline on the river bottom in the vicinity of the fishway near the proposed intake. The Peshastin discharge could help adult salmon navigate the mouth during low flow and would increase flow from the discharge site to the intake site downstream. Discharge near the fishway could help flush rock away from the fishway but would essentially result in minimal change in flow because water would be discharged near the intake.

The Physical Habitat Simulation System (PHABSIM) analysis developed by EES Consulting (EES Consulting 2005) was used to assess the potential impacts of the Dryden hatchery water use on ESA-listed fish in Peshastin Creek and Wenatchee River (see Appendix 10 for a description of the model). The Peshastin discharge option was analyzed because it has the largest possible impact on stream flow, and therefore represents the greatest potential to affect fish and fish habitat. The affected environment would include Peshastin Creek from the point of discharge downstream to the proposed intake at the fishway in the Wenatchee River. This includes about 200 lineal feet of Peshastin Creek, and 650 feet of the Wenatchee River. The daily mean flow in Peshastin Creek ranges from a low of around 10 cfs in mid-August to over 500 cfs in May. The daily mean flow in the Wenatchee River ranges from a low of around 750 cfs in September to nearly 10,000 cfs by late May.

EES Consulting (2005) estimated that spawning habitat was maximized at Peshastin Creek flows of 80 cfs for non-ESA-listed summer Chinook salmon (spring Chinook do not spawn in the affected portions of the Wenatchee River and Peshastin Creek) and 120 cfs for ESA-listed summer steelhead. Estimated rearing habitat was maximized at flows of 55 cfs for Chinook, 130 cfs for steelhead, and 19 cfs for bull trout.

The increased flow had very little effect on the modeled percent of habitat in the Wenatchee River. Although there were both positive and negative effects on the percent of habitat, the difference was always less than 1%.

The increased flow typically resulted in a modeled increase in the percent of habitat in Peshastin Creek but varied with species and life stage. The increased flow had a greater effect on habitat at low flows than during high flow periods. Optimal flow for summer Chinook salmon spawning (80 cfs) is typically not reached during the spawning season, so any increase in flow had a positive effect on amount of habitat. The increased flow during the mean low flow increased the percent of summer Chinook spawning habitat from 15.9 to 34.8%. In a few scenarios, the increased flow resulted in slight reductions (less than 1%) in the percent of habitat.

The results of the analysis indicated that withdrawing water from the Dryden fishway and discharging it into Peshastin Creek would generally have a positive effect on ESA-listed fish in Peshastin Creek and little to no effect on those in the Wenatchee River. The effects would be limited to the impact reach, and the magnitude would depend on the amount of water involved.

Fish passage at the mouth of Peshastin Creek has been identified as being limited by low flow conditions in the late summer and early fall (Andonaegui 2001, NPCC 2004a). Discharge of hatchery water into the creek during these periods could improve hydraulic conditions for returning adults.

Depending on the final design of the proposed Dryden facility, water withdrawals could have no measureable impact, or could increase available habitat in a 200-foot section of Peshastin Creek during low flows.

George: An alternative to the proposed Dryden hatchery site is located on the Wenatchee River 1.25 miles downstream of Lake Wenatchee. Both surface and groundwater sources might be developed. Potential impacts of hatchery surface water withdrawals on microhabitat availability for ESA-listed fish were evaluated using the PHABSIM methodology. This approach was chosen to enable direct comparison to flow effects quantified for the Dryden hatchery site.

Wenatchee River mean discharge below Lake Wenatchee ranges between 200 cfs and 8,000 cfs annually. A total of 8 cfs of water would be supplied to the George hatchery via ground and surface water sources. Approximately 4.7 cfs of surface water would be withdrawn from the Wenatchee River and piped to the hatchery. Hatchery discharge would be returned to the river 3,800 feet downstream of the withdrawal via an historic side channel that maintains subsurface connectivity to the mainstem. Discharged hatchery water would travel 5,600 feet before reaching the mainstem, and some water would likely be lost to the ground depending on the river's flow stage. For simplicity, analysts assumed that returned flows would be equivalent to the amount of surface flow withdrawn; thus, the study reach was defined by the upstream withdrawal and downstream discharge locations. Analysis showed that the relative change in weighted useable area (WUA, i.e., habitat) was extremely small (less than 1.5%) for all species and life-stages. Therefore, a 4.7 cfs flow change during low and extreme low flows in the Wenatchee River had negligible effects on habitat simulated for spring Chinook, steelhead, and bull trout (for details, see Appendix 10, Effects of Surface Water Withdrawals on Listed Fish).

A secondary discharge location just downstream of the withdrawal site is being considered for the George hatchery (see Appendix 1). The proximity of "Discharge 2" to the intake indicates that this discharge site would not measurably affect fish habitat in the Wenatchee River.

Trapping of Fish at Juvenile and Adult Traps

With one exception, all juvenile traps the project proposes to use are currently operating under existing permits. For the Natural Production Implementation Phase, the project proposes a new juvenile trap on the Little Wenatchee River to generate population estimates of spring Chinook and coho. It would operate from early March to late November. The specific location of the proposed new trap is unknown at this time, but given what is known about listed fish in this river, it probably would impact spring Chinook or bull trout (steelhead are not known to regularly spawn in the Little Wenatchee River) (K. Murdoch, YN, pers. comm., 2010). Before it could be installed or used, its location in relation to habitat for listed species and its potential to trap juveniles of those species would need to be assessed and reviewed by NMFS and USFWS.

No new adult traps are proposed for this project. Three facilities, Chiwawa Weir, Twisp Weir and Methow FH, would need to extend their periods of operation to allow coho trapping. Extending operations of Chiwawa Weir into the fall could affect bull trout. Steelhead are not expected to be present, but monitoring with PIT tags would be done to confirm their presence or absence. Extending operations of Twisp Weir and Methow FH could also affect bull trout, but steelhead are not expected to be present because data from current trapping sites (Icicle Creek and Winthrop NFH) indicate that steelhead do not ascend tributaries of the Wenatchee and Methow rivers until early spring, just prior to spawning (YN 2010a). Consultation with USFWS would be required to determine effects on bull trout; consultation with NMFS would be required if steelhead are shown to occupy the area during the coho trapping period. All other adult traps proposed for use by the project (see Chapter 2, Table 2-8) operate under existing permits.

3.7.3.2 Impacts of Increased Numbers of Coho in the Basins

The ecological risk associated with coho reintroduction efforts may be greatest for endangered species or those of critically low abundance. Many types of ecological interactions are theoretically possible between coho and other native fish species. Potential interactions could include predation, competition, or behavioral changes. Priorities can be assigned to different ecological interactions based on their effect on the productivity and viability of impacted populations. Although the impact of predation on an individual prey animal is unambiguous, the impact on a population of prey animals is not. Depending on the abundance and productivity of the prey population, the impact of predation on the persistence and productivity of the prey population may range from negligible to serious. The ecological interactions that influence the survival, growth, or broad-scale distribution of the impacted population would potentially be the most serious. Other potential interactions could include competition for space or food in the natal streams, or competition for spawning space and associated redd superimposition by returning adults. At the same time, there might be benefits to reintroducing coho to basins they historically occupied. The potential impacts, both beneficial and adverse, from increased numbers of coho in the two basins are discussed below.

Coho predation on other species

Coho juveniles have been shown to prey on sockeye salmon (Ricker 1941; Foerster and Ricker 1953; Ruggerone and Rogers 1992), and fall Chinook salmon fry (Thompson 1966; Pearsons and Fritts 1999). Assuming that coho consume prey a third of their body length (or a ninth of their weight), fish less than 1.8 inches would be vulnerable to predation using the target coho smolt size of 5.5 inches (YN 2010). Only spring Chinook and bull trout fry would be small enough to be potential prey for juvenile coho during rearing and acclimation. Because Chinook fry typically remain near spawning areas or disperse downstream after emergence, they would be expected to be present at, or within 0.6 miles downstream of, spawning areas. In contrast, juvenile bull trout tend to remain in their natal streams for one or more years (McPhail and Baxter 1996, USFWS 2002). Fry would be expected to be present only at sites near spawning locations, except in the White River where bull trout fry have been documented moving downstream. In the White River drainage, bull trout fry would be assumed to be present in the mainstem down to Lake Wenatchee.

Predation studies conducted during the feasibility phase of this project found that hatchery coho juveniles feed primarily on insects and rarely prey on fish. Less than 0.28% of the 2,159 **hatchery** coho salmon sampled in Nason Creek over two years were found to have preyed on spring Chinook fry or other fish (Murdoch and LaRue 2002, Murdoch et al. 2005). The estimated number of spring Chinook fry consumed was 1,009 or 0.14% of the total spring Chinook fry population in Nason Creek (Murdoch et al. 2005). The Yakama Nation conducted similar studies in the Yakima River basin on fall and spring Chinook salmon (Dunnigan 1999), and in the Wenatchee River on summer Chinook fry (Murdoch and Dunnigan 2002). All coho predation evaluations in the Wenatchee and Yakima River basins showed very low rates of predation by hatchery coho smolts on Chinook fry (less than 1% of the fry population) (Dunnigan 1999; Murdoch and Dunnigan 2002; Murdoch and LaRue 2002).

In Nason Creek, the incidence of predation (percentage of samples that had consumed fish) on spring Chinook fry by **naturally** reared coho was 2.7% (Murdoch et al. 2005). Studies also investigated predation on sockeye fry by hatchery coho smolts emigrating through Lake Wenatchee and found no predation on sockeye fry. Sample sizes for both naturally reared coho in Nason Creek and hatchery coho migrating through Lake Wenatchee were small, potentially increasing error in the estimates (Murdoch et al. 2005). Therefore, because populations of naturally produced coho were too small to make reasonable estimates of predation rates, populations of sensitive fish species would be monitored to determine if naturally produced coho prey on listed species with adverse effects (see Section 3.7.5.3 and Appendix 5).

In the event that the 100,000 coho proposed to be released from Leavenworth NFH cannot be acclimated there due to water quality restrictions (see Section 3.5.3.1), they might be released as pre-smolts in Icicle Creek. Spring Chinook in the Icicle are not ESA-listed, so any predation that might occur would not be an adverse effect on an at-risk natural population. Directly releasing coho as pre-smolts is unlikely to adversely affect steelhead yearlings in the Icicle because they would be larger than coho at that point, and young-of-the-year steelhead would not have emerged. Juvenile bull trout are not known to occupy the area, but adult bull trout are commonly seen holding in the hatchery pool (K. Murdoch, YN, pers. comm. 12/9/2011). Juveniles are most likely in the upper reaches of Icicle Creek and its tributaries and are unlikely to be affected by direct coho plants; however, coho pre-smolts and smolts could be prey for adult bull trout.

Competition between naturally produced coho and other fish species

During the feasibility phase of this project, the Yakama Nation investigated the competition for space and food between sub-yearling coho salmon, sub-yearling Chinook salmon and yearling steelhead in Nason Creek. The studies, undertaken in 2002 and 2003, found that juvenile coho, Chinook, and steelhead select different microhabitats; at densities tested, juvenile coho did not appear to displace juvenile Chinook from preferred microhabitats (Murdoch et al. 2005). However, because populations of naturally produced coho were too small to make reasonable estimates of the amount of competition between coho and listed fish, populations of sensitive fish species would be monitored to determine if naturally produced coho compete with listed species with adverse effects (see mitigation described in Section 3.7.5.3 and in Appendix 5).

Disturbance of other species' redds by spawning adult coho

At the two sites where the project proposes to plant adult coho, spawning coho could disturb eggs deposited in spawning redds established earlier in the year. These impacts would be limited to species that spawn in late summer or early fall. Spring spawners such as steelhead and other trout would be able to access these areas and spawn well before the weirs are installed. Further, steelhead and trout fry emerge during the summer, so eggs and alevins would not be disturbed by coho spawning activities in October. Spring Chinook would spawn prior to weirs being installed, so they would not be prevented from accessing these sites, but spawning coho salmon could potentially disturb their eggs. However, fall-spawning fish such as Chinook salmon and bull trout have not been documented spawning in either tributary proposed for adult plants.

Feasibility studies for this project examined the potential for coho to superimpose their redds on other species' redds, specifically on spring Chinook redds. In 2001, three coho redds were counted in Nason Creek and none had superimposed on spring Chinook redds. Since 2001, to determine Chinook redd locations, YN researchers relied on Chelan County PUD or WDFW to flag Chinook redds with a location description on the flagging; YN then followed an established procedure to identify coho superimposition. No redd superimposition in Nason Creek was observed. While it is possible that superimposition could occur with increased spawner densities of both Chinook and coho, in general, coho appear to select smaller gravels and different habitat types for spawning (coho select edges, while spring Chinook select pool tail outs) (YN 2010).

Benefits of nutrient additions from coho carcasses and coho as prey

Coho historically occupied the Wenatchee and Methow basins in significant numbers (Mullan 1984). Reintroducing coho in these basins could help restore the ecological balance of the system that changed as a result of human activities (see Chapter 1, Section 1.4.1). Carcasses from spawned coho could add nutrients to the system at a critical period—the onset of winter. Coho salmon may be a particularly important link in nutrient cycling processes. Coho spawn high in the watershed in late fall, delivering nutrients to the uppermost reaches where all species downstream would benefit (Vannote et al. 1980). The addition of coho carcasses during this period could provide an increased food base (Pearsons and Hopley 1999) and improve over-winter survival for all species, including those listed under the ESA.

Impacts of a coho harvest

In addition to coho harvest being a goal of the program, a terminal harvest is a tool to control the numbers of coho, and has already been used. As described in the Master Plan, specific numbers of hatchery-origin and natural-origin fish are proposed for escapement as well as for broodstock in order to meet the final goal of PNI >0.5. Tables showing those target numbers appear in Section 5.4 of the Master Plan. YN would recommend a sport fishery on coho to WDFW or would implement a tribal fishery when it is clear the target numbers for broodstock and escapement would be met. WDFW holds the ESA permit for sport fisheries in these basins and can approve or disapprove the fishery, which is strictly regulated. Because the run timing for coho and steelhead overlap, a coho fishery would coincide with the steelhead fishery. WDFW's permit #1395 specifies that the fishery must close down after a 2% hooking mortality on listed fish (natural-origin steelhead) in a normal run year. (The allowed mortality can increase to 4 – 5% in years with particularly large runs.) Thus a coho fishery would not result in additional mortality of listed fish beyond what occurs now.

3.7.3.3 Summary of Effects on PHS Fish

Based on the types of habitat and the analysis of effects on ESA-listed fish, Table 3-28 summarizes the potential effects on fish listed on WDFW's Priority Habitat and Species (PHS) list.

Table 3-28. Impacts on PHS fish from the Proposed Action

Species	Habitat	Impact
Pacific Lamprey *Lampetra tridentata*	**Wenatchee:** Spawn in freshwater runs and riffles. Juveniles generally limited to soft-bottom slow water areas. Distribution in the Wenatchee basin is poorly understood.	Most project activities are unlikely to result in measurable impacts to Pacific lamprey. Construction would not occur in breeding habitat, although it is possible that deepening/expansion of existing ponds accessible to lamprey could result in some mortality. Increased naturally spawning coho could result in some redd superimposition. Population-level effects are not expected. The small area disturbed and highly localized effects would impact only a few individuals at most.
Mountain Sucker *Catostomus platyrhynchus*	**Wenatchee:** Clear, cold creeks and small to medium rivers with clear rubble, gravel or sand substrate.	Most project activities are unlikely to result in measureable impacts to mountain sucker. Impacts would be similar to those described for ESA-listed fish, although displacement from rearing habitat is not expected. Population-level effects are not expected. The small area disturbed and highly localized effects would impact only a few individuals at most.
Pygmy Whitefish *Prosopium coulteri*	**Wenatchee and Methow:** Poorly sampled, believed associated with deep water habitat, primarily lakes.	No alteration of lake habitat is expected. If pygmy whitefish occur in the cold water streams near proposed construction sites, effects would be similar to those described for steelhead/rainbow trout. Population-level effects are not expected. Species probably are not present in areas of disturbance.
Sockeye Salmon *Oncorhynchus nerka*	**Wenatchee and Methow:** Primarily lake rearing; spawn and rear in and above Lake Wenatchee (known in the White River up to the Napeequa confluence and Little Wenatchee below RM 5).[a] No reported spawning in the Methow, although reported in the lower system.[b]	Similar potential effects as described for Chinook, although most rearing is likely in Lake Wenatchee, so displacement effects are expected to be less. Predation by coho on sockeye juveniles in the lake is not expected, based on feasibility studies. Population-level effects are not expected due to limited interactions and habitat disruption. Migration either upstream or downstream would not be prevented, as no stream would be completely blocked by coho acclimation activity.
Westslope Cutthroat *Oncorhynchus clarki lewisi*	**Wenatchee and Methow:** Generally cold, clear streams with overhead cover and gravel/ cobble/boulder substrate. Streamnet does not indicate presence but PHS maps show westslope cutthroat in both watersheds.	Potential effects similar to those described for steelhead/rainbow trout. Population-level effects not expected due to small area impacted.

a. C. Kamphaus, YN Fisheries Biologist, Pers. comm. 2010.
b. http://map.streamnet.org/website/bluesnetmapper/viewer.htm

3.7.4 Impacts of the No Action Alternative

Table 3-29 lists spring acclimation sites under the No Action Alternative where access to existing habitat could be blocked for 6 - 8 weeks of the year (mid-March through mid-May). Overwintering of coho is not expected under No Action due to lack of funding. A total of 1.72 acres of habitat could be excluded from use by listed fish; however, all but the Heath and Lincoln sites in the Methow are used for coho acclimation in the current program. Thus, under No

Action, about one third of an acre of currently accessible habitat would be excluded from use by other fish species over what is inaccessible in the current program.

Table 3-29. ESA-listed juveniles potentially displaced from existing habitat in spring: No Action

	Accessible area	Potential juveniles displaced		
Wenatchee	**excluded (acres)**	**Chinook**	**Steelhead**	**Bull trout**
Beaver	0.24	yes	yes	yes
Butcher	0.56	no	yes	no
Coulter	0.37	no	no	no
Leavenworth NFH	0	no	no	no
Rohlfing	0.17	no	yes	no
Methow				
Heath	0.15	yes	yes	yes
Lincoln	0.18	yes	yes	yes
Lower Twisp	0.05	yes	yes	yes
Winthrop NFH	0	no	no	no
Total	**1.72 acres**			

Because fewer sites would be operated under the No Action Alternative and no new construction is involved, the combined effects of operation would be less than those of the Proposed Action; consequently, the adverse impacts would be less than significant.

Under the No Action Alternative, the potential impacts and benefits of increasing numbers of coho are unlikely to be realized. The program's broodstock currently is essentially a domesticated hatchery stock, not fully adapted to conditions in the wild. Without deliberate selection for increased percentages of natural-origin fish in the broodstock, with more of those fish originating from high-quality habitat in upstream tributaries, the likelihood that viable natural populations of coho would be established throughout the basins is low. Experience with previous harvest augmentation programs suggests that naturally reproducing populations probably would not establish themselves in significant numbers, if at all (see Section 1.4.1).

3.7.5 Mitigation for the Proposed Action

The following measures would be undertaken to avoid or minimize impacts to fish.

3.7.5.1 Measures to avoid or mitigate impacts from construction activities

Section 2.2.2.3 contains a detailed list of all proposed measures to avoid construction impacts. The following list summarizes those that apply most directly to avoiding impacts to fish.

- Timing and methods of construction would be coordinated with resource agencies to minimize disturbance to listed species and life-stages.
- The construction area would be isolated by the placement of cofferdams at the inlet and outlet consisting of gravel-filled bags and plastic sheeting to prevent water and fish from entering the work area.
- YN would capture and safely move food fish, game fish, and other fish life from the impounded area as it becomes de-watered.
- The pond would be dewatered using screened pumps, after fish have been removed and prior to excavation activities.

- Discharge of sediment would be limited or prevented by implementing these measures:
  - A temporary barrier would be used to prevent backwater from entering the work area.
  - Prior to release of water flow to the project area, any sediment-laden water would be pumped out of the project area and through a filter medium.
  - When flow is returned to the active channel, the sediment plume would not be visible above background turbidity 150 feet downstream of the project.
  - New water channels would be lined with gravel and rock.
  - New ponds would be filled slowly to avoid suspending and mobilizing sediments.
  - Banks would be restored and replanted, trees would be avoided, and any habitat structures that must be moved (large rocks or large woody debris) would be re-installed immediately up- or downstream of the disturbance as feasible.

- To mitigate potential impacts to Pacific Lamprey, a PHS species that is very important to the tribes, BPA has committed to following the USFWS Best Management Practices to Minimize Adverse Effects to Pacific Lamprey for all fish and wildlife projects, including the Mid-Columbia Coho program. (http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf.)

Permitting agencies such as WDOE, U.S. Army Corps of Engineers, USFWS, or NMFS could require additional measures, which would be implemented.

3.7.5.2 Measures to avoid or mitigate habitat access impacts

- Barrier nets (see Chapter 2, Figure 2-10 for a description) would be used at acclimation sites where ESA-listed fish are not found. This would minimize premature escape of coho salmon.

- Seine nets (see Chapter 2, Figure 2-11) would be used at acclimation sites to partition off a portion of a water body while allowing free upstream and downstream passage of ESA-listed fish to available habitat. In areas where emergent spring Chinook or bull trout fry could be present, predation would be minimized by using fine seine mesh to exclude fry from enclosed areas. Seines would be installed in a manner that excludes fry from the coho acclimation area by moving out from the bank to encapsulate the rearing area. The enclosed area would be snorkeled to verify that no ESA-listed fish are present before hatchery coho are added.

3.7.5.3 Measures to avoid or mitigate predation and competition impacts

- Seine or barrier nets would be removed when coho reach a size that ensures most are ready to migrate. Feasibility studies showed that smolts migrate from the acclimation area quickly, reducing potential interactions with other species (Murdoch et al. 2005).

- Populations of sensitive fish species would be monitored to establish baseline levels. As the coho project moves into the natural production phases, ESA-listed and other sensitive fish populations would continue to be monitored to determine if their numbers are decreasing. If so, evaluations would be made to determine if the decreasing numbers are due to predation or competition by naturally produced coho. For details of the monitoring plan, see Appendix 5.

3.8 Priority Habitat, Plants, and Wildlife

For this EIS, priority habitats, plants, and wildlife include habitats, plants, and terrestrial animals (amphibians, birds, insects, mammals, and reptiles) with federal or state protected status; and/or species and habitats identified under the WDFW Priority Habitats and Species (PHS) Program. This section discusses potential project impacts to the following categories of habitat, plants, and wildlife:

- Wildlife species (non-fish) federally listed under the ESA
- Plant species federally listed under the ESA and state-listed under the Washington Department of Natural Resources (WDNR) Natural Heritage Program's (WNHP) Rare Plant list
- Wildlife (non-fish) and habitats state-listed under the WDFW PHS Program.

Section 3.7 discusses project impacts to ESA-listed fish and fish on the WDFW Priority Habitat and Species list. Section 3.9 discusses impacts to wetlands.

The WDFW oversees the state listing and recovery of fish and wildlife species in danger of extinction due to loss and/or fragmentation of critical habitat, disturbance, or introduction of non-native species. The WDFW Species of Concern list includes all state endangered, threatened, sensitive, and candidate fish and wildlife species, and also includes all federally listed endangered, threatened, and candidate species. All Species of Concern are automatically included as priority species in the PHS list.

The PHS list identifies habitats and species that are priorities for conservation, preservation, and management. [26] Priority species include all federal and state listed species, as well as animal aggregations (e.g., heron colonies, bat colonies) that are sensitive to habitat alteration, and species of recreational, commercial, or tribal importance that are vulnerable. Criteria are defined in Section 3.7.1.

The WNHP manages site-specific and species/ecosystem-specific information on priority plant species and ecosystems that are rare or have very limited distribution. The WNHP identifies which species and ecosystems are priorities for conservation efforts, and designates the state status for each species (e.g., endangered, threatened, sensitive) on the Rare Plant list. All federally listed plant species are included in the WNHP Rare Plant list.

3.8.1 Affected Environment

In both basins, vegetation types vary due to elevation and precipitation, with precipitation decreasing in each basin from west to east, as elevations decrease from mountains to the Columbia River. With the exception of areas at the highest elevations where the landscape is characterized by permanent ice and snow or alpine meadows, the western portions of each basin are forested, while the non-agricultural eastern portions contain primarily shrub-steppe species. To a certain degree, wildlife varies with the habitat. (See Section 3.3.)

Tables 3-30 through 3-32 show the complete list of plants, wildlife, and habitat found in each basin that are on one of the federal or state lists defined above. Relatively few of these species are found at project sites, as discussed in Section 3.8.3 Impacts of the Proposed Action.

[26] http://wdfw.wa.gov/hab/phslist.htm

Table 3-30. Federal and state listed species: plants

Species	State Status	Federal Status	Methow Basin	Wenatchee Basin
Showy Stickseed *Hackelia venusta*	Endangered	Endangered		X
Ute Ladies'-Tresses *Spiranthes diluvialis*	Endangered	Threatened	X	X
Wenatchee Mountains Checker-mallow *Sidalcea oregano var. calva*	Endangered	Endangered		X
Whited's Milk-vetch *Astragalus sinuatus*	Endangered	Species of Concern[a]		X
Triangular-lobed Moonwort *Botrychium ascendens*	Sensitive	Species of Concern	X	
Crenulate Moonwort *Botrychium crenulatum*	Sensitive	Species of Concern	X	
Two-spiked Moonwort *Botrychium paradoxum*	Threatened	Species of Concern	X	X
Stalked Moonwort *Botrichium pendunculosum*	Sensitive	Species of Concern	X	
Clustered Lady's Slipper *Cypripedium fasciculatum*	Sensitive	Species of Concern		X
Wenatchee Larkspur *Delphinium viridescens*	Threatened	Species of Concern		X
Chelan Rockmat *Petrophyton cinerascens*	Endangered	Species of Concern		X
Whitebark Pine *Pinus albicaulis*	N/A	Species of Concern	X	X
Seely's Silene *Silene seelyi*	Sensitive	Species of Concern		X
Thompson's Clover *Trifolium thompsonii*	Threatened	Species of Concern		X

a. Species of Concern: "An informal term referring to a species that might be in need of conservation action. This may range from a need for periodic monitoring of populations and threats to the species and its habitat, to the necessity for listing as threatened or endangered. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing." (USFWS Endangered Species Glossary. http://www.fws.gov/nc-es/es/glossary.pdf)

Table 3-31. Federal and state listed species: wildlife

Species [a]	State Status	Federal Status	Methow Basin	Wenatchee Basin
Canada Lynx *Lynx canadensis*	Threatened	Threatened	X	X
Gray Wolf *Canis lupus*	Endangered	Endangered	X	X
Grizzly Bear *Ursos arctos horribilis*	Endangered	Threatened	X	X
Marbled Murrelet *Brachyramphus marmoratus*	Threatened	Threatened		X
Northern Spotted Owl *Strix occidentalis caurina*	Endangered	Threatened	X	X
Fisher *Martes pennanti*	Endangered	Candidate	X	X
Greater Sage Grouse *Centrocercus urophasianus*	Threatened	Candidate	X	
Yellow-Billed Cuckoo *Coccyzus americanus*	Candidate	Candidate	X	X
Bald Eagle *Haliaeetus leucocephalus*	Sensitive	Species of Concern*	X	X
Black Swift *Cypseloides niger*	N/A	Species of Concern	X	X
Burrowing Owl *Athene cunicularia*	Candidate	Species of Concern	X	
California Floater *Anodonta californiensis*	Candidate	Species of Concern	X	X
California Wolverine *Gulo gulo luteus*	Candidate	Species of Concern	X	X
Columbian Sharp-tailed Grouse *Tympanuchus phasianellus columbianus*	Threatened	Species of Concern	X	X
Ferruginous Hawk *Buteo regalis*	Threatened	Species of Concern		X
Giant Columbia Spire Snail *Fluminicola columbiana*	Candidate	Species of Concern	X	X
Kincaid Meadow Vole *Microtus pennsylvanicus kincaidi*	N/A	Species of Concern		X
Loggerhead Shrike *Lanius ludovicianus*	Candidate	Species of Concern	X	X
Long-eared Myotis *Myotis evotis*	N/A	Species of Concern	X	X
Northern Goshawk *Accipiter gentilis*	Candidate	Species of Concern	X	X
Olive-sided Flycatcher *Contopus cooperi*	N/A	Species of Concern	X	X
Pallid Townsend's Big-eared Bat *Corynorhinus townsendii pallescens*	Candidate	Species of Concern	X	X
Peregrine Falcon *Falco peregrines*	Sensitive	Species of Concern	X	X
Sagebrush Lizard *Sceloperorus graciosus*	Candidate	Species of Concern	X	X
Sharptail Snake *Contia tenuis*	Candidate	Species of Concern		X
Western Gray Squirrel *Sciurus griseus griseus*	Threatened	Species of Concern	X	X

a. See Section 3.7 for listed fish species.

Table 3-32. Critical Habitats: wildlife and plants

Type	Methow Basin	Wenatchee Basin
Critical Habitat for Canada Lynx	X	X
Critical Habitat for Northern Spotted Owl	X	X
Critical Habitat for Wenatchee Mountains Checker-mallow	X	X

Source: USFWS 2010a,b
X = Species/habitat is identified by USFWS as occurring in either Okanogan County (Methow basin) or Chelan County (Wenatchee basin).

3.8.2 Types of Impact

Construction Impacts

Potential impacts to priority habitats or species from project construction activities include the following:

- Clearing and grading of vegetation and soil could result in removal, loss, and fragmentation of potential plant and wildlife habitat.
- Construction of new ponds could create open water habitat, riparian habitat and a food source, with the potential to attract wildlife. Consequences include potential alterations to species migration, feeding, and foraging behaviors and the potential for increased wildlife-human interactions.
- Noise from the use of construction equipment and the presence of workers could temporarily disrupt existing wildlife migration, feeding, and foraging behavior.

The effects described below are common to all the sites with proposed construction activity, although the extent and duration may vary between sites (from one to sixty days for acclimation sites and up to five months for the hatchery site).

Priority habitat and species could be affected by removal, loss, and fragmentation of habitat at new and modified sites. This impact would vary in severity depending on the type and quantity of vegetation that would be affected. With the exception of the hatchery construction at the Dryden site (or the backup George site), no buildings or paved surfaces are proposed. Project features such as new ponds and side channels would be designed to conform to the natural environment of the site as much as possible and, for the most part, would be in areas where forested habitat would not need to be cleared or removed. Vegetation cleared would be primarily shrubs or grass.

The physical impacts from construction would be minimal for all species. The acclimation sites are generally altered from natural conditions and regularly subject to human activity. Vegetation communities at the sites are commonly found throughout the region, although each site's location near streams, rivers, tributary channels, and ponds likely results in a more diverse assemblage of wildlife and plants than would be found elsewhere (Kauffman et al. 2001).

A minimal amount of vegetation at the sites would be removed or crushed. Small mammals and reptiles that are present at the sites during construction could be injured or killed due to construction activities. However, since the area impacted likely would be small, and animals probably would avoid or move out of the area in response to the disturbance, the numbers of individuals injured or killed would be few if any.

Habitat for ground and shrub-nesting birds would be affected, but the relative amount would be small; there are no special or unique vegetation communities in the areas proposed for construction that could provide habitat for such species. Few if any large trees would be removed, thus avoiding or minimizing direct effects to tree-nesting bat species or birds such as diurnal raptors, owls, woodpeckers, and passerines. [27]

The most likely impact to wildlife that would result is construction-related disturbance (noise and visual). Potential construction noise would be limited to construction machinery such as backhoes and bulldozers for excavation. No blasting, pile driving, or paved road construction is proposed.

Potential wildlife disturbance from the proposed construction activities would depend on several factors, including sound levels, duration, and surrounding topography and vegetation. The sound produced by conventional construction equipment typically ranges from about 75 to 90 decibels (dB): 78 dB for a dump truck, 80 dB for an excavator, 85 dB for a back hoe, and 87 dB for a bulldozer (LHSFNA 2009). Generally, disturbance activities would be limited to the immediate acclimation site, although noise from heavy machinery could extend approximately 600 to 1,000 feet outward from the site before diminishing to ambient levels. Adjacent hills and topographic changes in the landscape would reduce this distance by blocking or absorbing the sound. At all acclimation sites, construction would take place during summer months (May through September) for a period of from 1 to 60 days.

Noise and visual disturbance from pedestrians has been shown to elicit responses from nesting and foraging raptors at greater than 600 feet (Anthony et al. 1995, Richardson and Miller 1997), although these and other studies also suggest that noise without activity visible to the bird results in a much lower disturbance distance. There are no known bald eagle nests within two miles of any of the sites, but several regular concentrations are within one mile of several of the sites. No sites contain cliffs suitable for use by cliff-nesting raptors, but there is cliff habitat near the Rohlfing site and within a few thousand feet of the Tall Timber site. None of the sites contains trees of appropriate size for other raptor nests (e.g., red-tailed hawks), but some sites do have mature stands of trees in the vicinity that could provide nesting habitat. No raptors were observed during site visits; however, a comprehensive survey was not conducted, so existing nests might be unaccounted for.

Passerine birds and small mammals also would likely avoid the sites where construction is ongoing, but the area of effect would be small and the numbers affected would likely be very low compared to the numbers in the region.

Ungulates (deer and elk primarily) probably would avoid the sites while construction is actively occurring. Both species are known to avoid roads with vehicle traffic and pedestrian travel (Millspaugh et al. 2001, Wisdom et al. 2004). Construction is not likely to have a substantial effect on ungulates because: 1) human activity, including vehicle traffic to and from the sites, is already fairly common; 2) habitat is not known to be limiting; and 3) the amount of habitat excluded due to construction activities would be very small compared to what is available in surrounding areas.

[27] Passerine birds are perching birds or songbirds.

Operations Impacts

Each of the sites would require regular, daily human presence during the acclimation period, averaging 3 hours per day per site during daylight hours. For spring-only acclimation this is 1.4 percent of the year and for winter acclimation, 4.8 percent of the year. Two-person crews would be responsible for several sites and would drive between them during the course of the day. These activities would be consistent with average ambient noise levels.

All sites could require non-lethal hazing of predators. Hazing involves discouraging wildlife such as mergansers, kingfishers, herons, and otters from preying on coho by having humans on the site and moving around the ponds at key times (mornings and evenings). Techniques could also include use of paper coyote decoys and scent, electric owls, and sprinklers on motion sensors. All would be placed and used inconspicuously. These activities have not been shown to threaten the overall health or survival of any species.

Two primary acclimation sites, Two Rivers and MSWA Eightmile, would have generators running continuously for two months from mid-March through mid-May; impacts of the Two Rivers site, previously used by the coho program, were evaluated in previous NEPA documents. Three other primary sites (Rohlfing, Twisp Weir, and Lincoln) would use generators as needed during power outages. Three backup sites would require generators. Squadroni and MSRF Chewuch would have continuously running generators; McComas would require a generator only for emergencies. Both hatchery sites would require backup generators. Enclosing pumps and generators in noise-muffling structures would effectively eliminate disturbance to wildlife.

The reintroduction of coho salmon could provide important ecological benefits to priority species and habitats. Coho are a prey to several listed wildlife species and provide marine-derived nutrients to streams that support priority species.

3.8.3 Impacts of the Proposed Action

Table 3-33 shows that three ESA-listed wildlife species are documented to occur within 1,000 feet of 9 project sites. None of the primary or backup project sites in either basin is in designated critical habitat for wildlife or plants. Literature searches and on-site surveys found no ESA-listed or state-listed plants at project sites.

Table 3-33. Sites with documented occurrences of USFWS ESA-listed species and habitat

ESA-listed wildlife species	Sites with ESA-listed wildlife species in the project area	Sites with ESA-designated Critical Habitat in the project area
Northern spotted owl	<u>Wenatchee – primary w/ construction:</u> Chikamin, Minnow, Tall Timber <u>Wenatchee – primary no construction:</u> Beaver, Clear <u>Wenatchee – backup no construction:</u> Allen <u>Methow – primary no construction:</u> Goat Wall	None
Canada lynx	<u>Methow – primary w/ construction:</u> Gold	None
Gray wolf	<u>Wenatchee – primary no construction</u>: Butcher	None

While spotted owls are documented at the sites as shown in Table 3-33, only spotted owl management circles (locations occupied by territorial spotted owls that include buffered distances around known owl site centers) overlap any of the potential project sites. None of the project sites are located within designated critical habitat for spotted owl (USFWS 2009c). Of the seven sites that are overlapped by spotted owl management circles, only one, Tall Timber, has surrounding forest that contains components that could provide spotted owl habitat (Gutierrez et al. 1995, Everett et al. 1997). The remaining six sites are located near younger forests that lack the structure associated with owl habitat. In addition, four of the remaining six sites have no proposed construction, so no habitat would be disturbed. Of the two sites with proposed construction, Chikamin and Minnow, forested stands near the sites are dominated by deciduous species with no mature conifers.

Although lynx might travel through lower elevation areas, they are typically associated with subalpine forests above 4,000 feet (Stinson 2001); none of the sites, including the Gold site, is located above 2,500 feet. None of the project sites is located within designated critical habitat for lynx, as mapped by the USFWS (2009c). Any occurrence of lynx at the project sites would likely be transient.

Research indicates that, within their historical distribution, wolves occupied every habitat with large ungulates such as deer and elk, from sea level to mountains and in areas heavily disturbed by people (Fuller et al. 2003). However, surviving wolf populations in much of western North America, including the northern Rocky Mountain states and British Columbia, predominantly inhabit forests and nearby open habitats, with prey availability and extent of human tolerance strongly influencing occupancy. The majority (77% - 93%) of habitat used to date by two packs in Washington, including one in the vicinity of Winthrop, has been on public land (federal and state), primarily U.S. Forest Service land (Wiles et al. 2011).

The gray wolf is identified on WDFW PHS maps (WDFW 2009a) as having occurred within about 1,000 feet of the Butcher site, which is an acclimation site currently in use by the project where no construction is required. According to the PHS data, a gray wolf was observed near Butcher Creek in 1988. Because wolves likely would be only transients in project areas; because no project sites are in designated critical habitat for wolves; and because wolves tolerate a certain amount of human activity, they are unlikely to be adversely affected by the construction or operation of project facilities.

Table 3-34 lists sites where state-listed priority wildlife species and habitats have been documented within 1,000 feet of the site. Site-specific discussions follow the tables. Because operations impacts are expected to be consistent with ambient noise levels, the site-specific discussions focus on sites with proposed construction.

Wetlands are an important habitat for many PHS species; impacts to wetlands are evaluated in Section 3.9.

Table 3-34. Sites with documented occurrences of state-listed Priority Habitat and Species

State-listed wildlife species / habitats [a]	Sites with documented occurrences in the project area	Sites where habitat exists in the project area
Wildlife		
American marten	Sites w/in regular concentration areas: Chikamin, Minnow	
Bald eagle	Sites w/in regular concentration areas: Chewuch AF, Hancock, Heath, Lower Twisp, MSRF Chewuch, MSWA Eightmile, Pete Cr. Pond, Poorman, Winthrop NFH	All sites, except Dryden
Bat species	Chewuch AF	Tall Timber for breeding habitat, all sites for foraging habitat
Cavity nesting ducks	Sites w/in breeding occurrence range: Winthrop NFH	
Frog species	MSRF Chewuch	All sites, except Dryden
Great blue heron	Site w/ colony: Heath	All sites, except Dryden
Harlequin duck	Sites w/in regular concentration areas: Chewuch AF, Gold, Hancock, Heath, Lower Twisp, MSRF Chewuch, Poorman, Pete Cr. Pond, Winthrop NFH	George, Tall Timber, Twisp Weir, Newby, Utley
Lynx	Gold	
Mountain goat	Site w/in regular concentration area: Rohlfing Site w/in migration area: Tall Timber	Rohlfing, Tall Timber
Mule deer	Sites w/in breeding occurrence range: Beaver, Butcher, Clear, Coulter, Coulter/Roaring, Dirty Face, White R. Springs, Rohlfing, Squadroni, Tall Timber Sites w/in parturition (birthing) area: Chikamin, Minnow Sites w/in regular concentration area: Balky Hill, Chewuch AF, Dryden, Goat Wall, Gold, Hancock, Heath, Lincoln, Mason, MSRF Chewuch, MSWA Eightmile, McComas, Parmley, Poorman, Pete Cr. Pond	All sites
Northern goshawk	Nest site: Chikamin, Minnow Possible based on habitat: George, Newby, Twisp Weir, Utley	George, Newby, Twisp Weir, Utley
Northwest white-tailed deer	Sites w/in parturition (birthing) area: Goat Wall, Pete Cr. Pond, Winthrop NFH Sites w/in regular concentration area: Pete Cr. Pond, Winthrop NFH	All sites
White-tailed deer	Site w/in regular concentration area: Heath	All sites
Olive-sided flycatcher	Possible based on habitat: George, Newby, Twisp Weir, Utley	George, Newby, Twisp Weir, Utley
Sharp-tailed snake	Possible based on habitat: George	George
Waterfowl concentrations	None	All sites, except Dryden
Western gray squirrel	Sites w/in regular concentration area: Gold Possible based on habitat: Newby, Twisp Weir, Utley	Tall Timber, Newby, Twisp Weir, Utley
Western toad	Possible based on habitat: George, Newby, Twisp Weir, Utley	George
Woodpecker species	Possible based on habitat: George	George, Tall Timber
Habitat		
Meadows	Butcher, Coulter, Coulter/Roaring, Dirty Face, Squadroni, Tall Timber, White R. Springs,	Not Applicable
Riparian	Balky Hill, Beaver, Biddle, Chewuch AF, Dryden, Goat Wall, Gold, Hancock, Heath, Leavenworth NFH, Lincoln, MSRF Chewuch, Lower Twisp, Mason, MSWA Eightmile, Parmley, Pete Cr. Pond, Poorman, Scheibler, Winthrop NFH, Newby, Utley	Not Applicable
Aspen	Butcher, Coulter, Coulter/Roaring, George	Not Applicable

a. The WDFW PHS list also includes all federal ESA-listed species; the non-fish ESA-listed species documented within 1,000 feet of the project sites are shown in Table 3-33.

Because the impacts of operating the proposed facilities are unlikely to disturb any birds or wildlife beyond what is occurring currently (see Section 3.8.2), the following site-specific discussions focus on impacts at sites where construction is proposed.

3.8.3.1 Wenatchee Basin Acclimation Sites (Primary)

Chikamin

A new off-channel pond and two side-by-side river intakes are proposed for the Chikamin site, which is adjacent to the Minnow site. The pond would be approximately 120 feet long by 80 feet wide for a total area of about 9,600 square feet (0.2 acre). The pond would be excavated in a field dominated by grass and herbaceous vegetation. The intake structures would be placed in the Chikamin stream bank. A 120-foot-long water supply pipeline from the intake to the pond would be buried; approximately 0.03 acre of field and riparian (alder and willow) habitat would be disturbed. A rock-lined open channel, about 70 feet long and 5 feet wide, would be constructed from the pond to the creek in the riparian zone of Chikamin Creek dominated by willow and alder with young pine trees. Pine or other conifer trees in this area would be avoided if possible. Approximately 0.29 acre of surface area would be disturbed by all construction activities.

WDFW maps (WDFW 2009) identify the Chikamin site as within an established territory management circle for spotted owl. Timber harvesting has occurred at and near the site; existing trees are young and relatively young second-growth stands, so northern spotted owls are not expected to occupy the site. No other federally protected species are documented within 2 miles of the site.

WDFW priority species documented within 1,000 feet of the site include concentrations of marten, breeding mule deer, and a northern goshawk nest. Additional priority species that could be disturbed by construction are bald eagles, frogs, great blue heron, deer, and waterfowl. New pond and riparian habitat would provide additional aquatic habitat that could benefit these and other native wildlife species. The temporary disruption (less than two months) caused by construction noise would not significantly impact native wildlife species.

No plants with federally protected status or state rare plants or rare/high quality plant communities are documented within 3 miles of the Chikamin site (WDNR 2000, 2009).

Minnow

A new in-channel pond is proposed for the Minnow site in an existing creek channel. The site is under the same ownership as the Chikamin site. The Minnow site would require excavation in the existing channel of Minnow Creek, a tributary to Chikamin Creek. The pond would be approximately the same size as the Chikamin pond and would be excavated in the riparian zone of Minnow Creek. Habitat cleared during construction would include a combination of grass field and alder, willow, and young pine trees; however, pines and other conifers would be avoided as much as possible. Approximately 0.2 acre of surface area would be disturbed.

The pond banks would be replanted with native vegetation, with no net loss of riparian habitat. Approximately 0.2 acre of pond habitat would be created that would provide additional aquatic habitat for wildlife species in the Minnow Creek watershed.

Priority species and impacts are the same as for the Chikamin site. Maps of PHS (WDFW 2009) identify the Minnow site as within an established territory management circle for spotted owl and adjacent to a second management circle. As with the Chikamin site, timber harvesting has occurred on and near the project site and existing trees are young second-growth stands, so it is unlikely that spotted owls use the area. No other federally protected species are documented within two miles of the Minnow site. WDFW priority species documented within 1,000 feet of the site that could be disturbed by construction include American marten, breeding mule deer, and a northern goshawk nest. Construction would occur from June to October, during the nesting season for waterfowl and songbirds.

WDNR has not documented any occurrences of plants with federally protected status or state rare plants or rare/high quality plant communities within 3 miles of the Minnow site (WDNR 2000, 2009).

Tall Timber

The Tall Timbers site is located in an area with mixed open meadow and closed canopy forest on riparian terraces of the Napeequa River and the White River. The forest overstory has a diverse, mixed-age stand of Douglas-fir, ponderosa pine, western red cedar, grand fir, Engelmann spruce, bigleaf maple, and black cottonwood. Tree canopy cover ranges from 50 to 80 percent. Mid-canopy shrubs include Douglas maple, vine maple, and Sitka alder. Adjacent to and in riparian areas and wetlands, understory shrubs are diverse and include red osier dogwood, willow species, snowberry, rose species, twinberry, salmonberry, Sitka alder, thimbleberry and red elderberry. The herbaceous understory is moderately dense, with wild ginger, cow parsnip, hedge nettle, lady fern, aster, coltsfoot and trillium. Grass species present are primarily non-native pasture grasses including orchard grass, smooth brome and reed canarygrass. Skunk cabbage, red currant and slough sedge are present within the wetland. The river banks are steep and are composed of cobble, sand and gravel.

The Tall Timber site would require ground disturbance for an intake from the river and for a pipeline to deliver water to an existing, disconnected side channel. The intake structure would be in the riparian zone of the Napeequa River, where up to 400 square feet of forested and shrub habitat with cedar, pine, Douglas fir, willow, snowberry, and reed canarygrass would be disturbed. Conifer trees would be avoided, if possible. Rock and gravel would be placed around the intake to prevent erosion. A 350-foot-long water supply pipeline from the intake to the pond would be buried. Part of the pipeline would be dug through similar forest and shrub habitat. The disturbed areas would be replanted with native vegetation.

Impacts to the existing side channel (approximately 1,000 feet long and 60 feet wide) would be limited to filling the channel with water during the acclimation period.

WDFW PHS maps (WDFW 2009a) document the occurrence of two spotted owl established territory management circles in the vicinity of the Tall Timbers site, the borders of which are approximately 0.5 mile in opposite directions from the site. The nests associated with the management circles are located more than 1 mile from the site. The pipeline construction would occur near mature cedar, pine, and Douglas-fir trees, and it is possible that some trees may need to be removed. Prior to removal, a qualified biologist would confirm the presence or absence of nest activity in the trees, and if any is found, BPA would reinitiate consultation with USFWS (see Section 4.3.1). No adverse impacts to spotted owls are anticipated because: 1) the absence of owl nesting activity within trees to be removed would be confirmed; 2) the removal of a few trees within a densely forested area would not significantly modify habitat conditions; 3) the site includes a ranch and a church camp with regular, consistent human activity; 4) construction disturbances would be temporary, and temporary avoidance behavior by owls during the short term construction activity would be unlikely to result in a significant disturbance to the species. Meadow priority habitat documented adjacent to the site would be outside the area of proposed construction.

Priority species potentially disturbed by construction at the site are bald eagles, bats, frogs, great blue heron, harlequin duck, mountain goat, deer, waterfowl, western gray squirrel, and woodpeckers. The presence of mountain goats near the project area would be associated with transient or migration behavior. The loss of mature trees would disturb potential breeding habitat for bald eagles, bats, harlequin duck, western gray squirrel, and woodpeckers. Given the relatively small area and number of trees that would be removed relative to the surrounding available forested habitat, significant impacts to these species are not anticipated. Construction noise might cause these species to temporarily avoid the area, but such behavior is not likely to result in significant impacts to these or other native wildlife species.

No suitable potential habitat for ESA-listed plant species is present at the Tall Timbers site (Beck 2011).

3.8.3.2 Wenatchee Acclimation Sites (Backup)

Scheibler

If this site is used, an existing pond, about 100 feet long and 15 feet wide, would be expanded and deepened at this site. Approximately 350 cubic yards of material from the pond would be excavated to increase the pond capacity by 14,000 cubic feet. Construction would occur in late summer to early fall, within the nesting period for waterfowl and songbirds but avoiding the critical spring period.

Riparian priority habitat associated with Chumstick Creek adjacent to the site would not be disturbed. Priority species potentially disturbed are the same as for Chikamin and Minnow. The loss of a small area of agricultural and deciduous riparian habitat and temporary disruption caused by construction noise would not significantly impact native wildlife species.

WDNR has not documented any occurrences of plants with federally protected status or state rare plants or rare/high quality plant communities within 3 miles of the Scheibler site (WDNR 2000, 2009).

Squadroni

A new well, pond, 50-foot-long rock-lined open channel, and 20-foot-long discharge channel would be constructed on the Squadroni site, if it is used. Disturbances would occur in grass fields. A generator would be required to provide backup power in the event of a power outage during the acclimation period.

The species potentially disturbed by construction at the site are bald eagles, frogs, great blue heron, deer, and waterfowl. The loss of a small area of grass field habitat and temporary disruption caused by construction noise would not significantly impact native wildlife species.

WDNR has not documented any occurrences of plants with federally protected status or state rare/high quality plant communities within 3 miles of the Squadroni site. The state-listed species, clustered lady's slipper, is documented more than 2 miles from the site (WDNR 2000, 2009).

3.8.3.3 Hatchery Sites

Dryden (Primary)

The Dryden site is proposed as a primary site for a new hatchery. Chapter 2, Section 2.2.2.3 and Appendix 1 provide more detailed descriptions of hatchery design and construction requirements. The Dryden site is also identified as a backup site for acclimation.

The Proposed Action would require excavations for rearing ponds, raceways, a hatchery building, water and power supply, and an effluent treatment system. These excavations would be in an area that is a combination of disturbed bare ground and patches of grass and weedy species and occasional shrubs. No trees would be cleared. A surface water intake would be built in the fishway, which would not require excavation. Construction between May to October 2012 or 2013 would disturb four acres. Excavated material would be disposed in locations that meet permit conditions and minimize environmental impacts.

WDFW PHS maps (WDFW 2009) do not document any occurrences of federally listed wildlife or plant species within at least one mile of the Dryden site. The boundary of an established territory management circle for spotted owl is located between 1 and 2 miles from the site, south of Highway 2. Other WDFW priority species found within 1,000 feet of the site include concentrations of mule deer. Riparian priority habitat associated with the Wenatchee River is documented adjacent to the site but would not be disturbed. The loss of a small area of habitat that is mostly already disturbed would not significantly impact native wildlife species. Noise from construction and operation of the facilities is unlikely to affect wildlife any more than current activities at and near the site.

George (Backup)

If used, the George backup hatchery site would require construction similar to the Dryden site (see Chapter 2 and Appendix 1 for more details). A fence would be constructed around the facility and predator-control nets would be installed over rearing units.

A number of priority species may use habitat at the George site during part of their life cycle, including bald eagles, northern goshawks, harlequin ducks, great blue herons, pileated woodpeckers, olive-sided flycatchers, mule deer, long-eared myotis, sharp-tailed snakes, and western toads. Priority habitat on-site includes quaking aspen stands and riparian habitat. There are no documented occurrences of federally listed or state-listed plant species.

Construction of the surface water intake structure at the Wenatchee River and installation of the intake pipeline could affect riparian shrub-scrub and forested habitat. A large tract of priority aspen habitat exists near the area of the proposed intake and discharge pipelines. These pipelines would be located along the eastern boundary of this priority habitat to minimize the potential for impacts. Construction of the hatchery facility and rearing ponds as currently planned would not affect any priority aspen habitat. Some upland forested habitat is likely to be removed to construct the hatchery facility and rearing ponds. Impacts to forested habitat would be minimized to the extent possible; areas of shrub/scrub and emergent vegetation removed along the intake or discharge pipeline corridors would be restored with native plants when the project is completed. Removal of forested habitat would be mitigated by replanting native vegetation around the construction site and in disturbed and cleared areas (approximately 2.5 acres).

Construction of the hatchery facility, discharge/intake pipelines and water supply wells would not alter a substantial portion of riparian and forested habitat for wildlife species that have more extensive home ranges. Impacts to habitat and some individual amphibians that have comparatively limited home ranges (e.g., the western toad) could be possible at the local population level.

Noise generated during construction may cause priority species to avoid the site during construction; however, this impact would be temporary and noise would not be significantly elevated above existing ambient noise from surrounding highway traffic and landowner activities. The existing network of roads would be used to access the site and for moving construction equipment and crews. Existing cleared areas would also be used for staging of construction equipment and supplies. Based on these measures to avoid or minimize potential impacts during the construction of the hatchery, there would be no significant impacts to priority species or habitat at the George site.

3.8.3.4 Methow Acclimation Sites (Primary)

Gold

Approximately 260 cubic yards of silt, sand, and gravel deposits from an existing pond would be excavated. Vegetation adjacent to the pond includes mowed lawn that would be disturbed to access the ponds for excavation.

One federally and state-protected non-fish species, lynx, is identified on WDFW PHS maps (WDFW 2009a) as having occurred within about 1,000 feet of the Gold site. According to the PHS data, in 1993 lynx tracks were observed in two locations near the South Fork of Gold Creek. Although lynx might travel through lower elevation areas, particularly in winter, the construction activity in late summer or fall is not likely to do more than cause any animal that might be present to go elsewhere.

The reach of the South Fork Gold Creek adjacent to the Gold site is identified as riparian priority habitat but would not be disturbed. Bald eagles, frogs, great blue heron, deer, and waterfowl could be temporarily disturbed by construction noise but the impact would not be significant. No habitat would be lost.

WDNR has not documented any occurrences of plants with federally protected status within 3 miles of the Gold site, nor any occurrences of state rare plants or rare/high quality plant communities within 2 miles of the site (WDNR 2000, 2009).

MSWA Eightmile

A well and water supply channel from the well to the existing side channel are proposed. A generator would be installed near the well to provide the primary power source, and would run continuously during the acclimation period. It would be installed in a structure that would significantly attenuate the generator noise and limit the noise effects to the area within a few feet of the enclosure. Construction would be in an agricultural field in September. The reach of the Chewuch River adjacent to the site identified as riparian priority habitat would not be disturbed. Priority species and impacts are the same as Gold.

WDNR has not documented any occurrences of plants with federally protected status within 3 miles of the MSWA Eightmile site. Two state rare plants are documented more than a half mile from the site, black snake-root and common northern sweet grass. Crenulate moonwort is documented between 2 and 3 miles from the site (WDNR 2000, 2009).

Twisp Weir

Proposed construction at Twisp Weir includes the excavation of a new pond, construction of intake and discharge structures from the Twisp River to the new pond, burial of water lines, construction of two wells, and construction of 20 feet of access road to the pond. Most of the Twisp Weir site has been highly disturbed. The proposed pond area is located in a mowed upland pasture adjacent to roads and buildings and does not have any areas that are moist or temporarily inundated into the growing season. The vegetation of the pasture is comprised largely of European pasture grasses and non-native forbs. The exact location of the access road has not yet been determined; however, all the potential locations between the proposed pond and the existing gravel road are managed and maintained as mowed grass. The intake structure would be located at the existing diversion in the Twisp River, which is adjacent to the edge of a wetland identified by the National Wetland Inventory (NWI) (USFWS 2008) (see Section 3.9.3.3). The proposed intake pipeline would extend across an upland meadow to the proposed acclimation pond site. The proposed location for the discharge pipeline from the acclimation pond crosses maintained upland areas and then would pass under the existing irrigation canal into forested riparian habitat adjacent to the Twisp River. The proposed locations for the well and associated pipelines are also within this forested riparian habitat.

It is unlikely that priority species occupy the maintained portion of the Twisp Weir site because of the ongoing maintenance and operation of the site as a fish hatchery and the lack of native habitat observed. Priority species that may use the forested riparian and stream habitat at the site include western gray squirrel, western toad, northern goshawk, bald eagle, long-eared bat, olive-sided flycatcher, Columbia spotted frog, great blue heron, harlequin duck, and mule deer. Removal of forested riparian habitat for the discharge pipeline and water supply wells would not alter a substantial portion of the habitat for mammals and birds with more extensive home ranges; mature trees would be avoided to the extent possible. Impacts to riparian habitat and some individual amphibians with more limited home ranges, such as the spotted frog or western toad, are possible at the local population level.

Overall impacts at the site would be minimized by: 1) locating the acclimation pond in a fenced, mowed grass field; 2) placement of the intake structure at an existing diversion structure; and 3) selecting pipeline corridors and well locations that do not contain mature trees to the extent possible. Impacts to shrub/scrub vegetation would be temporary and restored after completion. Construction noise would be temporary and not significantly higher than existing noise from adjacent highway traffic and landowner activities. Significant permanent impacts to priority species and habitat at the Twisp Weir site are not likely.

No suitable potential habitat for federally listed plant species is present at the Twisp Weir site (Beck 2011).

Newby

Construction at the Newby site includes excavation of a new pond and construction of an intake structure at Newby Creek with intake and discharge pipelines. The pond would be in an upland meadow with vegetation consisting of upland grasses, mullein and goldenrod. The locations for the intake structure and discharge are along a reach of Newby Creek that has a relatively high gradient (greater than 5 percent) and a defined steep-sided channel that lacks riverine wetlands.

Vegetation that would be disturbed to construct the pond includes upland grasses, mullein and goldenrod. Vegetation that would be disturbed to construct the intake and discharge structures and pipelines includes riparian forest habitat dominated by quaking aspen, Douglas-fir, red osier dogwood, snowberry, serviceberry, and Nootka rose. Disturbance of mature and large trees would be avoided if possible. Most impacts would be to habitat along the riparian edge of Newby Creek. Priority species that might use the forested riparian and stream habitat at the Newby site are the same as those at Twisp Weir, and impacts would be similar. Impacts to individual amphibians that have a comparatively limited home range (e.g., spotted frog or western toad) are possible at the local population level. Based on ecology, life history and recent occurrences, plant priority species are unlikely to occur at this site (GeoEngineers 2010b).

3.8.3.5 Methow Acclimation Sites (Backup)

Chewuch AF

If this site is used, a new pond would be constructed downstream of the existing facility. It would be approximately 150 feet long by 50 feet wide and 3.5 feet deep, occupying approximately 7,500 square feet (0.2 acre). The existing campground, with a combination of bare ground and patches of native trees and landscaping shrubs, would be disturbed.

The reach of the Chewuch River identified as riparian priority habitat adjacent to the site would not be disturbed. Construction activity could disturb bald eagles, frogs, great blue heron, deer, and waterfowl. The loss of a small area of an existing campground and temporary disruption caused by construction noise would not significantly impact native wildlife species.

WDNR has not documented any occurrences of plants with federally protected status within 3 miles of the Chewuch AF site, nor any occurrences of state rare plants within 2 miles of the site or rare/high quality plant communities within 3 miles of the site. Common northern sweet grass has been documented between 2 and 3 miles from the site (WDNR 2000, 2009).

MSRF Chewuch

A new pond would be constructed at this site, if used, occupying approximately 7,500 square feet (0.2 acres). Approximately 890 cubic yards of material would be excavated from tree, shrub, and grass habitat dominated by deciduous species such as black cottonwood, aspen, alder, and reed canarygrass. Large trees would be avoided. Rock-lined, open channels would be constructed from the well to the pond and from the pond to the Chewuch River.

The rock-lined channel would be within a reach of the Chewuch River identified as riparian priority habitat. Priority species potentially disturbed by construction are the same as for the Chewuch AF site. The creation of additional pond and riparian habitat would benefit many of these and other native wildlife species. The temporary disruption caused by construction noise would not significantly impact native wildlife species.

WDNR has not documented any occurrences of plants with federally protected status within 3 miles of the MSRF Chewuch site nor any occurrences of state rare plants or rare/high quality plant communities within 2 miles of the site (WDNR 2000, 2009).

Utley

If the site is used, construction would include construction of an 80-foot-long channel to provide an outlet from the pond to the Twisp River. Access to the pond would be from the existing driveway southwest of the pond, across an upland maintained lawn. Existing trails and roads would allow access to the discharge site without damaging native wetland vegetation with construction equipment.

Priority habitats that would be disturbed include some upland meadow habitat with vegetation consisting of upland grasses (approximately 150 square feet of temporary impact); and some areas of forested riparian habitat with vegetation consisting of spruce (approximately 5 to 18 inch diameter at breast height [DBH]), aspen (approximately 2-3 inch DBH saplings), mountain alder, snowberry, and tall Oregon grape (approximately 950 square feet of temporary disturbance).

Priority species that might use the forested riparian and stream habitat at the Utley site are the same as for the Lower Twisp and Newby sites, and impacts are also similar and minor. Avoiding the removal of mature trees would avoid or minimize impacts to the species and habitat at the site.

Based on ecology, life history and recent occurrences, priority plant species are unlikely to occur at this site (GeoEngineers 2010b).

3.8.3.6 Combined Impacts

Clearing and grading of vegetation communities during construction would be limited to areas that are small relative to the total native habitat in the region. Impacts to forested habitat and wetlands would be avoided, disturbed areas would be replanted with native vegetation, and construction noise would be temporary. Construction would create new ponds and/or side channel habitats.

Humans would be present at all sites. However, disturbances would be limited to vehicles accessing the site and crews of two people walking the site for a small part of the day for six weeks to six months each year. Impacts to wildlife would be limited to avoidance behavior associated with human presence. Operations disturbances are unlikely to significantly affect priority species or other native wildlife and would have no impact on priority habitats or plants.

Overall, based on existing natural resource information, the type and scale of proposed construction and operation activities, and the habitats and vegetation communities that would be disturbed at the project sites, no significant adverse impacts to federally listed species are likely. In addition, while potential habitat for many of the state-listed species exists at or near many of the sites, impacts likely would be minor or insignificant and would be avoided to the greatest extent possible. No significant adverse impacts to state-listed species or habitats or other native wildlife are anticipated.

3.8.4 Impacts of the No Action Alternative

Because no new sites would be constructed, either for incubation and rearing or for acclimation, there would be no construction impacts to federally listed or state priority habitats and species.

Two sites in the Methow basin not used in the current coho program might be used for coho acclimation if the No Action Alternative is implemented. As a result, impacts of operations under the No Action Alternative would be slightly greater than those already occurring under the existing program at existing sites. Those impacts are the same as for the Proposed Action (primarily wildlife avoidance behavior associated with limited and intermittent human presence) and are considered negligible.

3.8.5 Mitigation for the Proposed Action

The following measures are proposed to avoid or minimize impacts to priority habitat, plants, and wildlife. Site-specific measures to mitigate impacts are described under the individual site analyses in Section 3.8.3. Measures to avoid impacts from construction are described in Section 2.2.2.3.

- Project features such as new ponds and side channels would be designed to be as natural as possible and in most cases would be in areas where forested habitat would not be cleared or removed.
- Few if any large trees would be removed, thus avoiding or minimizing direct effects to tree-nesting bat species or birds such as diurnal raptors, owls, woodpeckers, and passerines.
- Enclosing pumps and generators in noise-muffling structures would effectively eliminate disturbance to wildlife.

3.9 Wetlands

3.9.1 Affected Environment

Wetlands are classified in this EIS according to the USFWS classification developed by Cowardin et al. (1979). In this system wetlands are classified based on their physical characteristics, such as the general type of vegetation in the wetland (trees, shrubs, grass, etc.) and how much, and where, water is present. The wetland types found in the project area are:

- Palustrine forested (PFO) – These wetlands have at least 30 percent cover of woody vegetation that is more than 20 feet high.
- Palustrine scrub-shrub (PSS) – These wetlands have at least 30 percent cover of woody vegetation that is less than 20 feet high.
- Palustrine emergent (PEM) – These wetlands have erect, rooted, herbaceous vegetation present for most of the growing season in most years.
- Palustrine unconsolidated bottom (PUB) – These wetlands are characterized by open water, such as ponds, with less than 30 percent vegetation cover and substrate of cobbles, gravel, sand, mud, or organic material.
- Palustrine aquatic bed (PAB) – Areas of open freshwater that have rooted plants such as water lilies or cattails that project above the surface.

Due to the nature of the project, all the sites include or are adjacent to rivers, streams, or ponds; wetland habitat is typically limited to narrow patches along the shoreline of existing ponds or side channels. Although wetland habitat was anticipated at project sites, only a few require construction activities in wetlands. They are:

Wenatchee basin

- Wetlands present in proposed construction area: Scheibler (backup), George (backup hatchery site)
- Proposed construction but no wetlands present in construction area: Tall Timber, Dryden, Chikamin, Minnow, Squadroni (backup)

Methow basin

- Wetlands present and construction is proposed: Newby, MSRF Chewuch (backup), Utley (backup)
- Proposed construction but no wetlands present in construction area: Gold, MSWA Eightmile, Twisp Weir, Chewuch AF (backup)

Maps of documented wetlands at all sites are included in Appendix 4.

3.9.2 Types of Impact

The primary potential impact to wetlands from project construction would be removal, loss, and fragmentation of wetland habitat. This impact would vary in severity depending on the type and quantity of vegetation that would be affected.

Disturbances associated with operation at the sites would include trucks accessing the sites and crews of two people walking the sites. Even if wetlands exist at a project site, these activities would not affect them.

3.9.3 Impacts of the Proposed Action

Table 3-35 summarizes wetland conditions identified near sites with proposed construction activity and sites with potential wetland impacts.

3.9.3.1 Wenatchee Acclimation Sites (Primary)

Chikamin

A new pond and river intake is proposed for the Chikamin site, which is adjacent to the Minnow site. During a site visit on June 7, 2011, no wetland habitat was identified in the grass field or riparian habitat in the area of proposed construction. All disturbed areas would be replanted with native vegetation.

Minnow

A new pond is proposed for the Minnow site adjacent to an existing creek channel. Wetland habitat was not identified in the grass field or riparian habitat in the area of proposed construction during the June 7, 2011 site visit. The pond banks would be replanted with native vegetation, with no net loss of riparian habitat.

Tall Timber

The Tall Timber site would require ground disturbance for an intake from the river and for a pipeline to deliver water to an existing, disconnected side channel. The buried pipeline would deliver water to an existing side channel that contains wetland habitat along the edges. When the channel is filled with water during acclimation, it could change the plant composition if the level of inundation exceeds the current high water level.

GeoEngineers biologists visited the site on June 7, 2011; although wetland habitat was identified in the side channel, it was not delineated. The wetland is a palustrine forested and scrub-shrub wetland. The system is located in an old oxbow to the Napeequa River and is still connected to the river via a culvert under an abandoned road. No wetlands were identified at the intake site on the river.

Inundation of the side channel could slightly change the plant wetland composition; however, due to the seasonal nature of the inundation, and the fact that the inundation period corresponds with the normal high-water period, trees should not be adversely affected.

Table 3-35. Wetland conditions at or near project sites with construction activity

Site Name	Wetlands Observed During Site Visits	Wetlands Identified With Existing Information	Potential Wetland Impacts
Wenatchee Primary			
Chikamin	None observed.	PFO, PSS, and PEM wetland habitat mapped along riparian habitat a few hundred feet from the site.	No wetland impacts identified in proposed construction area.
Dryden	None observed.	PSS wetland habitat mapped along riparian habitat a few hundred feet from the site.	No wetland impacts identified in proposed construction area. - New wetland potentially created: 52,272 sq. ft.
Minnow	None observed.	PFO, PSS, and PEM wetland habitat mapped along riparian habitat a few hundred feet from the site.	No wetland impacts identified in proposed construction area.
Tall Timber	PSS and PEM wetland habitat associated with side channels.	PSS and PEM wetland habitat mapped along riparian habitat more than 1,000 feet from site.	Inundation of side channel could slightly change adjacent plant composition.
Wenatchee Backup			
Scheibler	PFO, PSS, and PEM wetland habitat associated with riparian habitat.	PSS and PEM wetland habitat mapped along riparian habitat at the site.	Temporary: 8,700 sq. ft. Permanent: 5,500 sq. ft.
Squadroni	Site visit not performed.	PSS and PEM wetland habitat mapped along riparian habitat of Nason Creek a few hundred feet from the site.	No wetland impacts identified in proposed construction area.
George (backup hatchery site)	Wetlands observed associated with the side channel (high-quality PSS and PAB wetland) and the Wenatchee River (PFO and PSS wetlands).	NWI PFO, PSS, and PAB identified associated with the Wenatchee River and the side-channel at the site.	Temporary: 45,000 sq. ft. (1 acre) Permanent: 1,075 sq. ft. (0.03 acres)

NWI – National Wetlands Inventory
PAB – Palustrine aquatic bed (wetland)
PEM – Palustrine emergent (wetland)
PFO – Palustrine forested (wetland)
PSS – Palustrine scrub-shrub (wetland)

Table 3-35 (continued)

Site Name	Wetlands Observed During Site Visits	Wetlands Identified With Existing Information	Potential Wetland Impacts
Methow Primary			
Gold	Potential small patches of PSS and PEM wetland along pond shoreline.	None within 1,000 feet of site.	No wetland impacts identified in proposed construction area.
MSWA Eightmile	PSS and PEM wetland habitat associated with riparian habitat.	PSS and PEM wetland habitat mapped along riparian habitat at the site.	No wetland impacts identified in proposed construction area.
Twisp Weir	None observed.	NWI PFO and PEM wetland habitat identified along the Twisp River at the site.	No wetland impacts identified in proposed construction area.
Newby	PSS wetland downstream of site.	None identified.	Temporary: 200 sq. ft. Permanent: 100 sq. ft. at discharge outfall.
Methow Backup			
Chewuch AF	None observed.	None within 1,000 feet of site.	No wetland impacts identified in proposed construction area.
MSRF Chewuch	PFO, PSS, and PEM wetland habitat associated with riparian habitat.	PFO, PSS, and PEM wetland habitat mapped along riparian habitat at the site.	Construction could impact wetlands along riparian habitat.
Utley	Potential patches of riverine wetlands along the Twisp River east and northeast of existing pond. A large PSS NWI wetland north of the pond may be connected to the ditch that drains the pond.	PSS NWI wetland approximately 250 feet north of the existing pond. PFO NWI wetland approximately 400 feet southwest of the pond but outside of any proposed construction areas.	Temporary:150 sq ft (0.003 acres)

NWI – National Wetlands Inventory
PAB – Palustrine aquatic bed (wetland)
PEM – Palustrine emergent (wetland)
PFO – Palustrine forested (wetland)
PSS – Palustrine scrub-shrub (wetland)

3.9.3.2 Wenatchee Acclimation Sites (Backup)

Scheibler

An existing pond would be expanded and deepened at the Scheibler site, if used. Expanding the existing pond could disturb wetland habitat associated with the pond and Chumstick Creek. Following expansion of the pond, native vegetation would be planted along the pond shoreline to create and/or enhance wetland habitat to compensate for wetland impacts.

GeoEngineers biologists visited the site on June 7, 2011. A palustrine emergent wetland (Scheibler Wetland) associated with Chumstick Creek was identified and delineated. The ordinary high water mark (OHWM) of Chumstick Creek is considered the eastern wetland delineation edge. The western bank OHWM and wetland edge was not delineated in the field due to lack of project activities proposed on the west side.

Approximately 14,200 square feet of wetland would be disturbed if this site is used. Of that amount, 8,700 square feet would be re-vegetated with native plants; 5,500 square feet of wetland would be permanently lost to the new pond area.

Squadroni

A new well, pond, surface water supply and discharge channels would be constructed at the Squadroni site, if used. All construction would be in grass fields, with no wetland habitat in the construction area; wetlands would not be affected, and no new wetland habitat would be created.

3.9.3.3 Methow Acclimation Sites (Primary)

Gold

Excavation of approximately 260 cubic yards of silt, sand, and gravel deposits from the existing ponds would be required. No additional construction activity is proposed. Vegetation adjacent to the ponds and the riparian habitat of the creek includes young trees of cedar, alder, and willow; shrubs such as red-osier dogwood, twinberry, vine maple, and snowberry; and mowed lawn. Potential PSS and PEM wetland habitat observed at the site was limited to some small patches of grass along the shoreline of the pond. While small patches of shrub and emergent species along the pond shorelines might meet the criteria of wetland habitat, it is unlikely; therefore, excavation of the pond is not expected to affect wetlands. In any event, the shorelines would not be disturbed because a long-reach backhoe will be used to excavate the ponds.

MSWA Eightmile

No wetlands were identified in the area of proposed construction.

Newby

Construction activities at the Newby site include excavation of a new pond and construction of an intake structure at Newby Creek with intake and discharge pipelines. Potential patches of PSS wetlands were observed along Newby Creek approximately 250 feet downstream of the driveway crossing over Newby Creek. The discharge pipeline would disturb approximately 200 square feet of wetland in this area. Of that amount, 100 square feet would be permanently lost for the outfall. Disturbed areas would be replanted with native vegetation. No other construction activity at this site would disturb wetlands.

Twisp Weir

Twisp Weir development includes the excavation of a new pond; construction of an intake structure, a well, and a 20-foot-long access road; and burial of pipelines.

The proposed pond is located within a mowed meadow upland habitat. The exact location of the access road has not yet been determined; however, all the potential locations between the proposed pond and the existing gravel road are upland habitat with vegetation consisting of upland grasses. Thus, wetlands would not be disturbed to construct the pond and road. The proposed location for the intake structure is at an irrigation channel at the edge of an NWI wetland habitat (PFO wetland area associated with the Twisp River) (USFWS 2008). The proposed location for the discharge pipeline traverses the NWI wetland habitat associated with the Twisp River (USFWS 2008). The proposed locations for the wells are within the NWI wetland habitat associated with the Twisp River (USFWS 2008).

If the NWI wetland areas identified at the site were an accurate characterization of actual wetlands, then wetland impacts would have been anticipated here. However, GeoEngineers biologists visited the site on June 6, 2011 and did not identify wetland habitat at the site.

3.9.3.4 Methow Acclimation Sites (Backup)

Chewuch AF

If this site is used, a new pond would be constructed, occupying approximately 7,500 square feet (0.2 acre). The pond would be dug in an existing recreational vehicle campground in an area of disturbed, bare ground and patches of native trees and shrubs used for landscaping the campground. Wetland habitat was not identified in the area of proposed construction, so no impacts to wetlands would occur.

MSRF Chewuch

A new pond would be constructed at this site, if used. The majority of the proposed construction activity does not appear to be located within wetland habitat. The open channels could encroach into PFO, PSS, and PEM wetland habitat in the area near the Chewuch River. If the site is used, a wetland survey would be conducted to confirm the presence of wetlands and identify mitigation.

Utley

Construction at the Utley site, if used, would include construction of an 80-foot-long channel between the existing pond (or the ditch draining the pond) and the Twisp River. Access to the pond would be from the existing driveway southwest of the pond, across an upland grassy area.

Approximately 150 square feet of riverine wetland within the normal channel of the Twisp River would be disturbed by construction of the outlet. If the ditch that drains the pond is identified as a wetland, any filling or excavation in the ditch would be considered wetland impacts. If the site is used, a wetland survey would be conducted to confirm the presence of wetlands and identify mitigation.

3.9.3.5 Hatchery Sites

Dryden (Primary)

The proposed hatchery site is currently used for gravel storage by Washington Department of Transportation. The majority of the site is disturbed bare ground with small patches of grass and weedy species. The riparian habitat of Peshastin Creek and the Wenatchee River includes patches of alder and black cottonwood trees. The USFWS Wetlands Mapper for NWI Map Information identifies a PSS wetland system associated with the Wenatchee River several hundred feet upstream of the Dryden site (USFWS 2009b). WDFW PHS maps do not document wetland priority habitat within 1 mile of the Dryden site (WDFW 2009). WDNR does not document any state rare/high quality wetland communities within 3 miles of the site (WDNR 2009). Wetland conditions were not observed at the site, which was confirmed by a second site visit by biologists on June 6, 2011.

Construction of the wastewater treatment wetland would create 52,272 square feet of new wetland.

George (Backup)

The hatchery would be located at the center of the site, south of the large meander bend on the side channel. Access roads for the hatchery site already exist. The intake, discharge and groundwater well pipelines traverse portions of the NWI wetland habitat associated with the Wenatchee River (USFWS 2008). In addition, the pump station and one of the wells would be located within the PFO NWI wetland (USFWS 2008). The intake structure could impact wetland, riparian vegetation and/or part of the Wenatchee River channel. Impacts to mature trees in all situations would be avoided during construction, and impacts to scrub-shrub and emergent vegetation from the pipelines, pump station, well, and intake structure would be restored with native plants after project completion.

The portion of the NWI wetland on the site is approximately 89 acres. Placement of the intake, discharge and groundwater well pipelines within the NWI wetland would result in temporary wetland impacts (approximately 45,000 square feet [sq ft] [1.0 acres]). Construction of the pump station, well, and intake structure would result in permanent wetland impacts (approximately 1,075 sq ft [0.03 acres]). Wetland habitat that would be impacted would include the riverine wetlands associated with the Wenatchee River containing quaking aspen, western redcedar, mountain alder, red osier dogwood, willows, Douglas spirea, and clover (Trifolium sp.).

3.9.3.6 Combined Impacts

Table 3-36 shows temporary and permanent impacts to wetlands at sites in the two basins.

Table 3-36. Estimated amount of temporary and permanent wetland impacts

	Temporary Impacts	Permanent Impacts	Construction of New Wetland Habitat
Wenatchee sites			
Backup acclimation Scheibler	8,700 sq. ft.	5,500 sq. ft.	
Primary hatchery Dryden			52,272 sq. ft.
Backup hatchery George	45,000 sq. ft.	1,075 sq. ft.	
Methow sites			
Primary acclimation Newby	200 sq. ft.	100 sq. ft.	
Backup acclimation			
Utley	150 sq. ft.		
MSRF Chewuch	undetermined	undetermined	
Total wetland impacts primary sites	**200 sq. ft.**	**100 sq. ft.**	**52,272**
Total wetland impacts backup sites	**53,850 sq. ft.**	**6,575 sq. ft.**	**0 sq. ft.**

The kinds of facilities that cause the impacts are summarized below.

Intakes and Discharges. New surface water intakes and discharges are proposed at several sites. The intakes and discharges would be built into stream banks and have the potential to permanently impact wetlands. At most of the sites, consultants did not identify wetland plants at proposed intake and discharge locations. Newby (discharge - primary acclimation site) and George (intake - backup hatchery site) are exceptions; at those sites, wetlands could be impacted.

Water channels. Several sites require surface water channels, but only two backup sites (MSRF Chewuch and Utley), could affect wetland vegetation during the construction of the channels. The impacts could be mitigated to a certain degree if appropriate native wetland and riparian vegetation can be established in disturbed areas after construction is completed.

Groundwater wells. New groundwater wells are proposed for several sites. A well and pump station at George could permanently remove wetland vegetation.

Ponds. A new pond would be constructed in Minnow Creek. Consultants did not identify wetland plants in the area where the pond would be built. Pond construction would include the planting of wetland plants along the new pond margins.

An existing pond at Scheibler would be expanded into wetlands, if the site is used (it currently is a backup site). The deeper pond water would not qualify as wetland habitat so there would be a net loss of wetland area. Non-native reed canarygrass that currently borders the pond and is the dominant species in the wetland would be removed and replaced with native wetland plants along the new pond margins.

New wetlands. The discharge treatment system proposed for the Dryden hatchery includes creation of a new wetland of about 1.2 acres for the purpose of removing nutrients from hatchery effluent.

3.9.4 Impacts of the No Action Alternative

There would be no adverse construction impacts to wetlands under the No Action Alternative because no new facilities would be constructed. No new wetland habitat would be created.

Impacts of facility operations would be the same as under the current program.

3.9.5 Mitigation for the Proposed Action

This section identifies measures designed to avoid, minimize, and mitigate potential impacts on wetlands and wetland buffers as a result of project implementation. Mitigation measures would be the same for all project sites.

- Clearing and grading would be designed to avoid wetland areas to the greatest extent possible.
- Disturbed areas would be re-vegetated with native vegetation.
- Staging areas for construction would be located outside wetland buffers and re-vegetated with native vegetation as necessary.
- Construction permits issued to the project would include detailed measures for protecting wetland habitats. The conditions included in the permits would be met during construction.

3.10 Floodplains

3.10.1 Affected Environment

The climate of the Wenatchee and Methow basins is characterized by warm, dry summers and relatively cold winters. The average annual precipitation in the lower elevations is slightly more than 11 inches, increasing with elevation to about 35 inches. The bulk of this precipitation falls as snow, which reaches 100 inches or more in the upper watersheds. The Wenatchee and Methow rivers and other perennial streams follow an annual cycle, with peak stream flow in April and May and low stream flow in August and September. Normally, stream flow in many of the smaller drainages is seasonally intermittent, while drainages in lower elevations are often dry (Chelan County Department of Emergency Management 2006, Okanogan County Department of Emergency Management 2009).

Two types of flooding common in the basin are stage and flash flooding. Stage flooding is usually seen during periods of heavy rains, especially upon existing snow packs during early winter and late spring. Stage flooding problem areas occur along the Wenatchee River near its confluence with Icicle Creek, the headwaters of the Wenatchee River, and the confluence area of the Wenatchee River (Chelan County Department of Emergency Management 2006). Stage flooding problem areas occur along the Methow River, especially where the Twisp River and Chewuch River join (Okanogan County Department of Emergency Management 2009).

Flash floods are more likely during the summer months, in thunderstorm season. The primary cause of flash flooding, which can occur in any drainage in the project area, is high-intensity rainfall. Although infrequent, and usually of short duration, high-intensity rainfall has been seen in all seasons in the past. Depending upon the characteristics of a particular watershed, peak flows may be reached from less than one hour to several hours after rain begins. The debris flows and mudslides accompanying rapid runoff conditions make narrow canyons and alluvial fans at the mouths of the canyons extremely hazardous areas (Chelan County Department of Emergency Management 2006, Okanogan County Department of Emergency Management 2009). Currently in the Methow basin, flash flooding problem areas include drainages in the Methow/Twisp area that have experienced forest fires in the recent past (Okanogan County Department of Emergency Management 2009).

3.10.2 Types of Impact

Potential impacts to floodplains from construction and operation activities include:

- Obstruction of flood flows and alteration of local drainage patterns.
- Disposal of spoil materials, filling the floodplain.
- Pond creation or expansion, adding floodplain storage.
- Potential increase in flows due to discharge of groundwater.

The primary goal of floodplain management is to restrict non-compatible development in the floodplain to avoid repetitive losses. The Federal Emergency Management Agency (FEMA) delegates the responsibility of project review to the local regulatory agency through the National Flood Insurance Program. Both Chelan and Okanogan Counties prohibit development within the floodway, but do allow development in the floodplain outside the floodway, as long the proposed development does not increase water surface elevation of the base flood by more than 1 foot. Therefore, a project that would encroach into the floodway and increase the base flood elevation (BFE) or that would encroach upon the floodplain and increase the BFE by more than 1 foot would be determined to have a significant impact on flooding. A project that reduced the BFE would have a beneficial effect on flooding.

3.10.3 Impacts of the Proposed Action

Implementation of the Proposed Action would probably have little or no effect on flood elevations. Where there is an effect, it is likely to be beneficial, as the new or expanded acclimation ponds would provide some small amount of additional floodplain storage (difference between the existing land surface elevation and the working water surface elevation). The spoil materials created by construction activities such as excavation of ponds and ditches, grading of roads to improve winter access, or installation of buried water supply pipes would be disposed of outside the 100-year floodplain in accordance with the local grading and floodplain management ordinances. Consequently, there are not likely to be changes in grades that could direct or divert flood flows affecting properties either upstream or downstream of the individual project sites.

Site-specific impacts are discussed only for the primary and backup sites with substantial construction activities. Sites that require only minor improvements to existing ponds, access roads, or conveyance facilities are not expected to alter the potential for flooding at those sites and are therefore not discussed further. New wells, although providing additional flow through the acclimation sites, would withdraw water from shallow aquifers that are typically hydraulically connected to the adjacent creek or river. Therefore, there is no real gain or loss of water (see Section 3.6). Additionally, the well discharge would be very minor compared to flood flows (Section 3.6). Consequently, sites that require only flow augmentation from wells are not discussed further.

3.10.3.1 Wenatchee Acclimation and Hatchery Sites

Table 3-37 lists all the Wenatchee basin hatchery and acclimation sites, the floodplain development activities associated with each project, and the likely need for a floodplain development permit. Where the floodplain development permit process is required, a professional civil engineer would need to perform substantially more detailed analyses of floodplain impacts. These detailed floodplain analyses are not part of this impact evaluation and are beyond the scope of the EIS.

Surface water intakes proposed at the Tall Timber, Chikamin, and Dryden sites would be below grade and would match the existing contours of the river banks. They would be designed so they do not decrease flood storage volume and would not impede flow. Pipelines delivering water from these intakes would be buried and would have no impact on flood elevations. Site-specific discussions of sites requiring construction follow the table.

Table 3-37. Wenatchee acclimation and hatchery sites with development activities in floodplains

Wenatchee River Basin, in Chelan County, Washington		
Primary Site	**Activities in Floodplain**	**Floodplain Development Permit Required**
Tall Timber	Excavation of Napeequa River bank, water intakes, and pipeline corridor	Yes
Chikamin	Excavation of a pond, Chikamin Creek bank, water intakes, open channel, and pipeline corridor	Yes
Minnow	Excavation of bed and banks of Minnow Creek	Yes
Butcher	None	No
Coulter	None	No
Rohlfing	None	No
White River Springs	None	No
Dirty Face	None	No
Two Rivers	None	No
Clear	None	No
Beaver	None	No
Brender	None	No
Leavenworth NFH	None	No
Dryden Hatchery	Development of water quality treatment wetlands	Yes
Backup Site	**Activities in Floodplain**	**Floodplain Development Permit Required**
Allen	None	No
Coulter/Roaring	None	No
McComas	None	No
Scheibler	Excavation of bed and bank of Chumstick Creek	Yes
Squadroni	Excavation of pond and open channels	Yes
George Hatchery	Excavation and construction of fish hatchery facilities	Yes

Primary Acclimation Sites

Tall Timber

The Tall Timber site is located on the unmapped section of the Napeequa River near its confluence with the White River. Although FEMA has designated a special flood hazard area along the White River (Zone A), the project site is located outside the special flood hazard area. The Tall Timber acclimation site would require a river intake and pipeline delivering water to an existing disconnected side channel. An 800-foot-long water supply pipeline from the intake to the side channel would be buried. An existing culvert would convey water from the side channel back to the river. Because the pipeline would be buried, it is expected that there would be no effect on flooding. Floodwater elevations in the stream reach between the intake and the outlet of the acclimation diversion may be slightly reduced due to the withdrawal of water from the main channel.

Chikamin

Construction of an acclimation pond at the Chikamin site would require excavation of approximately 1,370 cubic yards of material. An intake would be constructed on the bank of Chikamin Creek and a 200-foot-long water supply pipeline from the intake to the pond would be buried. A rock-lined open channel, 100 feet long and 5 feet wide, would be constructed to convey water from the pond back to the creek. The Chikamin site is not located in a FEMA mapped flood hazard area, but is likely in the 100-year floodplain of Chikamin Creek. The construction of a pond would likely lower flood elevations a small amount due the removal of excavated soils from the floodplain. Overall, the project would have little effect on flooding.

Minnow

Construction of an acclimation pond at the Minnow site would require excavation of approximately 1,370 cubic yards of material from the bed and banks of Minnow Creek, essentially widening and deepening the channel. The Minnow site is not located in a FEMA mapped flood hazard area but is in the 100-year floodplain and floodway of Minnow Creek. During a flood, the flows would be essentially the same because there is not a substantial amount of active storage in the pond. Consequently, there could be very small reduction in flooding but no change to the floodway.

Backup Acclimation Sites

Scheibler

If this site is used, Chumstick Creek channel would be excavated to expand an existing pond. Project construction would remove 350 cubic yards of material. Material excavated from the pond would be spread at approved areas, outside the floodplain. The site is located on Chumstick Creek floodplain in an area that has not been studied by FEMA. Furthermore, FEMA has not produced a flood hazard map of this reach. Because the construction is limited to excavation and the spoils would be disposed of outside the floodplain, the project could reduce flooding slightly along Chumstick Creek.

Squadroni

To construct the Squadroni acclimation pond, 1,200 cubic yards of material would be excavated. The seasonal flow from an existing ditch would contribute surface water, and a well would be constructed to supply additional water. Water from the well would be delivered through a 50-foot-long, rock-lined, open channel. A 20-foot-long discharge channel would return water from the pond to the ditch prior to discharge to Nason Creek. Spoil materials would be removed from the site for disposal outside the floodplain. Although the pond would provide some additional floodplain storage, the volume is very small compared to the flood flows. Consequently, the project may slightly reduce flooding on Nason Creek.

Hatchery Sites

Dryden

The Dryden hatchery would require excavations to create rearing ponds, raceways, a hatchery building, wells, and an effluent treatment system. These excavations would occur outside the flood hazard area. A flood study of the site was completed (Anchor QEA, 2009) and 100-year flood boundaries were mapped. They are shown in Figure 2-8 in Chapter 2. Some construction could occur in the floodplain to construct the wetlands that would help treat hatchery discharges. Constructed wetlands would be built at existing grade and would not impact flood elevations.

Approximately 2,050 cubic yards of material is proposed to be removed from areas outside the floodplain. Material disposal areas have not yet been located but they would be in approved locations that meet grading permit conditions and minimize potential for floodplain fill. Consequently, there would be no effect on flooding.

George

The George hatchery would require grading to create rearing ponds, raceways, a hatchery building, parking areas, backup generator station, and an effluent treatment system. The hatchery facilities would require a permanent footprint of 1.5 acres. Including pipelines, water supply construction, and hatchery facilities, a total of 2.5 acres of land would be disturbed during construction.

Permanent hatchery facilities would be located outside the limits of the 100-year floodplain boundary. As this is a backup site, detailed engineering studies have not been completed. Because the project is near the edge of the floodplain, at an elevation similar to the BFE, it is not expected that the project would measurably obstruct flood flows or reduce floodplain storage. Development of the site would have not have a substantial adverse effect on flooding.

3.10.3.2 Methow Acclimation Sites

Table 3-38 lists all the Methow basin acclimation sites, the floodplain development activities associated with each site, and the likely need for a floodplain development permit. Where the permit process is required, a more detailed analysis of floodplain impacts would need to be performed by a professional civil engineer. These detailed floodplain analyses are not part of this impact evaluation and are beyond the scope of the EIS.

Table 3-38. Methow acclimation sites with development activities in floodplains

Methow River Basin, in Okanogan County, Washington		
Primary Site	**Activities in Floodplain**	**Floodplain Development Permit Required**
MSWA Eightmile	None	No
Mason	None	No
Newby	Excavation of pond, water intake, and pipeline corridors	Yes
Twisp Weir	Excavation of pond, wells, water intake and pipeline corridor	Yes
Gold	None	No
Goat Wall	None	No
Pete Creek Pond	None	No
Heath	None	No
Parmley	None	No
Lower Twisp	None	No
Hancock	None	No
Winthrop NFH	None	No
Backup Site	**Activities in Floodplain**	**Floodplain Development Permit Required**
MSRF Chewuch	Excavation of a pond and open channels	Yes
Chewuch AF	Excavation of the Chewuch River bank, pond and pipeline corridors	Yes
Utley	Excavation of outlet channel to the Twisp River	Yes
Poorman	None	No
Biddle	None	No
Balky Hill	None	No

Primary Sites

MSWA Eightmile

The MSWA Eightmile site is located in an abandoned side channel of the Chewuch River, just upstream of the mouth of Eightmile Creek. Construction would include a well and a 100-foot long, 5-foot wide, rock-lined, open channel that would deliver water from the well to the side channel. FEMA has not mapped a special flood hazard zone near the site. There would be no effect on flooding.

Twisp Weir

Proposed construction at the Twisp Weir site would include a 140-foot long, 50-foot wide, 3.5-foot deep, constructed earthen pond occupying approximately 0.2 acres. Because the pond would be below existing grade and material would be removed and disposed of outside the floodplain, there would be no effect on flooding. The new intake, wells, surface water channels, and water pipeline would all be in the 100-year floodplain. All work would be at or below existing grade and material disposed outside the floodplain, so there would be no effect on flood elevations.

Gold

The Gold site consists of several existing ponds located adjacent to Gold Creek. Construction activities would involve removing some accumulated sediment from the ponds to restore water depths adequate for acclimation. Excavated materials would be disposed of outside the floodplain in accordance with grading permits. The project site is not within a FEMA-mapped special flood hazard area. The proposed construction would not alter the diversions from Gold Creek. Consequently, there would be no effect on flooding.

Newby

A 140-foot long, 50-foot wide, 3.5-foot deep earthen bottom pond and an intake on Newby Creek are proposed for the site. Buried water delivery pipelines from the intake to the pond and from the pond back to the Twisp River would also be constructed. The construction activities would be within the special flood hazard area along the Twisp River. Because excavated materials would be disposed of outside the floodplain there would be no effect on flooding.

Backup Sites

MSRF Chewuch

Acclimation pond construction would include the excavation of approximately 890 cubic yards of material. A well would also be constructed. Rock-lined open channels, a total of 320 feet long and 5 feet wide, would be constructed from the well to the pond and from the pond to the Chewuch River. FEMA designated a special flood hazard area (Zone A5) along the Chewuch River in the vicinity of the project, but the project is outside the flood hazard area. There would be a minor increase in floodplain storage capacity and potentially a slight reduction in flood elevations due to pond construction.

Chewuch AF

Acclimation pond construction would include the excavation of approximately 975 cubic yards of material. Water would be diverted from the Chewuch River. Water delivery pipelines with fish screens would also be constructed. The Chewuch AF site is located in the FEMA-mapped flood hazard area (A3). Excavated materials would be removed from the site and disposed of in an upland location outside of the floodplain in accordance with local floodplain management ordinance requirements. Consequently, there would a minor increase in floodplain storage capacity and potentially a slight reduction in flood elevations due to pond construction.

Utley

An 80-foot long, 3-foot wide channel from an existing pond to the Twisp River is proposed to allow acclimated smolts a route to the river. The pond and the proposed channel are within the special flood hazard area. Because excavated materials would be disposed of outside the floodplain, there would be no effect on flooding.

3.10.3.3 Combined Impacts

The total amount of ground disturbed in floodplains during construction of all the primary sites is proposed to be less than 5 acres for new and expanded ponds, water delivery channels, and other facilities as described in Appendices 1, 2, and 3. The pond excavations would remove material from floodplains, slightly increasing floodplain storage capacity and potentially decreasing flood elevations.

Proposed clearing and grading during construction is limited to small areas relative to total floodplain areas. At each site, impacts to flooding would be avoided or compensatory floodplain storage would be created to offset facilities located above ground in the floodplain.

Overall, the combined effects to flooding due to proposed construction and operation of acclimation and hatchery sites are not considered to be a significant impact because the sites individually have negligible or no effect.

3.10.4 Impacts of the No Action Alternative

No Action would cause no impacts to floodplains because no new sites would be constructed.

3.10.5 Mitigation for the Proposed Action

Measures that would be implemented to minimize potential impacts to flooding include:

- Compensatory storage incorporated in the project design where above-ground facilities are located within the floodplain.
- Spoil materials removed and disposed in uplands or at off-site locations outside the floodplain.
- Infrastructure buried below grade, not in elevated road prisms, preventing diversion or rerouting of floodwaters.
- Using as many existing ponds as possible for fish acclimation and release.

3.11 Visual Quality and Recreation

3.11.1 Visual Quality

The construction of a new small hatchery in the Wenatchee basin has the potential to alter the visual environment of the surrounding area. Both the primary and backup facility locations are included in this assessment. Proposed acclimation sites (including existing, expansion of existing, and construction of new) are small-scale ponds without significant structures such as buildings. Development or modification of these sites would not constitute a significant or noticeable change in the visual character of the area. Therefore, proposed acclimation sites would not have an impact on aesthetic quality and are not included in this analysis.

3.11.1.1 Affected Environment

The visual impact analysis included two areas in the Wenatchee basin. The Dryden site is the preferred (primary) location for a small, new incubation and rearing facility on the Wenatchee River (RM 18.6) at the mouth of Peshastin Creek. In the event construction at Dryden is infeasible, the George site is proposed as an alternative (backup) location on the Wenatchee River (RM 51.6) just downstream of Lake Wenatchee. Both sites are located in primarily rural areas in the Wenatchee watershed (see Chapter 2 and Appendix 1 for details).

3.11.1.2 Types of Impact

Whether the Proposed Action is considered to affect scenic or visual quality of an area is determined by the number of viewer groups affected, the presence of scenic resources, the magnitude of change from the existing condition, and sensitivity of viewers to changes.

3.11.1.3 Impacts of Proposed Action

Dryden Study Area (Primary)

The Dryden study area encompasses lands and waterways within view of a new small hatchery on the right (west) bank of the Wenatchee River, just upstream of the Dryden Dam (Figure 3-6). The 24-acre parcel currently is owned by the Washington State Department of Transportation (WSDOT) and was used as a gravel pit and stockpile site from 1961 to 2008 when it was declared surplus property. The parcel has no buildings or structures and has been significantly modified from its natural state by over 40 years of WSDOT activities. Most of the parcel that would be affected by construction of the facility is currently covered in varying amounts of gravel and sand, and there is little or no vegetation. The topography of the parcel is relatively flat and sits at an elevation of 984 feet.

The proposed new hatchery would modify up to four acres of the parcel. The facility would consist of a one-story building of about 3,000 square feet, parking for up to ten vehicles, four concrete raceways, two ponds, a two-acre constructed wetland for water treatment, and water supply pipelines (both above-ground and buried). An 8-foot-tall cyclone fence would surround the portion of the property with the hatchery building, raceways, and ponds. Viewer groups that might be affected by the change to the site include boaters, fishers and other visitors who use these reaches of the Wenatchee River and Peshastin Creek; surrounding landowners and orchard workers; gun club visitors; and train riders.

Figure 3-6. Visual Impact Analysis Study Area for the Dryden Incubation and Rearing Facility, Wenatchee River

View 1 – East of Dryden:

The parcel is bordered to the east by the Wenatchee River and steep terrain that quickly ascends from the river banks to an elevation of 1,400 feet. Boaters and recreationists on the Wenatchee River would potentially have a view of the proposed facility. Existing evergreen trees and other vegetation along the shoreline would block or significantly limit most lines of sight between the river and the facility, particularly during the busy summer season when deciduous vegetation is fully leafed. Along the east bank of the Wenatchee River, railroad tracks run along the base of the ridge and are used by a variety of railway companies, including Amtrak's Empire Builder route that currently passes the parcel twice a day—once between 5:00 a.m. and 6:00 a.m., and again between 8:00 p.m. and 9:00 p.m. Views of the facility from the trains would be partially limited by shoreline vegetation, daylight, and train speed, but brief unobstructed glimpses of the facility during the summer months would be possible. East of the railroad tracks, land that would be within view of the facility is largely undeveloped, with some orchards near the top of the ridge and to the southeast. There is one house in an orchard to the southeast at an elevation of approximately 1,100 feet that would have a year-round view of the facility. There are no public roads or trails on this side of the river that are within view of the study area.

View 2 – South of Dryden:

Areas in the southern portion of the Dryden study area include an unimproved pull-out site for rafters and kayakers for portaging around Dryden Dam, a gravel access road to the pull-out, and orchards. The boater pull-out is located adjacent to the southeast boundary of the parcel; users would have a partial view of the facility. Existing evergreen trees and other vegetation along the shoreline would block or significantly limit most lines of sight between the pull-out and the facility, particularly during the busy summer season when deciduous vegetation is fully leafed. Users of the gravel access road would travel along the southern perimeter of the parcel and would have unobstructed views of the entire facility. To the immediate south of the access road, elevation gradually increases to a bluff (approximately 1,050 feet) that is lined with evergreen trees and other vegetation. Beyond the vegetation is an orchard, portions of which would have a view of the Dryden facility. Views from these vantage points within the orchard would be limited or blocked by vegetation during much of the year.

View 3 – West of Dryden:

Areas in the western portion of the Dryden study area include orchards, houses and outbuildings, the Dryden Gun Club, and a section of Peshastin Creek. Views of the facility from the southwest would potentially be possible from parts of an orchard near the bluff edge and from the far edge of the gun club target range. These vantage points are privately owned and are not expected to be visited frequently, and views would be blocked or limited by vegetation much of the year. The house and outbuilding in the orchard, as well as the Dryden Gun Club clubhouse, parking lot, and shooting area, would not have a view of the facility at any time. Boaters and recreationists in and along the section of Peshastin Creek to the west of the parcel may have partial views of the one-story building. However, the vast majority of people who visit Peshastin Creek do so in the summer months when the potential for views of the facility would be blocked or significantly limited due to seasonal vegetation. Views of the facility from the northwest would be possible from one house and outbuilding in an orchard, primarily during the winter months when the trees are not leafed out.

View 4 – North of Dryden:

The study area to the north of the Dryden facility included the lower section and mouth of Peshastin Creek where it flows into the Wenatchee River and orchards on the opposite side of the creek. Boaters and other visitors to this section of Peshastin Creek may have views of the facility, though many lines of sight would be blocked or limited by vegetation. Some areas along the shoreline, particularly near the mouth of the creek, may have year-round views of parts of the facility. The orchards on the opposite side of the creek would have partial views of the facility from a few vantage points, primarily during the winter months when the trees are not leafed out.

Construction Impacts

Construction-related activities, including heavy equipment operation, clearing and grading, material stockpiles, and worker presence, would be visible from all identified viewpoints at Dryden throughout construction of the facility. Construction at Dryden would attract attention of sensitive viewers and alter the existing viewscape from those viewpoints. Sensitive viewers would experience a negative effect locally from construction activities; however, this effect would occur for a relatively brief period of 5 months until construction is completed.

Many of the viewpoints of the Dryden facility are blocked or limited by existing vegetation surrounding the site (see descriptions above). This vegetation would not be removed and would restrict the view of the site during construction. Therefore, construction of a new hatchery at the Dryden location would have a noticeable but short-term adverse impact to visual quality.

Operations Impacts

The Dryden facility would replace an existing gravel pit and stockpile site, and would be visible from the viewpoints identified above. The facility would be operated year-round. The new one-story building would be the most prominent feature of the facility and would be designed to reduce the contrast with the surrounding landscape (natural materials, neutral colors, etc.). The raceways, ponds and water supply system would be relatively low-profile and would have much less potential to be seen from the viewpoints, particularly during months when vegetation and trees are fully leafed. The constructed two-acre wetland would be designed to closely resemble a natural wetland environment and would likely be viewed as a significant improvement over existing conditions. Furthermore, the established wetland would eventually support vegetation that would contribute to the screening of the building and facilities from most viewpoints.

Considering that the existing condition of the Dryden site is significantly modified from its natural state, it is reasonably likely that construction of the new facility would reduce the contrast of the site with the surrounding area and add to the aesthetic appeal for viewers. Therefore, changes to the viewscape due to the operation of the Dryden facility would represent a long-term minor beneficial impact to visual quality.

George Study Area (Backup)

The George study area encompasses lands and waterways within view of a new incubation and rearing facility that would be constructed if the primary location at Dryden is infeasible. The 150-acre parcel is approximately two miles downstream from Lake Wenatchee (the source of the Wenatchee River) and is at an elevation of 1,870 feet. The parcel was logged in the past and is currently privately owned and undeveloped. A few primitive, unimproved old logging roads provide limited access to the site. There are no public roads, trails, or sites near the area, and there are no homes within view of the proposed construction site.

The new incubation and rearing facility would modify up to 2.5 acres of the parcel. The facility would consist of a one-story building, parking for up to ten vehicles, four concrete raceways, two ponds, and water supply pipelines (both above-ground and buried). The facility would be constructed in the forest approximately ¼ mile from the river and out of view of anyone on or along the river. A concrete water intake structure installed in the river would be visible below the water surface. The water delivery pipeline would be buried and not visible between the intake and the hatchery. A small pump station would be located in the forest approximately 50 feet from the intake and may be visible through the trees from the river or the shoreline.

The only viewers who might be affected by the change to the site are boaters who use this reach of the Wenatchee River. Much of the upper Wenatchee River corridor is part of the Wenatchee National Forest; there are launch sites for rafts, kayaks and canoes approximately two miles upstream of the George site. The next access point for boaters is an unimproved site approximately ten miles downstream of the site. Considering the long stretch of river between launch and pull-out points, and that the reach adjacent to the proposed facility is inaccessible by any other means, there would be few potential viewers and they would be in the area for only a brief time as they move downstream.

Construction and Operation Impacts

The duration of construction within view of river users would be extremely short (days) and would require little to no disturbance to the surrounding areas. Due to the very low magnitude of change in visibility of the site and the infrequent and very low number of viewers, it is reasonably certain that construction and operation of the George facility would have little or no effect on the visual quality of the area.

3.11.1.4 Impacts of the No Action Alternative

The No Action Alternative would require no new facilities, ground-disturbing activities, or alteration of the Dryden or George sites. The sites would remain in their current state, and views at each site would be unaffected by this alternative. No direct or indirect effects to visual quality of the area would result from the No Action Alternative.

3.11.1.5 Mitigation for the Proposed Action

To avoid, minimize, or mitigate potential impacts to visual quality, areas of disturbance would be minimized to the greatest extent possible. Upon completion of facility construction, all disturbed areas would be seeded with native grasses or planted with native vegetation, where appropriate.

3.11.2 Recreation

Recreational resources in the Wenatchee and Methow basins could potentially be impacted by project construction and operation activities. Proposed project sites where construction would occur and/or where operations would change from the current conditions were evaluated for proximity to recreational areas (e.g., campgrounds, trails, rivers, resorts). Sites were not included in the analysis if there were no nearby recreational resources that could be affected by project activities or if there was no potential for impact (i.e., no construction and no change from existing operating conditions).

3.11.2.1 Affected Environment

Of the 39 primary and backup sites proposed as part of the project, a total of 11 would be located in areas that are near or adjacent to existing recreational resources. Two of those sites would have no potential for impact (no construction and no change in operations from the current conditions) and are not included in the analysis. Therefore, the recreational impact analysis focuses on the construction and operation of one proposed new incubation and rearing facility at Dryden and eight new or expanded acclimation sites.

The Dryden study area is the same as described in the visual impacts analysis. Recreation in the Dryden study area largely centers on the Wenatchee River and Peshastin Creek. The Dryden Gun Club to the south of the facility is also included in the analysis.

The study areas for the eight acclimation sites included three sites in the Wenatchee basin and five in the Methow basin. Three of the sites would not require construction, and potential impacts would solely be the result of a change in operations activities from current conditions.

Figures 2-6 and 2-7 in Chapter 2 show the locations of project sites in each basin. Large-scale maps of each proposed and backup site can be found in Appendix 4.

3.11.2.2 Types of Impact

The adverse impacts to recreation by construction and operation of the proposed facilities are determined by the presence of recreational resources, the number of affected recreational groups, the magnitude of change from the existing condition, and the sensitivity of area recreationists.

If the proposed program successfully reintroduces coho, recreational fishing opportunities would be increased. A recreational coho fishery was held on the Methow and Wenatchee rivers in fall of 2011, the first in at least 30 years.

Natural coho populations would increase wildlife viewing opportunities. Spawning coho adults in the late fall and increased numbers of predator species in general could increase the options for viewing wildlife in the region.

3.11.2.3 Impacts of the Proposed Action

Dryden (Primary Hatchery Site)

A variety of users visit the Dryden study area year-round for boating, fishing, and other river-related types of recreation. The 17-mile reach of the Wenatchee River from Leavenworth to Cashmere (river mile 27 to 10) has an overall gradient of 0.4% with multiple class-2 and class-3 rapids, making it ideal for commercial and recreational rafting and kayaking. As a result, this reach has the most access points on the river, including improved pull-out and launch sites at Leavenworth and Cashmere and several unimproved sites throughout the reach. There are also several parking and walk-in easements for sport fishing access.

All boaters traveling downstream must pull out above Dryden Dam (adjacent to the southern boundary of the new facility location) and re-launch just downstream of the dam. The pull-out area is also accessible by a gravel road that leads west to Highway 2 (via Saunders Road). A section of the gravel access road would be within the boundaries of the southern portion of the facility property.

The Dryden Gun Club is located on Saunders Road off of Highway 2 and provides a recreational shooting range and target practice area for hunters, marksmen and other gun enthusiasts. The clubhouse and lot are also often used for a variety of public and private functions, including weddings, picnics, family reunions and conventions.

Construction

Recreational resources near the Dryden site could be temporarily affected during construction of the facility. Construction would have no direct impacts to users of the boaters' pull-out or other recreationists in the area; neither the pull-out nor the access road would be modified as part of the proposed project, and full access to the sites would be maintained for all users. Boaters, fishers, gun club visitors, and other recreationists who use Saunders Road and the gravel access road could be temporarily affected by the intermittent presence of construction vehicles and equipment. This temporary increase in traffic congestion may on occasion briefly delay travel along the roads due to slow-moving construction vehicles and equipment, and might also increase noise and dust in the immediate areas along the roads. Intermittent noise associated with the construction of the facility might also be heard by visitors to the area, but would be limited primarily to the immediate area surrounding the facility (e.g., the gravel access road) and would not be expected to significantly affect the experience of recreationists.

All traffic, noise and other construction-related impacts to recreationists in the area would be temporary in duration (up to five months), intermittent, low in magnitude and limited to normal workday hours (8:00 a.m. to 5:00 p.m., Monday through Friday). Though daily use of the area by recreationists could occur, it is expected that recreational activity peaks on the weekends when there would be no construction at the facility and no potential for impact. Therefore, it is reasonably certain that construction of the Dryden facility would have a short-term, minor adverse effect on recreational resources.

Operation

Operation of the Dryden facility would minimally affect recreational users in the area, if at all. Facility operations would have no direct impacts to users of the boat pull-out or other river recreationists in the area. The proposed new facility is accessible only from Saunders Road, so visitors to the area might notice occasional traffic of project vehicles. Hatchery vehicles would primarily be standard-sized pick-ups and, infrequently, larger fish-transport trucks. Traffic would occur daily, year-round, and would be noticeable but would not affect other users of local roads, the experience of visitors to the area, or events at gun club facilities.

Noise associated with facility operations would be maintained within state-approved environmental noise regulations (WAC Chapter 173-60 of the Noise Control Act of 1974) by installing all pumps and generators in sound-enclosures. It is reasonably certain that noise due to operations activities would not be detectable beyond the facility property and would not impact recreational visitors.

Potential impacts due to operations activities would likely be low in magnitude and would not affect access to recreation or the experience of recreational visitors; therefore, operation of the Dryden facility would have, at most, a minor adverse effect on area recreation.

Acclimation Sites

Table 3-39 lists the eight acclimation sites (five primary and three backup) where proposed construction and/or new use of the site as an acclimation facility could affect nearby recreational resources. All eight sites would have operations activities that are different from current conditions. A few existing, currently operating acclimation sites are on recreational property, but because no new construction is required, the proposed project would not affect them differently. In addition to the 8 sites, several others are on property with homes used for vacation homes.

Table 3-39. Recreational resources near proposed acclimation sites

Basin	Primary or Backup	Site Name	Nearby Recreational Resources	Construction / Operation[a]	Generator
Wen	P	Tall Timber	Tall Timber Ranch church camp	new H_2O delivery system / new acclimation	None
Wen	B	Allen	Valley Hi community recreation pond	no construction / new acclimation	None
Wen	B	Coulter / Roaring	habitat preservation; adjacent recreation property	no construction / new acclimation	None
Met	P	Gold	walking trails and benches	expand existing ponds / new acclimation	None
Met	P	MSWA Eightmile	wildlife conservation and public recreation	new well and H_2O and electrical delivery systems / new acclimation	Primary power March-May
Met	P	Pete Creek Pond	adjacent 9-hole golf course	no construction / new acclimation	None
Met	P	Newby	recreation property	new pond and H_2O delivery system / new acclimation	None
Met	B	Chewuch AF	RV campground	new pond, well and H_2O delivery system / additional acclimation	None

a. Operations activities at all eight sites would change from existing conditions.

Construction

Construction at four primary acclimation sites and one backup site with nearby recreational resources could temporarily affect residents and visitors. The level of construction would vary between sites, and could include the construction of a new pond, the expansion of an existing pond, the installation of a new well, and/or the installation of a new or expanded water delivery system. The duration of construction activity would be from 1 to 60 days at each site, and would be limited to normal weekday work hours of 8:00 a.m. to 5:00. p.m., Monday through Friday.

Recreational visitors to the area during the construction periods could notice intermittent increases in noise due to construction activity, but the magnitude of impact is likely to be low, temporary and brief, and is not expected to affect users' experience of the area. Therefore, it is reasonably certain that construction activities at the acclimation sites would have a short-term, minor adverse effect on recreation.

Operation

Ongoing project activities during operation of acclimation sites could infrequently affect nearby recreational properties. Project staff would access the sites at least twice a day during the spring acclimation period of March through April; none of the primary or backup sites with recreational facilities nearby is an overwinter site. Traffic associated with site operations would typically consist of one or two standard-size pick-ups. A large fish transport truck would visit each site once per year to transfer juvenile coho from the hatchery to the acclimation ponds. A generator is proposed to provide primary power at one site (MSWA Eightmile) during the entire six-week acclimation period, and would be contained within a sound-enclosure to minimize noise; all sound levels would be maintained within state guidelines for environmental noise and would not be detectable beyond the immediate area surrounding the enclosure.

Operations activities at eight primary and backup acclimation sites could be detectable by recreationists in the area, but would likely be very low in magnitude and are not expected to affect access to recreation or the experience of recreational visitors. Therefore, operations activities at the sites would have little or no adverse effect on recreational resources in the area.

3.11.2.4 Impacts of the No Action Alternative

The No Action Alternative would require no new facilities, no ground-disturbing activities, and no modifications at any of the proposed sites. Recreational resources and users would be unaffected by construction activity. Increased recreational fishing opportunities might continue but are less likely. Without naturally spawning populations, wildlife viewing opportunities would not increase.

3.11.2.5 Mitigation for the Proposed Action

To avoid or minimize impacts to recreational resources and users, all construction activity would be limited to normal workday hours of 8:00 a.m. to 5:00 p.m., Monday through Friday. Noise associated with facility operations would be maintained within state-approved environmental noise regulations by installing all pumps and generators in sound-enclosures.

3.12 Socioeconomics

3.12.1 Affected Environment

The general area for socioeconomic effects includes Chelan and Okanogan counties. The acclimation sites in both basins are primarily rural and widely distributed in the upper portions of the Wenatchee and Methow watersheds. Cashmere, Peshastin, and Leavenworth are the nearest towns to the Wenatchee acclimation sites. Twisp and Winthrop are the nearest towns to the acclimation sites in the Methow basin. Wenatchee is largest municipality in the area.

The per capita income of the area is low compared to Washington in general (Table 3-40). Although county unemployment rates are stable and comparable to the statewide average, they may be higher within the small communities (Washington State Data Book 2008) primarily due to changes in the viability of the tree fruit industry and agriculture in the area (B. Brammer, Crane & Crane, and E. Parisel, Brewster Heights Packing, personal communications, October 2005 as reported in Chief Joseph Hatchery Program EIS, BPA 2010). Employment opportunities are better in Wenatchee and East Wenatchee, which have more diversified economies.

Table 3-40. County income and employment

Sector	Chelan Co.	Okanogan Co.	Washington
Per Capita Income (2006)	$29,657	$25,850	$38,067
Employment (2008)	36,230	16,930	3,200,000
Unemployment Rate (2010)	7.7%	9.1%	9.1%

Source: Washington State Data Book 2008: Unemployment data from US Bureau of Labor (http://www.bls.gov/lau/home.htm) for August 2009-September 2010, not seasonally adjusted

3.12.2 Impacts of the Proposed Action

3.12.2.1 Construction Effects

Costs

Capital costs include land purchase, facility construction, and equipment that is considered an integral part of the program. The total future estimated project capital cost is $6,730,000. Of this total, $4.5 million is programmed for the construction of the proposed Dryden hatchery, and $2.2 million for construction at the acclimation sites. Included in these amounts are $1.2 million for land purchase. All the capital costs are expected to be incurred in 2012 or 2013, one year before facilities for the Natural Production Implementation Phase need to be operational.

Existing hatcheries that have no associated capital cost would provide the bulk of pre-smolt production. The new incubation and rearing facility proposed at the Dryden site (or George, the backup site) would require land purchase, water supply development, and facility construction.

Like other aspects of the proposed program, acclimation also relies on existing sites with little capital cost. In general, land purchase is not expected at acclimation sites; in most cases they are on private land where lease agreements would be developed. Acclimation site capital costs include construction activities for pond development, site facilities and water supply development at the proposed primary acclimation sites.

Population Size

Permanent human population changes are not expected from project construction. The local population may increase temporarily by a small number if a few construction workers from outside the area seek temporary accommodations rather than returning to their own homes.

Employment

Construction would provide short-term employment opportunities for local and non-local labor, based on the location of the prime and sub-contractors and the need for skilled and general laborers. Expenditures for labor, materials, and services would likely occur within the local area and throughout the State of Washington primarily at the contractor's discretion, with corresponding employment and income impacts. The number of local residents who may be employed during construction is not predictable, but the construction work force would likely range from about 3 to up to 15 full- and part-time positions at one time depending on the construction phase.

Infrastructure

The Proposed Action would place minimal demands on local utility and municipal services for transportation, power, and telephone/computer connections. Population impacts resulting from project construction and operation would not require an investment in new local services beyond those already planned for general development. The project would require no new services. Temporary increase in local demand for retail goods and services (e.g., fuel, groceries, personal supplies, and restaurants) is likely during construction but would not exceed current capacity.

3.12.2.2 Operations Effects

Costs

Operating costs for the Proposed Action (all program components), including labor, supplies, leases, travel, hardware, etc., would taper from about $4.2 million during the first year of operation to about $2.2 million in 2027 at the end of the program. Project costs are a fraction of BPA's total budget and would not directly or indirectly increase electricity rates.

Employment and Income

Operation of the proposed rearing and incubation facility and the acclimation ponds would require a workforce of about 10 to 12 full-time and part-time positions. Most of these positions would be filled by Yakama Nation staff already involved in the current program. Approximately 6 new hires (3 full-time and 3 part-time) would be required. Even assuming each employee has additional family members, the effect of the increase in local population on area infrastructure is expected to be negligible. Potential population growth related to any improved salmon-related recreational opportunities is also expected to be negligible.

The Proposed Action, although not a commercial operation, could help establish tribal commercial fisheries and non-tribal commercial and recreational fisheries that would have economic value. There would be in-basin tribal and non-tribal recreational fisheries; tribal commercial fisheries in the mainstem Columbia River Zone 6 (Bonneville Dam to McNary Dam); non-tribal commercial and recreational fisheries below Bonneville Dam in the mainstem Columbia; and non-tribal commercial and recreational ocean fisheries. Although the amount is not known and harvest seasons/quotas would be determined in federally recognized harvest forums, the fisheries would generate recreational expenditures and income throughout the region.

Cultural Benefits

Restoration of coho has been a long-standing goal of the Columbia River Tribes, as expressed in *Wy-Kan-Ush-Mi Wa-Kish-Wit* (CRITFC 1995). This plan was developed by the four Columbia River Treaty Tribes (Nez Perce, Umatilla, Warm Springs, and Yakama). It is a comprehensive plan put forward by the Tribes to restore anadromous fishes to rivers and streams that support the historical cultural and economic practices of the tribes. The Proposed Action has the potential to enhance the culturally significant tribal ceremonial and subsistence fishery for coho salmon in the Wenatchee and Methow rivers and in the Columbia River below McNary Dam.

3.12.3 Impacts of the No Action Alternative

Under the No Action Alternative, no construction would occur, and the program would remain at its current size until 2018 (see Section 2.3). If, after that time, the program were to be converted to a hatchery program for the sole purpose of providing a fishery, that benefit could eventually occur on a routine basis under this alternative. Terminal harvests have been implemented under the current program on an as-needed basis when broodstock and escapement goals have been met, but are not guaranteed to occur. No other social or economic benefits would accrue over the long term.

3.12.4 Mitigation for the Proposed Action

Because the impacts of the Proposed Action have primarily beneficial socioeconomic impacts, no mitigation measures are proposed.

3.13 Cultural Resources

3.13.1 Affected Environment

Cultural resources include prehistoric and historic archaeological sites, historic structures, and traditional cultural properties (properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and those that meet the National Register of Historic Places listing criteria). The National Historic Preservation Act of 1966, as amended, requires that cultural resources be inventoried and evaluated for eligibility for listing in the National Register and that federal agencies evaluate and consider effects of their actions on these resources. Cultural resources are evaluated for eligibility in the National Register using four criteria commonly known as Criterion A, B, C, or D, as identified in 36 CFR Part 60.4 (a–d). These criteria include an examination of the cultural resource's age, integrity, and significance in American culture, among other things. A cultural resource must meet at least one criterion to be eligible for listing in the National Register. Laws and regulations protecting cultural resources are described in Chapter 4, Section 4.4.

Staff from BPA's cultural resources consultant, Historical Research Associates, reviewed the Washington Department of Archaeology and Historic Preservation's online database for archaeological site records, cultural resource survey reports, cemetery records, Historic Property Inventory forms, and nominations to the NRHP and Washington Heritage Register. The Washington Department of Archaeology and Historic Preservation's statewide predictive model was analyzed for probability estimates for prehistoric cultural resources, and to aid in developing the field strategy. The consultants also reviewed relevant environmental, archaeological, ethno-historic, and historical reports at the Spokane Public Library's Northwest Room. In addition, staff examined General Land Office plats available online through the U.S. Department of the Interior's Bureau of Land Management website to locate nearby historical features that might have left archaeological remains.

3.13.1.1 Pre-contact Overview

The Columbia Plateau region, with its large, north-south trending river systems, has seen prehistoric settlement and subsistence throughout the Holocene.[28] The culture of the Plateau

[28] The Holocene is a geological epoch which began approximately 11,700 years ago and continues to the present.

peoples focused on the mass harvesting and long-term preservation and storage of three key resource groups: fish (particularly salmon), roots, and large ungulates. Settlement patterns focused on lower elevations in the winter, with forays into higher elevations and places with key fish runs along rivers during warmer weather (Walker 1998).

Although it is uncertain when people first arrived in the area, it is thought that it was somewhere between 12,000 and 11,000 Before Present (B.P.) (Ames et al. 1998). It is likely that the structure of settlement consisted of small, highly mobile bands of hunter-gatherers.

By the beginning of the Windust Phase (11,000-8,000 B.P.), small, highly mobile bands sparsely populated the developing grasslands and gallery forests. Sites adjacent to rapids, particularly along the Columbia and Snake rivers, contain an abundance of fish remains and associated artifacts, such as grooved net sinkers and gorges (Ames et al. 1998; Cressman et al. 1960), which indicate increasing use of anadromous fish populations in the Columbia and its tributaries. In drier upland sites there is often a predominance of milling stones, suggesting that seed gathering was also an important aspect of subsistence.

During the Vantage Phase (8,000-4,500 B.P.), inhabitants of the region restricted their range to river and some upland mountain environments. Inhabitants were probably organized as highly mobile, opportunistic foragers (Chatters 1989; Galm et al. 1985).

At the beginning of the Frenchman Springs Phase (4,500-2,500 B.P.), increased precipitation significantly altered the nature and distribution of land use. Non-riverine environments gradually became more productive. In addition to open sites and rock shelters, pit houses are found in riverine and some non-riverine environments.

Toward the end of the period, at least on the mid- and upper Columbia River, it is believed that habitations became more functionally distinct (Chatters 1986) and included hunting camps, shellfish processing camps, fishing camps, and plant-processing camps (Chatters 1989). It was toward the end of the Frenchman Springs Phase that local inhabitants intensively exploited seasonally available resources such as salmon, bulbs, and roots, and increased their food storage activity (Ames et al. 1998).

The beginning of the Cayuse Phase (2,500-250 B.P.) is marked by a return to drier conditions. Resources became concentrated into fewer productive patches as resource productivity and diversity decreased. Along the Columbia River, a decrease in the number of sites was associated with an increase in the density of pit houses and longhouses after 1,500 B.P. Large villages were situated on islands or on the downstream portion of sandbars. Later, the more portable mat house became important at upland camps, and it appears that upland hunting, plant gathering, and quarrying of rock or stone increased during this phase (Ames et al. 1998).

3.13.1.2 Ethnographic Overview

This period is generally regarded as the transition from late prehistory to the time when Native Americans were moved to reservations. The groups traditionally inhabiting the project area were part of a regional grouping known as the Middle Columbia River Salishans, and included the Wenatchee, Entiat, Chelan, Methow, and Sinkaiuse, also called the Columbia, Moses Columbia, and Middle Columbia (Bruce et al. 2001; Miller 1998; Ray 1974; Relander 1956; Spier 1936; Teit 1928).

Estimates of populations for the Columbia group, prior to the outbreak of epidemics, range from 10,000 to as low as 2,200 (Creighton 2001; Teit 1928; Mooney 1928). Population counts of

Ethnographic Period groups are estimates at best. Early epidemics, such as the 1801 smallpox epidemic, may have eradicated entire groups of people, and are estimated to have generally cut population counts in half (Boyd 1985; Walker, Jr. and Sprague 1998).

During ethnographic times, Columbia Plateau groups continued the traditional seasonal round that developed in the previous millennia. The yearly cycle centered on the Columbia River, though upland locations were also well-used. Along the Columbia River, a staple of subsistence, and some would argue of society, was the salmon. The major fishing season for anadromous and freshwater fish lasted from early spring until late fall. One of the prime fishing areas for the Wenatchee was at the junction of the Wenatchee River and Icicle Creek (Miller 1998).

Fall was the prime season for deer and elk. In addition to hunting and fishing, the Columbia Plateau groups relied on gathering roots and vegetables to eat, as well as medicinal plants for a variety of ailments. Root digging was undertaken in the spring in the uplands, away from the permanent river villages.

3.13.1.3 Historic Overview

With the onset of the fur trade industry and such expeditions as that of Lewis and Clark in 1805-1806, the increase in Euro-American settlers expanded in the nineteenth century. In 1811, representatives of the North West Company explored down the Columbia River and established depots among the Colville and Lakes groups, while the Astor Company established Fort Okanogan (Kennedy and Bouchard 1998; Miller 1998). Fort Colvile was established in 1825 after a verbal agreement between the Hudson's Bay Company and the Kettle Falls chief (Kennedy and Bouchard 1998). Religious missionaries soon followed, expanding from missions built in the Plains. A mission was built near Cashmere in 1872 to serve the Wenatchee, and by 1898 a Jesuit boarding school was established at St. Mary's Mission in Omak (Raufer 1966).

Pressure from the United States government was exerted in the mid-1850s, when Territorial Governor Isaac Stevens was ordered to conduct treaty negotiations with Native American tribes and to place these groups onto reservations, in order to free up land for settlers heading west. In May of 1855, the Walla Walla Council was held. Native Americans from several areas on the Interior Plateau convened. Three reservations were established as a result, including the Yakama Reservation.

Tensions ran high between the indigenous populations and the Euro-American settlers (Kennedy and Bouchard 1998). War between the Native populations and Euro-Americans erupted in the late 1850s. Miners and other settlers actively opposed the vast Colville reservation, and in 1886 it was reduced to its present-day size.

By the end of the nineteenth century, hostilities had died down and gold was found on the Colville Reservation, and in other areas like Peshastin Creek and the Methow Valley. The Homestead Act of 1862 encouraged Euro-American settlement in the region. Soon after, logging and mining became large-scale industries. By the late 1860s, there were an estimated 300-400 Chinese immigrants mining along the Columbia River and its tributaries (Ficken and LeWarn 1988). Mines previously abandoned by Euro-Americans on the bars of the Columbia, Okanogan, and lower Similkameen rivers were taken over by Chinese immigrants in the 1870s (Schlegel and Mauser 2008). Placer operations could be found along the Columbia and Methow rivers, and gold strikes occurred in the Methow Valley in the 1880s.

Farming pursuits increased in the 1880s; farmers and stockmen began to settle in the Methow and Okanogan valleys as soon as 1886 (Roe 1980). The agricultural industry grew in the mid- to late twentieth centuries (McKenney and Stevens 2005). By 1893, the Great Northern Railroad built a line across Stevens Pass and the area increased in population and industry as a result.

3.13.2 Impacts of the Proposed Action

Section 106 of the National Historic Preservation Act of 1966 (U.S.C. 470 *et seq.*, as amended) requires federal agencies to consider the effect of any proposed undertakings on properties listed in, or eligible for listing in, the National Register. BPA's cultural resources consultant, HRA, determined the Proposed Action to have a moderate probability of affecting archaeological resources that may be eligible for listing in the National Register. This assessment is primarily due to the project's proximity to several water sources, such as the Twisp River, Methow River, and Wenatchee River, as well as to smaller tributaries. Cultural resources that might be identified in the project's area of potential effect are materials associated with prehistoric, ethnographic, or historic-period Native American groups. Euro-American historic resources possibly present in the area of potential effect include remnants of homesteads, railroad grades, wagon roads, and refuse dumps. Sites, features, and artifacts such as springboard notches, skid roads, and metal implements or machinery associated with logging may also be in the area.

The following proposed or backup acclimation and hatchery sites that require some form of ground disturbance or alteration of the site have previously recorded cultural resources within a half mile:

- Wenatchee basin: Butcher, Chickamin/Minnow, Tall Timber, and Dryden (primary sites); Squadroni (backup site)
- Methow basin: Gold, Newby, and Twisp Weir (primary sites); Chewuch AF and MSRF Chewuch (backup sites).

Features include cabins, a homestead and school site; wagon roads and trails; irrigation, mining, transportation and communication features; a prehistoric campsite and burial; a pithouse depression; and lithic scatters.

On-site surveys for most of the sites were conducted by HRA in spring of 2011, with a survey of the Newby site conducted by BPA archaeologists in summer 2011. They found no cultural resources that would be affected at any primary or backup acclimation and hatchery sites where ground disturbance is proposed (Dampf et al. 2011). Several of the proposed project areas do not have any proposed ground disturbance. Therefore, BPA determined that implementation of the project in these areas would have no effect on cultural resources, and the Washington State Historic Preservation Office has concurred with that determination. If cultural resources are identified during construction or operation of the proposed facilities, BPA would comply with the requirements of the National Historic Preservation Act in determining their eligibility, modifying activities to minimize effects, and mitigating for any unavoidable adverse effects if necessary. Additional laws, regulations, and executive orders could affect how any potential cultural resources are addressed. (See Chapter 4, Section 4.4).

3.13.3 Impacts of the No Action Alternative

If the No Action Alternative is selected, no new facilities would be constructed, nor would existing facilities be modified; therefore, there would be no potential to affect cultural resources.

3.13.4 Mitigation for the Proposed Action

The following measures are proposed to mitigate potential impacts of the Proposed Action to cultural resources:

- In consultation with the Washington Department of Archaeology and Historic Preservation, the Yakama Nation, and the Confederated Tribes of the Colville Reservation, BPA would develop a mitigation plan for any significant cultural resources identified during construction or operation in any of the project areas where impacts cannot be avoided.
- BPA would prepare a plan of action to be taken in the event of an unanticipated discovery of cultural resources during construction.

3.14 Public Health and Safety

3.14.1 Noise

3.14.1.1 Affected Environment

The Washington State Administrative Code defines categories of properties based on their sensitivity to noise. "EDNA" means the environmental designation for noise abatement: an area or zone (environment) within which maximum permissible noise levels are established (WAC 173-60-020). Table 3-41 shows permissible noise levels for the three classes of property defined in the code. The project area contains many sites that could fall into Class A or Class B EDNAs. Classes of property potentially affected by the Proposed Action are defined below (not all examples from the code are listed) (WAC 173-60-030).

Table 3-41. Maximum permissible noise levels (dBA) at three classes of property [29]

EDNA of Noise Source	EDNA of Receiving Property		
	Class A	Class B	Class C
Class A	55 dBA	57 dBA	60 dBA
Class B	57 dBA	60 dBA	65 dBA
Class C	60 dBA	65 dBA	70 dBA

Class A EDNAs are lands where human beings reside and sleep. Typically, Class A properties include single- and multiple-family residences, and recreational and entertainment properties where people sleep, such as camps, parks, camping facilities, and resorts. Many of the proposed acclimation sites would fall into this category.

Class B EDNAs have uses requiring protection against noise interference with speech—generally commercial establishments such as office buildings, restaurants, and entertainment facilities not designed for human habitation, such as fairgrounds and amusement parks.

Class C EDNAs are lands involving economic activities for which higher noise levels than experienced in other areas would normally to be expected, including warehouses and distribution

[29] "dBA" means the sound pressure level in decibels measured using the "A" weighting network on a sound level meter. Decibels are usually measured with a filter that emphasizes sounds in certain frequencies. The "A" filter (dBA) is the one most frequently used. The "C" filter (dBC) puts more weight on low-frequency sounds such as the bass in amplified music.

centers, agricultural lands raising crops or livestock, and manufacturing facilities. A few sites could fall into this category, e.g., the Two Rivers acclimation site.

The noise limits shown in Table 3-41 have a few modifications or exceptions that are relevant to this project:

- In general, between the hours of 10:00 p.m. and 7:00 a.m. the noise limitations shown in the table must be reduced by 10 dBA for receiving properties within Class A EDNAs.
- Noise limits may be exceeded at any time during the day or night for brief periods of from 1.5 to 15 minutes, depending on the decibel level.
- Construction noise from temporary construction sites may exceed noise limits except between the hours of 10 p.m. and 7 am. at Class A EDNAs.

3.14.1.2 Impacts of the Proposed Action

The decibel (dB) is a measure of sound intensity; that is, the magnitude of the fluctuations in air pressure caused by sound waves. The decibel scale is logarithmic, not arithmetic. This means that a doubling of sound intensity is not represented as a doubling of the decibel level. Rather, an increase of 3 dB means twice as much sound, and an increase of 10 dB means ten times as much sound.

A sound pressure level of 0 dB represents the threshold of hearing for a young, healthy ear, while painful sensations in the ear occur at about 120 to 130 dB. The perception of loudness by the human ear is not directly proportional to the decibel level. For example, a sound 10 dB greater than another is not perceived as being ten times as loud but only about three times as loud.

Construction Impacts

The sound produced by conventional construction equipment typically ranges from about 75 to 90 decibels (dB): 78 dB for a dump truck, 80 dB for an excavator, 85 dB for a backhoe, and 87 dB for a bulldozer (LHSFNA 2009).

The intensity of sound attenuates, or diminishes, by about 7.5 dB as distance doubles, where vegetation is present to absorb noise. Atmospheric conditions and topography also strongly influence attenuation. The zone of effect is considered to extend from the source of the noise to the point at which the noise attenuates to ambient levels. Ambient noise levels at the project sites are unknown; however, rural areas typically have an ambient noise level of 35 to 40 dB (WSDOT 2007). A variety of site conditions would contribute to noisier than typical background noise for rural areas, such as the presence of roads or highways and streams and rivers located near or adjacent to all of the sites. In addition, adjacent land use activities such as farming, ranching, and recreational activity (e.g., snowmobiling) would include machinery that would influence ambient noise levels.

Based on the WSDOT spreading noise model for attenuation over distance, assuming an ambient noise level of 40 dB, a bulldozer operating at a site (87 dB) could be heard above ambient noise ranging from about 600 to 1,000 feet away. However, the actual extent of disturbance around the sites would likely be much smaller, because most of the sites have hillsides or topographic changes near the sites that would contain noise.

Construction would take place for a few days to 5 months, depending on the site, from May through September in 2012 or 2013. At all sites, construction would be limited to the hours between 8 a.m. and 5 p.m., Monday through Friday. Therefore, while some sites with residences or campgrounds might experience noise above ambient levels during the day for the construction period, noise levels during evenings, nights, and early mornings would return to normal.

Operations Impacts

Disturbance associated with operation at the sites would include vehicle noise associated with accessing the sites and crews walking the sites. Each of the sites would require regular, daily human presence during the acclimation period (6 weeks to 7 months, depending on the site). Crews of two people would be responsible for several sites and would drive between them during the course of the day, visiting each site at least twice a day. These types of operation activities would likely be consistent with average ambient noise levels.

Operational noise also would include generators at 5 primary acclimation sites: 2 primary Wenatchee sites and 3 primary Methow sites; and at 2 backup sites in the Wenatchee and one backup site in the Methow. Both hatchery sites would require generators. The size of the generators depends on the size of well pumps which depends on depth to water, none of which would be known until test wells have been drilled. The generators would either operate continuously during acclimation or only during power outages, depending on the capacity and presence of existing line power. Noise muffling enclosures would be used to ensure that generator noise does not exceed decibel limits at noise-sensitive properties.

3.14.1.3 Impacts of the No Action Alternative

Because no new facilities would be constructed, there would be no construction noise. In the Wenatchee basin, operational noise would continue or be reduced from current conditions, depending on how many currently used sites would be operated. In the Methow basin, the potential use of two sites not now used by the current program could minimally increase operational noise; or operational noise levels would remain the same or be reduced, depending on the number of sites used.

3.14.1.4 Mitigation for the Proposed Action

To avoid or minimize impacts, all construction activity would be limited to normal workday hours of 8:00 a.m. to 5:00 p.m., Monday through Friday. Noise associated with facility operations would be within state-approved environmental noise regulations (WAC Chapter 173-60 of the Noise Control Act of 1974) by installing all pumps and generators in sound-enclosures.

3.14.2 Air Quality

3.14.2.1 Affected Environment

The Environmental Protection Agency (EPA) and the Washington Department of Ecology (WDOE) both have responsibility for air quality in the State of Washington. The EPA has established National Ambient Air Quality Standards (NAAQS) to protect the public from air pollution (42 U.S.C. 7401 *et seq.*). The NAAQS focus on “criteria pollutants,” which are pollutants of particular concern for human health. The NAAQS are shown in Table 3-42. In addition to the NAAQS, the WDOE has established State Ambient Air Quality Standards (SAAQS) that are at least as stringent as the NAAQS. These are also listed in Table 3-42.

The project areas under evaluation in this EIS are all in areas that are in attainment with the NAAQS (EPA 2010c). This means that the concentrations of criteria pollutants in the area are historically below (in attainment with) the thresholds described in the NAAQS. Attainment status is a federal designation determined by the EPA based on the NAAQS. Washington does not determine or define attainment for areas based on the SAAQS. Sources of criteria pollutants in the vicinity of the project sites include vehicles on state and local highways, residential home heating (particularly wood burning), agricultural practices (particularly outdoor burning and re-suspension of dust and fine particles), and re-suspension of road dust from traffic on unmaintained roadways.

Table 3-42. National and state ambient air quality standards

Pollutant	Measurement Period	Maximum Concentration	
		NAAQS	SAAQS
Carbon Monoxide	8 hour average[a]	9 ppm	9 ppm
	1 hour average[a]	35 ppm	35 ppm
Lead	Calendar quarter	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$
Ozone	1 hour average	—	0.12 ppm
	8 hour average[b]	0.075 ppm	—
Nitrogen Dioxide	Annual arithmetic mean	0.053 ppm	0.05 ppm
Sulfur Dioxide	Annual arithmetic mean	0.03 ppm	0.02 ppm
	24 hour average	0.14 ppm	0.10 ppm
	3 hour average	0.5 ppm	0.50 ppm
Particulate Matter (PM_{10})	Annual arithmetic mean	—	50 $\mu g/m^3$
	24 hour average	150 $\mu g/m^3$	150 $\mu g/m^3$
$PM_{2.5}$	Annual arithmetic mean[c] 24 hour average[d]	15 $\mu g/m^3$ 35 $\mu g/m^3$	— —

Sources: EPA Office of Air Quality Planning and Standards (OAQPS) (EPA 2010a) and the Washington Administrative Code (WAC 173, Sections 470, 474, 475)

Note: ppm = parts per million; $\mu g/m^3$ = micrograms per cubic meter; PM_{10} = particulates with an aerodynamic diameter of less than or equal to 10 micrometers; $PM_{2.5}$ = particulate with an aerodynamic diameter of less than or equal to 2.5 micrometers.

[a] Not to be exceeded more than once per year

[b] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008) to meet the federal standard.

[c] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$.

[d] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$. This standard replaces the 24-hour $PM_{2.5}$ standard of 65 $\mu g/m^3$ as of December 17, 2006.

3.14.2.2 Types of Impact

Construction projects are established as sources of air pollution and are subject to the provisions of WAC 173-400-040, General Regulations for Air Pollution Sources. Typical air pollutants from construction sites include fugitive dust, vehicle emissions, and particulate emissions from activities such as burning of cleared vegetation. In significant amounts, these pollutants can be a public health hazard, especially for people with respiratory ailments; and they can reduce visibility on roads, highways, and in scenic areas, to the detriment of public safety or enjoyment.

In addition, vehicle emissions and combustion of fossil fuels during project operations, as well as during construction can contribute to climate change. Potential climate change impacts are discussed separately in Section 3.14.3.

3.14.2.3 Impacts of the Proposed Action

Construction

Other than vehicle emissions (see Section 3.14.3), the primary potential air quality impact from construction of project facilities would be fugitive dust. Cleared vegetation would not be burned; it would be disposed at approved landfills, so smoke and particulate pollution would not be created by the proposed project. Impacts of fugitive dust would be limited to those sites requiring substantial excavation—a total of 7 primary acclimation sites, 6 backup sites, and the proposed and backup hatchery sites.

Construction activity at the proposed hatchery at Dryden is the most likely to create noticeable amounts of fugitive dust, because it is located in a drier part of the Wenatchee basin than other sites requiring construction, and because it also requires the most significant amount of construction (a total disturbance of approximately 4 acres) during the driest part of the year. At Dryden, dust could affect visibility on Highway 2 or Highway 97 or other nearby roads, depending on the amount of dust and the wind direction and speed. It could also be a nuisance to nearby residences and the gun club.

Pond excavation at other sites in both basins could also cause fugitive dust problems, most noticeably those with nearby recreation or vacation property or that are otherwise currently in use, such as Tall Timber, Gold, Newby, and Twisp Weir.

Use of the proposed mitigation measures would keep impacts of dust from construction activities to a minimum.

Operations

A number of existing and new sites are accessed via unpaved roads. Project vehicles would travel to and from each site at least twice a day during the acclimation period, which could be for periods of 6 weeks in March through early May or 7 months from November through early May. Roads at some sites could be snow-covered during some of this period, so dust would not be an issue. Later in the spring, after roads dry out, dust from vehicle travel could be noticeable to nearby residences but, with limited number of visits to each site, airborne dust not expected to impact air quality or be a nuisance to neighbors.

3.14.2.4 Impacts of the No Action Alternative

No new facilities would be constructed, so the No Action Alternative would not affect air quality with additional dust beyond what is created by current activities, primarily vehicles travelling on unpaved roads.

3.14.2.5 Mitigation for the Proposed Action

- Burning of cleared vegetation or other debris would not be done. All such material would be transported to an approved landfill.
- Water supplies and dust suppression equipment would be employed at the Dryden hatchery site and at all acclimation sites requiring excavation or road improvement to ensure that dust does not create visibility problems on nearby roads and highways and does not become a nuisance to neighbors.

3.14.3 Climate Change

3.14.3.1 Affected Environment

Greenhouse gases (GHG) are chemical compounds in the earth's atmosphere that absorb and trap infrared radiation (heat) that is reflected or emitted from the surface of the earth. The trapping and subsequent build-up of heat in the atmosphere creates a greenhouse-like effect that maintains a global temperature warm enough to sustain life (EIA 2009). Some forms of GHG can be produced either by natural processes or as a result of human activities. However, the current scientific consensus is that anthropogenic (human-made) sources are increasing atmospheric GHG concentrations to levels that could raise the earth's average temperature by up to 7.2 degrees Fahrenheit within the 21st century (EPA 2010a).

The United States Global Climate Research Program (USGCRP) has found that since the 1970s, average U.S. temperatures and sea levels have risen and precipitation patterns have changed (USGCRP 2009). These conclusions are further supported by the Intergovernmental Panel on Climate Change (IPCC) that found similar patterns on a global climate scale (IPCC 2007). Climate models indicate that atmospheric concentrations of all GHG would continue to increase over the next century, but the extent and rates of change are difficult to predict, particularly on a global scale.

Human activities result in the emission of four main forms of GHG that are implicated in climate change (EPA 2010b):

- Carbon dioxide (CO_2) constitutes 81% of all anthropogenic GHG emissions in the U.S., primarily due to the combustion of fossil fuels (coal, oil, gasoline, natural gas, and other fuels) and wood products (EPA 2010a, 2010b; Houghton 2010). Changes in land use and management can also increase CO_2 emissions into the atmosphere (e.g., conversion of forests into croplands, application of synthetic fertilizers, and development of grasslands into residential settlements). Some industrial activities (e.g., cement manufacturing) have also been identified as contributing significantly to U.S. CO_2 emissions.
- Methane (CH_4) is emitted during the production and transport of fossil fuels, through intensive animal farming, and by the decay of organic waste in landfills.
- Nitrous oxide (N_20) is emitted during agricultural and industrial activities, and during the combustion of fossil fuels and solid waste.
- Fluorinated gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), are synthetic compounds emitted from industrial processes. These gases are created and emitted solely through human activities (not naturally produced). Although emission levels of these compounds are relatively small, these gases have a much higher capacity for trapping heat than other GHG and are considered to have a high potential for contributing to climate change. Activities that emit fluorinated gases are not proposed as any part of this project, and thus are not included in the analysis of impacts.

To assess the potential impacts of the Mid-Columbia Coho Restoration Program on climate change, BPA considered the potential GHG emissions associated with construction and operation activities at all proposed project locations in the Wenatchee and Methow basins. Many sites proposed for use by the project already exist and/or are already operating. Sites that would not change due to project implementation would not be expected to have any impact on GHG emissions or climate change, and are not included in the analysis.

In the event any of the primary sites are determined infeasible, a backup site would be used; however, the total number of project sites would remain constant and activities at backup sites would be similar in scope and duration. Therefore, it is reasonably certain that GHG emissions from project activities would be relatively similar regardless of which (if any) backup sites would need to be used.

3.14.3.2 Types of Impact

In a general sense, all combustion of fossil fuels contributes to CO_2 concentrations in the atmosphere that may contribute to significant long-term effects on the climate. In response, the EPA established the Mandatory Reporting of Greenhouse Gases Rule in 2008 (74 FR 5620), which requires reporting of GHG emissions data for sources that emit 25,000 metric tons or more per year, roughly equivalent to the CO_2 emitted by 4,545 passenger vehicles per year (EPA 2005). The rule requires federal reporting of GHG emissions, but does not require any other action (40 CFR Parts 86, 87, 89 et al.).

Although the proposed project is reasonably certain to fall well below the federal reporting threshold, BPA evaluated the most significant sources of GHG emissions that would result from project implementation. Direct GHG emissions from hatchery projects are primarily due to vehicle and equipment activity (both during construction and operation activities). The proposed project would involve the operation of vehicles and generators at many locations, which would emit CO_2 from the combustion of fossil fuels and contribute to atmospheric GHG levels.

GHG emissions were calculated based on methodology provided by the EPA, IPCC and the Energy Information Administration (EIA) using estimates of multiple variables including, but not limited to, the number of project vehicles, number of trips per day, distance traveled, other sources of fossil fuel combustion (e.g., generators), and duration of activities.

Changes in land cover (e.g., tree removal) due to the construction of facilities may also increase GHG emissions; however, the effects of land use change are not well understood and there are currently no accepted methodologies for quantifying impacts of land use changes on GHG emissions. Furthermore, the total acreage of land that would be impacted by project construction would be less than 5 acres, and the majority of impact would either result in an insignificant change in land cover (e.g., installation of wells, expansion of acclimation ponds) or potentially an improvement to existing conditions (e.g., conversion of an existing gravel pit to a 2.5 acre wetland). Therefore, due to the inability to quantify the impacts of land use changes, and the likely insignificant level of project-related land use changes that may elicit such impacts, this variable was not included in the analysis.

Soil disturbance may also result in GHG emissions, but research has shown that effects are temporary and return to background levels within several hours (Kessavalou et al. 1998, IPCC 2006). Therefore, soil disturbance was not included in the analysis.

In an effort to compensate for any potential GHG emissions due to soil disturbance, land use changes, or other unidentified mechanisms not included in the analysis, BPA conservatively estimated vehicle and equipment emissions. The calculated GHG estimate is therefore likely higher than actual vehicle and equipment emissions, and therefore may capture residual emissions from other sources.

3.14.3.3 Impact of the Proposed Action

According to BPA's calculations (Table 3-43), the project could emit up to 502 metric tons of GHG as a result of five months of construction activities (roughly equivalent to the annual emissions from 89 passenger vehicles), and up to 1,050 metric tons of GHG per year as a result of operations activities (roughly equivalent to the annual emissions from 187 passenger vehicles).

Table 3-43. Estimated annual greenhouse gas emissions from the Mid-Columbia Coho Restoration Program

Activity	CO_2 Emissions (metric tons)	CH_4 Emissions [a] (CO_2-e metric tons)	N_2O Emissions [a] (CO_2-e metric tons)	Total CO_2-e Emissions in Metric Tons
Construction (total for 5-month period)	241.0	37.3	223.2	502
Operations and maintenance (annual emissions)	920	7.5	123.1	1,050

[a] CH_4 and N_2O emissions have been converted into units of CO_2 (CO_2equivalent = CO_2-e) using the IPCC global warming potential factors of 21 for CH_4 and 310 for N_20.

Construction Impacts

Proposed construction activities associated with one new incubation and rearing facility and seven new or expanded acclimation ponds would result in direct GHG emissions from the operation of project vehicles and construction equipment (e.g., bulldozers, augers, backhoes). Emissions from construction vehicles and equipment would impact atmospheric GHG concentrations incrementally because construction equipment and vehicles would be fueled by gasoline and diesel combustion motors.

Considering the low level of GHG emissions (502 metric tons of $CO_{2\text{-}e}$) and the brief duration of the impact (5 months), project-related construction activities would have a minor short-term adverse impact on atmospheric GHG concentrations and an unquantifiable, likely insignificant, impact on climate change.

Operations Impacts

The proposed project would involve the year-round operation of the hatchery, and seasonal operation of the acclimation sites and traps. Many of the acclimation sites and all but one each of the adult and juvenile traps are already in operation and would not change due to project implementation. The primary sources of GHG emissions would be from the operation of project vehicles between sites (46% of all operations-related GHG emissions) and the use of diesel generators as primary power at two acclimation sites for six weeks of the year (35% of all operations-related GHG emissions). It is likely that diesel generators would be switched to propane in the near future, potentially reducing annual GHG emissions by approximately 380 metric tons per year.

The calculated estimate of operations-related annual GHG emissions is relatively low (1,050 metric tons of $CO_{2\text{-}e}$), and is likely very conservative considering the calculations were based on estimates of the maximum number of vehicles, miles, trips, etc., that would be involved in operational activities. Therefore, the operation of facilities and sites would constitute a minor adverse impact on atmospheric GHG concentrations and an unquantifiable impact on climate change.

Location of a small hatchery in the Wenatchee basin might reduce the number of trips necessary to transport fish to and from the Bonneville Dam area beginning as early as 2013; it is unclear if that reduction would be offset by more trips to in-basin acclimation sites.

3.14.3.4 Impacts of the No Action Alternative

The No Action Alternative would require no new construction or operation activities that would involve combustion of fossil fuels, and therefore no GHG would be emitted. The sites would remain in their current state, and the current hatchery programs would continue unchanged. With no new in-basin hatchery, any potential reduction in emissions resulting from reducing the number of long trips to lower Columbia hatcheries would not be achieved, because they would continue as they are under the current program. No direct or indirect effects to atmospheric GHG concentrations or climate change would result from the No Action Alternative.

3.14.3.5 Mitigation for the Proposed Action

The following measures could be implemented to reduce or eliminate project-related GHG emissions and potential impacts on climate change:

- Use gravity-flow water supplies and existing ponds wherever possible.
- Use measures that minimize vehicle and equipment emissions (e.g., reduce vehicle and equipment idling, use driving techniques that increase fuel economy, perform regular maintenance and upkeep of vehicles and equipment, use the most efficient vehicle or equipment available, etc.).
- Encourage carpooling and the use of shuttle vans among construction workers and operations staff to minimize vehicle trips and associated emissions.
- Locate construction staging areas in previously disturbed or graveled areas to minimize soil and vegetation disturbance where practicable.
- Use propane generators at all sites as soon as feasible.
- Submit a plan for approval to recycle or salvage non-hazardous construction and demolition debris.
- Use locally sourced supplies as much as possible.

3.15 Cumulative Effects

Cumulative impacts are the environmental effects that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such other actions.

Table 3-44 shows reasonably foreseeable actions that could be taken in the two basins that could add to the impacts created by the Mid-Columbia Coho Restoration Program.

Table 3-44. Future known projects in the Wenatchee and Methow basins

Wenatchee Basin	Methow Basin	Resource Affected
Change to TMDL allocations at Leavenworth NFH		Reduce TP levels in Icicle Cr.
New water supplies for residential, commercial and industrial uses and allocations for groundwater rights by WDOE	New water supplies for residential, commercial and industrial uses and allocations for groundwater rights by WDOE	Minor reductions in stream flows
YN habitat restoration projects	YN habitat restoration projects	Improve fish and wildlife habitat conditions, reduce flood potential
BPA-funded habitat restoration projects (other than YN)	BPA-funded habitat restoration projects (other than YN)	Improve fish and wildlife habitat conditions
Salmon Recovery Funding Board habitat restoration projects	Salmon Recovery Funding Board habitat restoration projects	Improve fish and wildlife habitat conditions, reduce flood potential
Continued commercial and industrial development	Continued commercial development	Loss of habitat for fish, wildlife, and plants, including wetlands
Habitat improvement projects under Chelan County PUD and Douglas County PUD Habitat Conservation Plan (HCP) Tributary Fund	Habitat improvement projects under Chelan County PUD and Douglas County PUD Habitat Conservation Plan (HCP) Tributary Fund; GCPUD Habitat Fund under the Priest Rapids Salmon and Steelhead Settlement Agreement	Improve fish and wildlife habitat conditions, reduce flood potential
Continued diking, road development, and residential/urban development	Continued diking, road development, and residential/urban development	Increase potential for flooding
Chelan County projects CRP636-North Road and CRP612-Eagle Creek Road	WSDOT and Okanogan County improvements to Twisp River Road	Floodplains of Chumstick Creek; Twisp River
Chelan County project CRP597-Old Blewett Highway	WSDOT and Okanogan County improvements to Twin Lakes Road	Floodplains of Peshastin Creek; Methow River
WSDOT project US 2 bridge over Chiwaukum Creek		Floodplain of Chiwaukum Creek
WSDOT project US 2 Wenatchee River bridge at Tumwater		Floodplain of Wenatchee River
WSDOT road improvements on US 97		Floodplain of Peshastin Creek
YN Multi-Species Acclimation Project	YN Multi-Species Acclimation Project	Rearing habitat for juvenile fish

3.15.1 Surface Water Quality

Proposed Action

The timing of acclimation phosphorus discharges, in relation to annual flow patterns, is important to the evaluation of cumulative project impacts on water quality. The Wenatchee and Methow rivers have peak average flows in early June. Acclimation normally ends in early May just as spring runoff begins. Data collected from the basins (see Appendix 6, Water Quality Data) demonstrate that river phosphorous concentrations and loads peak along with river flows, as accumulated nutrients and attached algae that have been suspended are flushed from the basins. The majority of the phosphorous introduced by acclimation is included in this mechanical removal process, thereby limiting the impact of project nutrients on water quality in the critical late summer through winter period.

For the Wenatchee basin, the model simulations suggest that potential impacts of the proposed project, as defined by the criteria for DO and pH, would be negligible under foreseeable future conditions. When viewed in light of the conservative assumptions employed in establishing the translation of loads and flow conditions within the model framework, the actual impacts under average flow conditions would be much smaller than what was determined by the QUAL-2K modeling exercise. The fact that the model results indicated that much of the project load is likely to be assimilated upstream of Leavenworth suggests that existing public treatment works are not likely to be further burdened by requirements to buffer activity from the proposed project in the upper reaches. Although allowable levels of Total Phosphorus (TP) discharged from Leavenworth NFH will be reduced, the decrease in the proposed numbers of coho acclimated there would reduce the amount of nutrients discharged from the hatchery from current levels by as early as 2013, making it easier for the hatchery to comply with the reduced hatchery allocation.

For the Methow basin, the contribution of the project-related loads relative to the cumulative basin load (Methow River at Pateros in Table 3-9) was estimated to be about 0.8%. The equivalent calculation for the Wenatchee sites resulted in a relative project contribution of 1.1% of the basin TP loading (Table 15 in Appendix 7). As described previously, modeling indicated that acclimation-related loads in the Wenatchee basin caused a negligible change in DO and pH even in the presence of sources such as public water treatment works. Given the lower estimate of nutrient loading from acclimation activity in the Methow basin and the similarity in the basin characteristics, the TP loads from acclimation activity are unlikely to cause a measurable change in DO and pH in the Methow River; thus cumulative effects of the project would be negligible.

No Action Alternative

As with the Proposed Action, the impacts of discharges from the sites in the No Action Alternative were assessed for the case when public treatment works discharge at their design capacity, contributing a phosphorus load as allocated in the WDOE TMDL (corresponding to 90 μg/L). The spatial trends in water quality parameters were similar to those predicted for the Proposed Action. As expected, the changes in minimum DO and pH range over the background conditions were predicted to be milder than for the Proposed Action, and thus cumulative effects of the project would be negligible. However, the reduction in the allowable TP to be discharged at Leavenworth NFH would mean that continued acclimation of 500,000 coho there would contribute 27% of the TP load discharged from the hatchery, making it more difficult for the hatchery to meet its reduced allocation.

3.15.2 Surface and Groundwater and Water Rights

Proposed Action

Other proposed groundwater withdrawals or surface water diversions, if not non-consumptive or water-balance neutral, could impact the stream flows in the two basins. New water supplies for residential, commercial and industrial uses and allocations for groundwater rights by WDOE are likely during the time period of the proposed project. Groundwater and surface water sources are proposed or being developed for other salmon restoration projects in the two basins, including sites that might be used by this project, such as McComas in the Wenatchee basin and Lincoln in the Methow basin.

The proposed groundwater uses for the project and others like it would have impacts only within the drawdown cone created by groundwater withdrawals because the groundwater uses are water budget neutral. In addition, the aquifers likely to be used at the proposed sites are in hydraulic continuity with the streams, which would reduce the size of the drawdown cones. Thus, the impacts would be localized. Other future groundwater uses would also create drawdown cones and, unless these future drawdown cones intersect the drawdown cones created by the project, the project would not impact these uses. Other future surface water uses may be positively impacted immediately downstream and not impacted further downstream by the proposed discharge of groundwater into the streams.

The Proposed Action includes facilities with very minor groundwater withdrawal rates compared to the total groundwater storage capacity in the shallow aquifers in the Wenatchee River and Methow River basins. The proposed groundwater withdrawals are also small when compared to the flows in the two rivers. Operation of the proposed facilities individually or collectively is not expected to have measurable impacts to stream flows or water quality in areas outside the immediate facility locations.

No Action Alternative

If existing project facilities cease using currently used groundwater, cumulative impacts to groundwater could be reduced.

3.15.3 Fish

Past and present activities that may have affected fish habitat in the Wenatchee and Methow basins include diversions and dams, agricultural activities, stream channelization and diking, roads and railways, timber harvest, and urban and rural development (Mullan et al. 1992; Chapman et al. 1994, 1995; NPCC 2004a & b). A hydropower dam constructed on the lower Methow River near Pateros in 1915 blocked upstream anadromous fish passage until it was removed in 1929 (Mullan et al. 1992; Peven 1992; Andonaegui 2000). Humans have altered habitat primarily in the lower gradient, lower reaches of the basins (Andonaegui 2000, 2001); these alterations have blocked access to habitat and reduced habitat complexity, off-channel habitats, and large, deep pools. Extensive use of rip rap to stabilize stream banks has decreased the channel sinuosity and recruitment of large woody debris (LWD). Chronic sedimentation from land and water management activities has degraded habitat in some areas. In contrast, upper reaches of these basins are in relatively good condition (Andonaegui 2000, 2001; NMFS et al. 1998).

Habitat conditions have improved in recent years and further improvements are expected in the future. Some of the factors that have affected habitat of ESA-listed fish have been partially addressed through changes in land use practices (UCSRB 2007). These include improving fish passage at dams, installing irrigation diversion screens, culvert replacement, riparian buffer strips, and improved livestock management. Two major habitat restoration efforts are being funded by BPA in the Wenatchee and Methow basins. The Yakama Nation will be receiving 6-7 million dollars annually over ten years for habitat restoration in these basins. In addition, the Salmon Recovery Funding Board will be receiving about 3.5 million dollars for habitat restoration projects beginning in 2011. These efforts should result in substantial habitat improvements over the next decade.

Under another BPA-funded YN project, the Multi-Species Acclimation Project,[30] some of the coho acclimation sites are being used to acclimate ESA-listed hatchery steelhead and spring Chinook smolts, and vice versa. The Multi-Species Acclimation Project was proposed to enhance the goals of recovery for these two listed stocks. The Multi-Species Acclimation Project would not increase hatchery production but would use existing Public Utility District and federal steelhead and spring Chinook mitigation production in the region. Fish from the existing programs either have been directly released without acclimation or have been released in large numbers directly from hatcheries in the Wenatchee and Methow basins. The Multi-Species Acclimation Project refines those releases by acclimating small groups of steelhead and spring Chinook in known habitat reaches for these species in the Wenatchee and Methow watersheds. These reaches are in the same areas as some of the coho acclimation sites.

Proposed Action

As discussed in Section 3.7.3.1, proposed new or changed-use coho acclimation sites would temporarily displace steelhead, spring Chinook, and bull trout from approximately1.53 acres in both basins each year until 2028 or project goals are met. Sites currently in use in both basins temporarily displace other fish from approximately 1.48 acres of what had been accessible habitat for 6-8 weeks annually (Beaver, Butcher, Coulter, Rohlfing, and Lower Twisp). For two of those existing sites (Rohlfing and Lower Twisp), the period of displacement would increase under the Proposed Action to as much as 7 months. So, for those two sites, the amount of area excluded to other fish would not increase with the Proposed Action, but the period of time they would be excluded would increase; therefore, for purposes of this analysis, the area that is subject to exclusion for a longer period is considered newly excluded area under the Proposed Action. Cumulatively, all coho acclimation sites in both basins, both currently used and proposed new sites, would continue to or newly displace listed steelhead, spring Chinook, and bull trout as well as other fish from 2.14 to 2.33 acres of accessible habitat for 6 weeks to 7 months annually (depending on whether Butcher or Coulter is used in alternate years in the Wenatchee basin) until approximately 2028. Because most of this habitat normally is not preferred by spring Chinook, steelhead and bull trout, the impacts from the proposed seasonal use of small areas for acclimation and rearing purposes would not be additive to cumulative effects of past, present, and anticipated future human-caused adverse impacts to habitat.

The current Multi-Species Acclimation sites (Rohlfing in the Wenatchee basin and the Winthrop NFH, Heath, and Biddle in the Methow basin) are all analyzed in this EIS, and are also the subject of environmental reviews for the Multi-Species Acclimation Project. A total of approximately 25,000 steelhead and 160,000 spring Chinook are proposed to be acclimated in 2012 under the Multi-Species Acclimation project. When the coho sites are used for spring

[30] BPA Project 2009-001-00

Chinook and steelhead acclimation, the number of coho being acclimated would be reduced so that the total number of fish being acclimated in any one pond would not be more than proposed under the coho project; therefore, impacts to habitat would not increase for these ponds. Future planned expansion of the Multi-Species Acclimation project to increase numbers of fish and add sites will be addressed in a separate NEPA process for that project.

When considered in a cumulative sense, the effects of habitat use for acclimation would be balanced by the benefits of the BPA-funded habitat improvement projects currently underway and proposed in the basins. Figures 3-7 and 3-8 show those projects in relation to the proposed coho restoration program sites. These and other programs being implemented by other agencies are expected to improve the overall quantity and quality of fish habitat in the two basins.

By improving the ecological balance in the two basins, the Proposed Action could add to the cumulative benefits that all these actions are providing; and with the improvements and increases in habitat, any potential adverse interactions between coho and other species are not likely to measurably add to the other stressors on ESA-listed fish.

The Proposed Action would also result in potential short-term acute delivery of additional sediment from bank disturbance and pond construction. Permit conditions would require that sediment be strictly controlled during construction; and in the small areas affected, any unforeseen increased sediment delivery is likely to be minimal and highly localized. Construction is not expected to result in conditions that cause chronic increases in sediment loads. Therefore, although the project could add to the cumulative effects of basin-wide sources of sediment in streams, the contribution would be small, localized, and would not persist past construction.

No Action Alternative

The cumulative impacts of the No Action Alternative on fish would be mixed. No additional fish would be excluded from habitat they currently use because no new facilities would be constructed, nor would the annual period of use change from spring-only to overwinter. There also would be no temporary small increase in sediment in streams due to construction. Therefore, the alternative would not add to such impacts that are otherwise occurring in the basins. On the other hand, given that a naturally reproducing population of coho would not be established, any additional benefit to ongoing and future ecological improvements from such populations in the basins would not occur.

Sites that are proposed to be used to acclimate spring Chinook or steelhead under the Multi-Species Acclimation Project could be used for that purpose under the No Action Alternative. The current sites (Rohlfing in the Wenatchee basin and the Winthrop NFH, Heath, and Biddle in the Methow basin) have been the subject of environmental reviews for the Multi-Species Acclimation Project. It is possible that, without coho being acclimated at these sites, more spring Chinook or steelhead could be acclimated in those ponds. The effects on water quality would not change, however, because the amount of fish biomass would not change from current conditions, as described under the Proposed Action above. The amount of habitat excluded from use by other fish would be the same as for the Proposed Action.

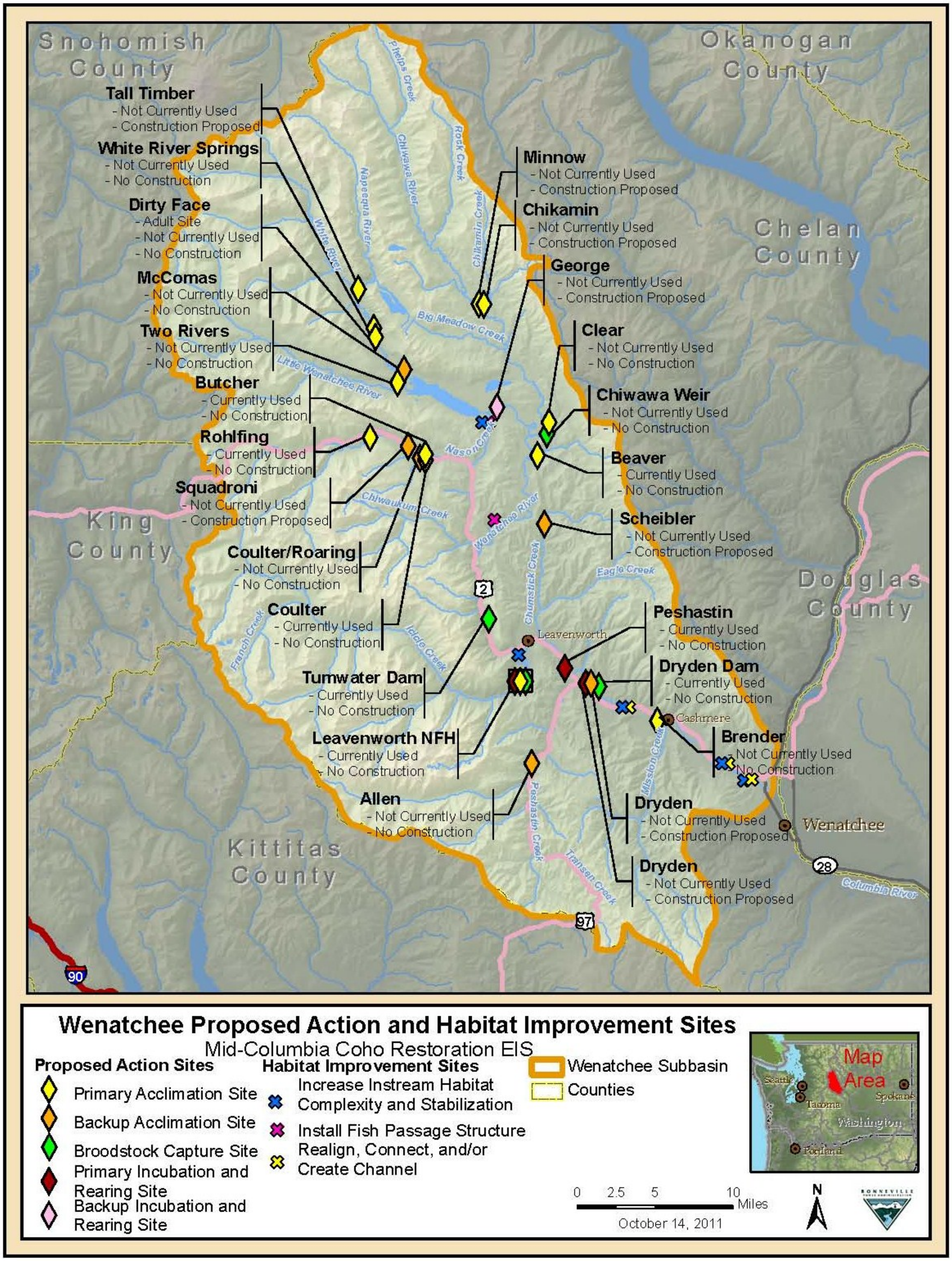


Figure 3-7. BPA-Funded Habitat Improvement Projects in the Wenatchee Basin

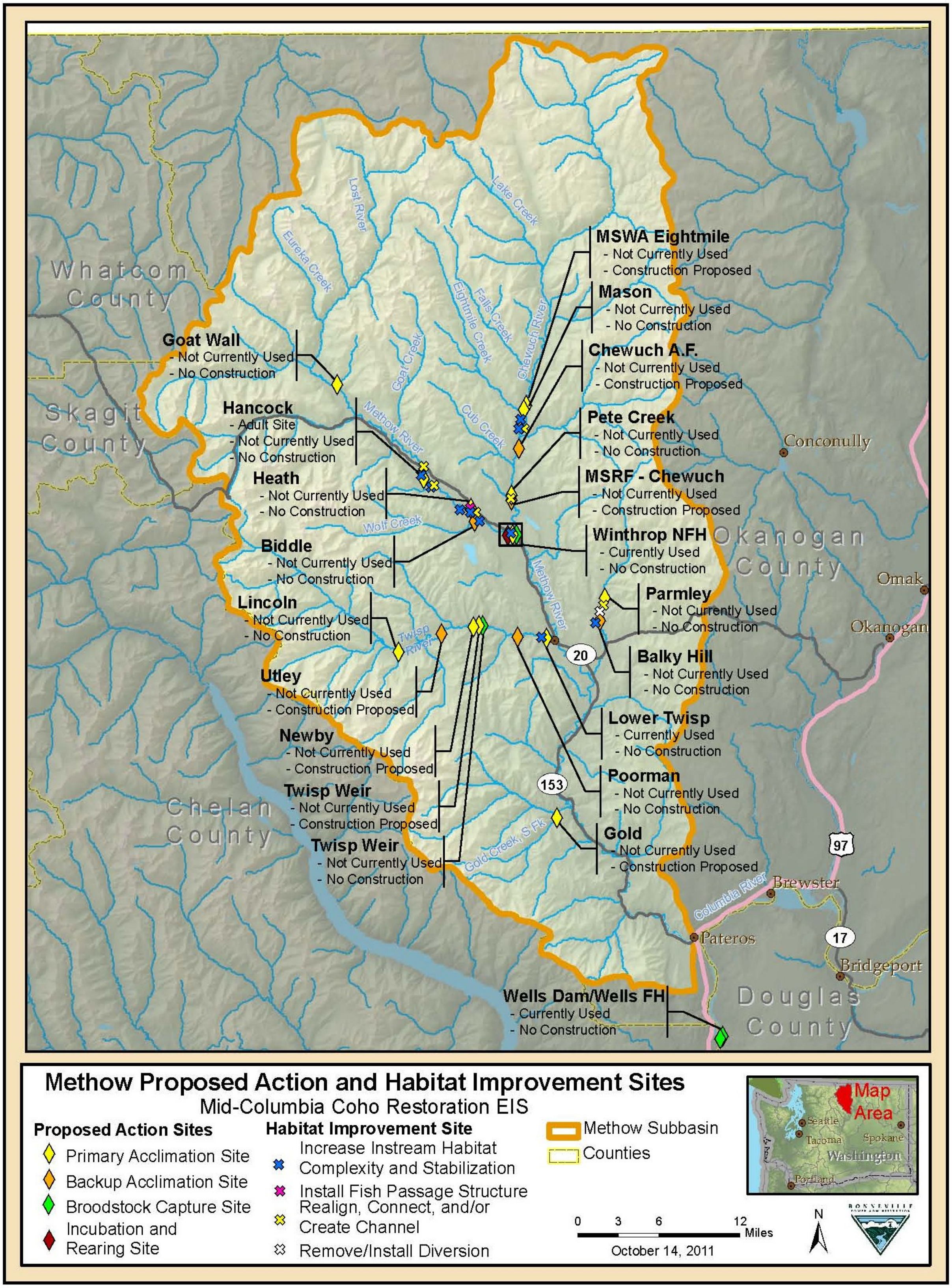


Figure 3-8. BPA-Funded Habitat Improvement Projects in the Methow Basin

3.15.4 Priority Habitat, Plants, and Wildlife

Proposed Action

Residential development is anticipated in the Wenatchee and Methow basins over the next several years, and would likely contribute to cumulative impacts to native vegetation communities, which could disturb priority habitats and species. Clearing and construction at the project sites contributes in very minor ways to cumulative regional fragmentation and net loss of native vegetation and habitats. Impacts from continued growth in the region will occur regardless of whether the proposed project is implemented, and is likely to contribute to loss of habitat in significant ways, unlike the proposed project. However, some project activities would create additional aquatic habitat for native species in the region, adding a small area (about one acre) to other habitat protection and enhancement being undertaken in the basins.

Operation of the project would result in an increase in human activity at the sites. While the sites are primarily located in rural areas, most of the sites are associated with residential property and with associated existing human activity and vehicle traffic. Also, the program is proposed to end in 2028. The human disturbance impacts associated with the Proposed Action would also then end. No significant cumulative impacts associated with operation of the project are anticipated.

No Action Alternative

The cumulative effects of No Action on priority habitat, plants, and wildlife, when added to other development effects undertaken in the two basins, would be undetectable.

3.15.5 Wetlands

Proposed Action

Development projects are anticipated to occur in the Wenatchee and Methow basins in the vicinity of the project sites over the next several years, and would likely contribute to cumulative impacts to wetland habitats. Clearing and construction at the project sites contributes to cumulative regional fragmentation and net loss of wetland habitat. However, construction activities associated with proposed primary project sites would not permanently reduce the amount of wetland habitat, and would add about 52,000 square feet of new wetland. Therefore, the project would not contribute to cumulative loss of wetlands, and could contribute a small amount to an increase in wetland habitat in the Wenatchee basin.

No Action Alternative

With no construction of new acclimation sites or a hatchery, the project would add nothing to the cumulative loss of or increase in wetlands in the basins.

3.15.6 Floodplains

Proposed Action

Activities in the two basins other than this project that could exacerbate flooding include diking, road development, and residential/urban development.

Because construction activities associated with the project are anticipated to result in very minor conversion of forested lands compared to the watershed as a whole, because the some acclimation sites would provide additional floodplain storage, and because new construction would be in accordance with floodplain development codes, the cumulative effects of these actions are not considered a significant impact. Additionally, many proposed county and state-funded road improvement projects include culvert replacements on existing roads having the potential to mitigate or reduce the effects of existing flooding. The known road improvement projects are identified in the following sections.

Habitat improvement projects are also proposed throughout the project area. These projects are funded by federal and state dollars under multiple programs and implemented by local stakeholder groups, counties, and conservation districts. Habitat improvement projects that re-establish floodplain access to undeveloped floodplain habitat have the potential to further mitigate or reduce the effects of existing flooding. Habitat improvement projects funded and proposed for implementation in the Wenatchee and Methow basins using Washington State Salmon Recovery Funding Board (SRFB) grants can be tracked at the Upper Columbia Salmon Recovery Board's salmon habitat implementation website (http://uc.ekosystem.us//). Habitat improvement projects funded in the Wenatchee and Methow basins using Chelan County PUD and Douglas County PUD Habitat Conservation Plan (HCP) Tributary Fund dollars can be found at the Chelan County PUD HCP website (http://www.midcolumbiahcp.org/). Other projects could be implemented by other public agencies or private parties that are not known at this time.

Wenatchee Basin Road Projects

Planned projects in the basin include road improvements throughout the watershed that could have localized effects on nearby creeks. These projects are Chelan County projects: CRP636-North Road and CRP612-Eagle Creek Road that could impact Chumstick Creek, CRP597-Old Blewett Highway that could impact Peshastin Creek; and Washington State Department of Transportation (WSDOT) projects: US 2 bridge over Chiwaukum Creek, US 2 Wenatchee River bridge at Tumwater, and road improvements along US 97 that could impact Peshastin Creek. It is anticipated that Chelan County and WSDOT would implement mitigation measures and best management practices (BMPs) according to the Highway Runoff Manual (WSDOT 2008) to minimize floodplain impacts from any of these projects. Consequently, the cumulative effects of the Proposed Action and other known projects in the Wenatchee basin are not considered to be a significant cumulative impact.

Methow Basin Road Projects

In the Methow basin, other known planned projects include road improvements throughout the watershed that could have localized effects on nearby creeks. These projects are Okanogan County and WSDOT road improvement projects such as Twisp River Road (affecting Twisp River), and Twin Lakes Road (affecting Methow River). It is anticipated that Okanogan County and WSDOT would implement mitigation measures and BMPs according to the Highway Runoff Manual (WSDOT 2008) to minimize floodplain impacts from any of these projects. Consequently, the effects of the Proposed Action combined with the effects of other known projects in the Methow basin are not considered to create a significant cumulative impact.

No Action Alternative

Because no new development would take place in floodplains as part of this alternative, there would be no impacts to floodplains and thus no cumulative effects with other floodplain development projects in the basins.

3.15.7 Visual Quality and Recreation

Proposed Action

The Proposed Action would not noticeably change visual quality or affect recreational uses, so would not contribute to other visual quality and recreational impacts occurring in the basins.

No Action Alternative

There would be no change to current conditions, so there would be no cumulative effects.

3.15.8 Socioeconomics

Proposed Action

The Proposed Action would add relatively few permanent jobs to the region, so the incremental effects on area population and income, and the need to change infrastructure and services, would be negligible. Expenditures and income associated with the terminal fishery are minor and not expected to measurably affect local or regional economies. The numerous federal, state, local, and tribal efforts to improve fish populations, river flow, and aquatic habitat in the region, of which this program is a small part, should result in salmon population increases which, together, should provide economic and cultural benefits.

No Action Alternative

The No Action Alternative would not add noticeably to adverse economic and social effects in a regional sense. Any loss of employment due to lack of funding of the project would be significant to individuals but would be an incrementally minor impact on current unemployment levels in the region. The incremental lost opportunity impacts on the economic, social, and cultural benefits of future coho harvests could be noticeable, although unquantifiable, if other regional efforts to improve fish populations and habitat are similarly curtailed and if the current Mid-Columbia coho program is not converted to a harvest augmentation program.

3.15.9 Cultural Resources

Proposed Action

The Proposed Action would not affect cultural resources, so would not contribute to cumulative effects on those resources that might be caused by other ongoing development in the basins.

No Action Alternative

Because no new site development would take place, there would be no potential for the project to add to the past, current, or future development impacts on cultural resources in the basins.

3.15.10 Public Health and Safety

Proposed Action

The largely minor and short-term and increases in fugitive dust and construction noise would not add to the cumulative long-term impacts to air quality and noise from increased development and population levels in the two basins. The project could add theoretically measurable amounts to greenhouse gas concentrations in the basins, but the contribution to climate change would be unquantifiable.

No Action Alternative

The No Action Alternative would have no cumulative effects on noise, air quality, or climate change.

3.16 Unavoidable Adverse Effects and Irreversible and Irretrievable Commitment of Resources

- Short-term minor increases in sediment in water bodies near some acclimation sites, due to the need to develop water supply and discharge channels and lines.
- Short-term avoidance by wildlife of some project sites due to construction activity.
- Short-term disturbance during construction at residential and recreational sites.
- Potential loss of small numbers of listed fish to predation or competition with coho, or to trapping for juvenile or adult coho.
- Annual temporary exclusion of listed fish from a small amount of habitat.
- Irreversible uses of fuel, office supplies, petroleum products, chemicals, and other operational supplies. Some building materials and equipment might be re-usable, but much of it would not.

3.17 Short-Term Use of the Environment and Effects on Long-Term Productivity

The proposed Mid-Columbia Coho Restoration Program is expected to enhance productivity of the aquatic environment through salmon population increases, from which other aquatic and terrestrial species including humans may derive benefits. The lands developed for a small hatchery complex and for acclimation ponds would be permanently taken out of vegetative productivity. Construction activities would temporarily affect more land than would be permanently developed, but long-term productivity would not likely be adversely affected because of the measures that would be taken to restore disturbed, undeveloped areas to pre-existing condition or better (replanting with native species, weed control, standard construction BMPs, etc.). The stream reaches between the intakes and outlets of the ponds would have slightly lower total flow when water is diverted for fish acclimation, but these distances are generally 1,500 feet or less. Groundwater production in wells near some acclimation sites might be reduced. An incremental amount of greenhouse gases would be emitted during construction and hatchery operation, which would add to global climate change, but energy efficiency considerations in project design would make this contribution insignificant at local and global scales.

The No Action Alternative would not change the aquatic environment, either positively or negatively, or alter any terrestrial sites.

Chapter 4. Consultation and Coordination

Numerous federal, state, and local environmental laws and administrative requirements must be satisfied prior to initiation of the proposed program. This chapter reviews the program's compliance with these regulatory requirements.

4.1 Environmental Policy

4.1.1 National Environmental Policy Act

The National Environmental Policy Act of 1969 as amended (42 U.S.C. 4321 *et seq.*) requires federal agencies to assess and disclose the effects of proposed actions on the environment before making a decision to proceed. This EIS has been compiled to meet NEPA requirements.

BPA and the Yakama Nation conducted scoping meetings and informal outreach efforts with interested and potentially affected parties, who identified issues to be considered in the environmental analysis. The draft EIS was completed in June 2011 and was sent to regulatory agencies and other interested organizations and individuals for review and comment (Chapter 8). The formal public comment period on the draft EIS ended in August 2011, and BPA considered all comments and made additions, corrections, or clarifications to the analysis for this final EIS. BPA will document its final decision in a record of decision after the Final EIS has been issued.

4.1.2 State Environmental Policy Act

The State Environmental Policy Act (SEPA), Washington State's most fundamental environmental decision-making law, was enacted in 1971 as chapter 43.21C Revised Code of Washington. Much like the federal National Environmental Policy Act, SEPA is designed to provide decision-makers and the public with impartial information about a project and analyze alternatives to the proposal, including ways to avoid or minimize adverse impacts or to enhance environmental quality. The purpose of SEPA is to encourage harmony between the citizenry and the environment, to promote efforts that will prevent or eliminate damage to the environment, to stimulate human health and welfare, and to enrich understanding of the ecological systems and natural resources that are important to Washington State. Information provided during the SEPA review process helps decision-makers understand how a proposal would affect the environment and identify measures to reduce likely effects, or deny a proposal when adverse effects are identified. Okanogan County, as the lead state agency to fulfill the SEPA requirement, may adopt this EIS.

4.2 Northwest Power Act

Provisions of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (16 U.S.C. § 839b) are intended to protect, mitigate, and enhance fish and wildlife of the Columbia River and its tributaries. This project would help BPA fulfill its obligations under the Act (16 U.S.C. § 839b(h)(10)(A)).

In April 1996, the coho reintroduction project was one of 15 high-priority supplementation projects recommended for funding by the Northwest Power Planning Council (now Northwest Power and Conservation Council) and was incorporated into the Fish and Wildlife Program (program measures 7.1H, 7.4A, 7.4F, and 7.4O).

In the FY 1998 Annual Implementation Work Plan, the Council recommended funding for completion of the environmental review of the first phase (feasibility studies). As feasibility studies began showing success, the Yakama Nation submitted a Master Plan for the proposed expanded program in fulfillment of Step 1 of the Three-Step process (see Chapter 1). The Master Plan (YN 2010) was developed with review and assistance by fish and wildlife agencies and a number of scientists (including the Council's Independent Science Review Panel [ISRP]). It detailed the approach and biological rationale to realize the YN's long term vision for coho in the region. The Council and the ISRP reviewed drafts of the Master Plan, and on March 9, 2010, the Council recommended that BPA and YN proceed to Step 2 of its process, which includes preparation of this EIS. The program described in the Master Plan provided the basis for the Proposed Action evaluated in this EIS (see Chapter 2). The EIS would provide the basis for the Council's review under Step 2 of the process. Should the project proceed, final designs would be developed that would be reviewed by the Council under Step 3 of the process.

4.3 Wildlife and Habitat

4.3.1 Endangered Species Act

The Endangered Species Act of 1973 and its amendments (ESA, 16 U.S.C. 1531 *et seq.*) require federal agencies to ensure that their actions do not jeopardize endangered or threatened species or their critical habitats. The effects on species listed under ESA are discussed at length in Chapter 3 of this EIS: Section 3.7 (Fish) and Section 3.8 (Priority Habitat, Plants, and Wildlife). Based on the information in these sections, Biological Assessments have been prepared and submitted to USFWS and NMFS for formal consultation under Section 7 of the ESA.

4.3.2 Fish and Wildlife Conservation Act and Fish and Wildlife Coordination Act

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 *et seq.*), encourages federal agencies to conserve and promote conservation of game and non-game species and their habitats. This project is designed to promote the restoration of coho salmon in areas from which it was extirpated, and to contribute to the ecological balance of the Methow and Wenatchee basins by providing a source of nutrients to other species at the onset of the critical winter period. See Chapter 3, Section 3.7.

The Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661 *et seq.*) also requires federal agencies to consult with the USFWS and state fish and wildlife agencies when "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted…or otherwise controlled or modified" by permit or license. The USFWS and WDFW were sent copies of the Draft EIS. The Department of Interior, including the USFWS, sent comments on the DEIS that are addressed in Appendix 12. WDFW did not comment.

The proposed action would divert waters of rivers and streams in the Wenatchee and Methow basins to rear and acclimate coho salmon. This use would not consume the water, but would use it briefly and then discharge it back into the river. This use would enhance the potential to restore naturally reproducing populations of coho, increasing their abundance, productivity, distribution, and diversity.

4.3.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 U.S.C. 703-712) prohibits the taking, killing, or possession of migratory birds except as allowed by the Secretary of the Interior. The list of migratory birds is found in 50 CFR 10, and permit regulations are found in 50 CFR 21. This project would not take, kill, or possess migratory birds. See Chapter 3, Section 3.8.

4.3.4 Bald Eagle Protection Act

The federal Bald Eagle Protection Act (16 CFR 668-668d) prohibits the taking, possession, purchase, sale, barter, transport, export, or import of any bald or golden eagle or any part, nest, or egg of a bald or golden eagle, except for certain scientific, exhibition, and religious purposes. Eagle permit regulations are found in 50 CFR 22.

Washington state wildlife law is contained in Title 77, Revised Code of Washington (RCW). This title contains several sections generally applicable to the EIS process. Taking protected wildlife and destroying eggs, including removal of raptor nest trees, are prohibited under RCW 77.15.120.

Bald eagles would not be taken or otherwise harmed by this project. The most likely effect would be beneficial, by increasing a source of food—coho salmon. See Chapter 3, Section 3.8.

4.3.5 Magnuson-Stevens Fishery Conservation and Management Act of 1976

NMFS (National Marine Fisheries Service) is responsible for ensuring compliance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976. Public Law 104-297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Act to establish new requirements for evaluating and consulting on adverse effects to essential fish habitat (EFH). EFH includes all streams, lakes, ponds, wetlands, and other viable water bodies, and most of the habitat historically accessible to salmon necessary for spawning, breeding, feeding or growth to maturity.

The facilities associated with the Mid-Columbia Coho Restoration Program are located within EFH Habitat for Pacific salmonids (coho and Chinook salmon). As discussed in Section 3.7, changes to Chinook salmon habitat would be unlikely, and juvenile Chinook would be excluded from at most approximately 1.5 acres of habitat they might currently use for a period of 6 weeks to 7 months each year. The Biological Assessment submitted to NMFS in November 2011 detailed conservation measures intended to avoid and minimize impacts to essential fish habitat of federally managed fish species.

4.4 Heritage Conservation and Cultural Resources Protection

The National Historic Preservation Act of 1966 as amended (16 U.S.C. 470) requires federal agencies to take into account the potential effects of their undertakings on properties that are listed or eligible for listing on the National Register of Historic Places. Consultation must occur with the State Historic Preservation Office, Indian tribes that attach religious and cultural significance to historic properties that may be affected by an undertaking, and additional consulting parties regarding the inventory and evaluation of properties potentially eligible for National Register nomination; and to determine whether the project would adversely affect them.

Cultural resource surveys conducted at each proposed project site where ground might be disturbed (Chapter 3, Section 3.13) identified no cultural resources that would be affected. Findings were shared with the Washington State Historic Preservation Office, the Yakama Nation, and the Confederated Tribes of the Colville Indian Reservation. If construction or operation activities reveal cultural resources at any site, consultation will be initiated to determine how to avoid or mitigate adverse effects.

Facilities proposed on federal or Tribal land would follow the requirements of the Archaeological Resource Protection Act (16 U.S.C. 470aa-mm). Currently, the Proposed Action includes no alterations to sites on federal properties. Only one site is on Tribal land; it is currently being used by the Mid-Columbia Coho Restoration Program, and no new construction is proposed under the Proposed Action.

The Archaeological and Historic Preservation Act (16 U.S.C. 469 *et seq.*) directs federal agencies to notify the Secretary of the Interior if they find that a federal action might cause the destruction of significant scientific, prehistoric or archaeological data. As stated above, on-site surveys identified no cultural materials at the proposed construction sites.

Executive Order 13175, Consultation and Coordination with Indian Tribes, states that the U. S. government will continue to work with Indian Tribes on a government-to-government basis to address issues concerning tribal self-government, trust resources, and Indian tribal treaty and other rights. The Mid-Columbia Coho Restoration Program (sponsored by the Yakama Nation) would contribute to the spirit of intergovernmental cooperation, and if implemented, has the potential to enhance the culturally significant tribal ceremonial and subsistence fishery for coho salmon in the Wenatchee and Methow rivers and in the Columbia River below Wells Dam.

4.5 Floodplain/Wetlands Assessment

The U.S. Department of Energy mandates that impacts to floodplains and wetlands be assessed and alternatives for protection of these resources be evaluated in accordance with Compliance with Floodplain/Wetlands Environmental Review Requirements (10 CFR 1022.12) and Federal Executive Order 11988, Floodplain Management and Executive Order 11990, Protection of Wetlands. If either would be affected or altered by project facilities, the effects must be disclosed. Sections 3.9 and 3.10 of this EIS describe the effects of the proposed program on wetlands and FEMA-mapped floodplains. Section 4.5 is the Floodplain and Wetland Assessment required under the Executive Orders.

4.5.1 Project Description and Impacts

Floodplains

Most, if not all, of the 26 proposed sites are in or near a floodplain. Appendix 8 provides details of the FEMA flood insurance rate maps (FIRMs) that apply to each site. However, not all sites require construction that would potentially affect the floodplains. Table 4-1 identifies all the proposed acclimation and hatchery sites, both primary and backup, and the kind of construction activity that would take place in floodplains. The total amount of ground disturbed during construction of all the primary sites is proposed to be less than 5 acres and would include four new water intake structures, three new wells, and 20 feet of unpaved road. New ponds are proposed for the Dryden hatchery, four primary acclimation sites, and four backup sites; one backup site would expand an existing pond in a floodplain. The construction details for each site are described in Appendices 1, 2, and 3. The new ponds would remove material from floodplains, slightly increasing floodplain storage capacity and potentially decreasing flood elevations.

Proposed clearing and grading during construction is limited to small areas relative to the total floodplain. At each site, impacts to flooding would be avoided or floodplain storage would be created to offset facilities located above ground in the floodplain.

Table 4-1. Acclimation and hatchery sites with development activities in floodplains

Wenatchee River Basin, in Chelan County, Washington		
Primary Site	**Activities in Floodplain**	**Floodplain Permit Required**
Tall Timber	Excavation of Napeequa River bank intakes and pipeline corridor	Yes
Chikamin	Excavation of pond, Chikamin Cr. bank intakes, open channel, pipeline	Yes
Minnow	Excavation of bed and banks of Minnow Creek	Yes
Butcher	None	No
Coulter	None	No
Rohlfing	None	No
White River Springs	None	No
Dirty Face	None	No
Two Rivers	None	No
Clear	None	No
Beaver	None	No
Brender	None	No
Leavenworth NFH	None	No
Dryden Hatchery	Development of water quality treatment wetlands	Yes
Backup Site	**Activities in Floodplain**	**Floodplain Permit Required**
Allen	None	No
Coulter/Roaring	None	No
McComas	None	No
Scheibler	Excavation of bed and bank of Chumstick Creek	Yes
Squadroni	Excavation of pond and open channels	Yes
George Hatchery	Excavation and construction of a fish hatchery and associated facilities	Yes
Methow River Basin, in Okanogan County, Washington		
Primary Site	**Activities in Floodplain**	**Floodplain Permit Required**
MSWA Eightmile	None	No
Mason	None	No
Newby	Excavation of pond, pipeline corridors, new water intake	Yes
Twisp Weir	Excavation of pond and pipeline corridor, new water intake	Yes
Gold	None	No
Goat Wall	None	No
Heath	None	No
Parmley	None	No
Pete Creek Pond	None	No
Lower Twisp	None	No
Hancock	None	No
Winthrop NFH	None	No
Backup Site	**Activities in Floodplain**	**Floodplain Permit Required**
MSRF Chewuch	Excavation of a pond and open channels	Yes
Chewuch AF	Excavation of the Chewuch River bank, pond and pipeline corridors	Yes
Utley	Excavation of outlet channel to the Twisp River	Yes
Poorman	None	No
Biddle	None	No
Balky Hill	None	No

Implementation of the Proposed Action would probably have little or no effect on flood elevations. Where there is an effect, it is likely to be beneficial, as the acclimation ponds would provide a small amount of additional floodplain storage (difference between the existing land surface elevation and the working water surface elevation). The spoil materials from construction activities such as excavation of ponds and ditches, grading of roads to improve winter access, or installation of buried water supply pipes would be disposed of outside the 100-year floodplain in accordance with the local grading and floodplain management ordinances. Consequently, there are not likely to be changes in grades that could direct or divert flood flows affecting properties either upstream or downstream of the individual project sites.

New wells, although providing additional flow through the acclimation sites, would withdraw water from shallow aquifers that are typically hydraulically connected to the adjacent creek or river. Therefore, there is no real gain or loss of water (see Section 3.6). Additionally, the well discharge would be very minor compared to flood flows (Section 3.6), so there would be no impact on floodplains from construction or operation of wells. Site-specific discussions can be found in Chapter 3, Section 3.10.3.

There would be little to no effect on lives or property from the proposed actions that are located in floodplains. As discussed above, the overall effects on flooding may be slightly beneficial due to the excavation of ponds and ditches.

Wetlands

Wetlands were identified primarily from existing information and from visits to project acclimation sites requiring construction and to the backup hatchery site. Not all sites requiring construction would affect wetlands, and at the Dryden site, the project would create new wetlands where none now exist. Table 4-2 summarizes the types of wetlands identified at primary and backup sites in the two basins where construction is proposed, and the amount of disturbance, removal, or newly created wetland currently estimated.

Table 4-2. Wetlands effects at project sites: temporary, permanent, and newly created wetland

Site Name	Wetlands Observed During Site Visits	Wetlands Identified With Existing Information	Potential Wetland Impacts
Wenatchee Primary			
Chikamin	None observed.	PFO, PSS, and PEM wetland habitat mapped along riparian habitat a few hundred feet from the site.	No wetland impacts identified in proposed construction area.
Dryden	None observed.	PSS wetland habitat mapped along riparian habitat a few hundred feet from the site.	No wetland impacts identified in proposed construction area. - New wetland potentially created: 52,272 sq ft.
Minnow	None observed.	PFO, PSS, and PEM wetland habitat mapped along riparian habitat a few hundred feet from the site.	No wetland impacts identified in proposed construction area.
Tall Timber	PSS and PEM wetland habitat associated with side channels.	PSS and PEM wetland habitat mapped along riparian habitat more than 1,000 feet from site.	Inundation of side channel could slightly change adjacent plant composition.
Wenatchee Backup			
Scheibler	PFO, PSS, and PEM wetland habitat associated with riparian habitat.	PSS and PEM wetland habitat mapped along riparian habitat at the site.	Temporary: 8,700 sq ft. Permanent: 5,500 sq ft.
Squadroni	Site visit not performed.	PSS and PEM wetland habitat mapped along riparian habitat of Nason Creek a few hundred feet from the site.	No wetland impacts identified in proposed construction area.
George (backup hatchery site)	Wetlands observed associated with the side channel (high-quality PSS and PAB wetland) and the Wenatchee River (PFO and PSS wetlands).	NWI PFO, PSS, and PAB identified associated with the Wenatchee River and the side-channel at the site.	Temporary: 45,000 sq ft. (1 acre) Permanent: 1,075 sq ft. (0.03 acres)
Methow Primary			
Gold	Potential small patches of PSS and PEM wetland along pond shoreline.	None within 1,000 feet of site.	No wetland impacts identified in proposed construction area.
MSWA Eightmile	PSS and PEM wetland habitat associated with riparian habitat.	PSS and PEM wetland habitat mapped along riparian habitat at the site	No wetland impacts identified in proposed construction area.
Twisp Weir	None observed.	NWI PFO and PEM wetland habitat identified along the Twisp River at the site.	No wetland impacts identified in proposed construction area.
Newby	PSS wetland downstream of site.	None identified.	Temporary: 200 sq ft. Permanent: 100 sq ft. at discharge outfall.

NWI – National Wetlands Inventory
PAB – Palustrine aquatic bed (wetland)
PEM – Palustrine emergent (wetland)
PFO – Palustrine forested (wetland)
PSS – Palustrine scrub-shrub (wetland)

Table 4-2 (continued)

Site Name	Wetlands Observed During Site Visits	Wetlands Identified With Existing Information	Potential Wetland Impacts
Methow Backup			
Chewuch AF	None observed.	None within 1,000 feet of site.	No wetland impacts identified in proposed construction area.
MSRF Chewuch	PFO, PSS, and PEM wetland habitat associated with riparian habitat.	PFO, PSS, and PEM wetland habitat mapped along riparian habitat at the site.	Proposed construction could impact wetlands along riparian habitat.
Utley	Potential patches of riverine wetlands along the Twisp River east and northeast of existing pond. A large PSS NWI wetland north of the pond may be connected to the ditch that drains the pond.	PSS NWI wetland approximately 250 feet north of the existing pond. PFO NWI wetland approximately 400 feet southwest of the pond but outside of any proposed construction areas.	Temporary:150 sq ft. (0.003 acres)

NWI – National Wetlands Inventory
PAB – Palustrine aquatic bed (wetland)
PEM – Palustrine emergent (wetland)
PFO – Palustrine forested (wetland)
PSS – Palustrine scrub-shrub (wetland)

Table 4-3 summarizes the amount of wetland area affected in both basins.

Table 4-3. Total estimated square feet of temporary and permanent wetland impacts

Sites	Temporary Impacts	Permanent Impacts	Construction of New Wetland Habitat
Wenatchee sites			
Backup acclimation Scheibler	8,700 sq. ft.	5,500 sq. ft.	
Primary hatchery Dryden			52,272 sq. ft.
Backup hatchery George	45,000 sq. ft.	1,075 sq. ft.	
Methow sites			
Primary acclimation Newby	200 sq. ft.	100 sq. ft.	
Backup acclimation			
Utley	150 sq. ft.		
MSRF Chewuch	undetermined	undetermined	
Total wetland impacts primary sites	**200 sq. ft.**	**100 sq. ft.**	**52,272**
Total wetland impacts backup sites	**53,850 sq. ft.**	**6,575 sq. ft.**	**0 sq. ft.**

4.5.2 Alternatives and Mitigation

Proposals for construction in floodplains have been limited by using existing natural and human-made ponds for acclimation as much as possible; of the 26 primary sites proposed in both basins (including the proposed hatchery site), only 6 require construction in floodplains. Water supply intakes and hatchery/acclimation pond outlets are water dependent uses, and it is not feasible to locate these facilities outside of the floodplain and riparian areas. It is essential that the ponds be located to use the river waters for imprinting and acclimation of juvenile salmon and to allow smolts to eventually volitionally release into the rivers for out-migration.

In the Wenatchee basin, 4 of the 13 proposed primary sites, including the proposed Dryden Hatchery, require some work in floodplains. Two sites might require excavation of ponds in floodplains, and the Dryden work would be to create a water treatment wetland. The other site would be water intakes and pipelines only. In the Methow basin, 2 of 12 primary sites require work in floodplains, Twisp Weir and Newby.

The project includes alternative or backup sites for acclimation and the hatchery, in the event that one or more primary sites are infeasible. In the Methow, 3 of the 6 backup sites require construction in floodplains. In the Wenatchee, two of the six backup acclimation sites require construction in floodplains. At the George backup hatchery site, permanent hatchery facilities would be near the edge of the floodplain but outside the 100-year floodplain boundary. As this is a backup site, detailed engineering studies have not been completed. Because the project is near the edge of the floodplain, at an elevation similar to the BFE, it is not expected that the project would measurably obstruct flood flows or reduce floodplain storage. Development of the site would have not have a substantial adverse effect on flooding.

Measures that would be implemented to minimize potential impacts to flooding include:

- Compensatory storage is incorporated in the project design where above-ground facilities are located within the floodplain.
- Spoil materials would be removed and disposed of in uplands or at off-site locations outside the floodplain.
- Infrastructure buried below grade would not be placed in elevated road prisms, preventing diversion or rerouting of floodwaters.

Wetlands

Where new construction is proposed, facilities would be sited to avoid wetlands, if possible. Only one of the proposed 25 primary acclimation sites (Newby) would require construction in wetlands; the proposed hatchery site at Dryden would not affect wetlands, but its water treatment proposal could create over 52,000 square feet of new wetland. At least two of the backup sites require construction in wetlands, and the backup hatchery site could require significant work in wetlands (see Table 4-3).

Measures that would be implemented to avoid, minimize, and mitigate potential impacts to wetlands and wetland buffers include:

- No development features such as buildings or paved surfaces are proposed in wetlands.
- Clearing and grading would be designed to avoid wetland areas to the greatest extent possible.
- Disturbed areas would be re-vegetated with native vegetation.
- Staging areas for construction would be located outside wetland buffers and re-vegetated with native vegetation as necessary.
- Construction permits issued to the project would include detailed measures for protecting wetland habitats. The conditions included in the permits would be met during construction.

4.6 State, Area-wide, and Local Plans and Permits

4.6.1 Wenatchee and Methow Subbasin Plans

The proposed Mid-Columbia Coho Restoration Program is consistent with and supports the vision and goals of both the Wenatchee and Methow subbasin plans. The vision for the Wenatchee subbasin includes restoring extirpated fish and wildlife and natural habitats that perpetuate native wildlife and fish populations into the foreseeable future. The vision for the Methow subbasin is to support self-sustaining, harvestable, and diverse populations of fish and wildlife.

Restoring extirpated fish and wildlife is a specific goal and priority to advance the vision of the Wenatchee Subbasin Plan, and is also a specific goal of the Methow Subbasin Plan: "The goal for coho salmon includes re-establishment of run sizes that provide for species recovery, mitigation of hydro-system losses, and harvestable surpluses." (NPCC 2004b)

In both the Wenatchee and Methow subbasin plans, coho salmon are listed as a focal species. Many of the prioritized habitat restoration actions in the subbasin plans are aimed at supporting continued restoration of coho populations. Coho salmon prefer and occupy different habitat types than the other focal species, selecting slower velocities and greater depths. Habitat complexity and off-channel habitats such as backwater pools, beaver ponds, and side channels are important for juvenile rearing, making coho salmon a good biological indicator for habitat recovery prioritized in the subbasin plans.

The following excerpts from the two subbasin plans are a sample of how coho have been incorporated into the plans. Emphasis within the quotations was added to highlight issues.

Methow Subbasin Plan excerpts:

> *Page xxi, Section 1 Fisheries Management:* This section provides the Methow Subbasin Plan goals for focal species. "**The goal for coho salmon includes re-establishment of run sizes that provide for species recovery, mitigation of hydro-system losses, and harvestable surpluses.**"
>
> *Page 33, Section 3.3.1 Fish Focal Species: Population Characterization and Status:* "A focal species has special ecological, cultural, or legal status and represents a management priority in the Methow subbasins and, by extension, in the Columbia Cascade Eco-province. Focal species are used to evaluate the health of the ecosystem and effectiveness of management actions." The inclusion of coho salmon as a "focal species" in the Methow Subbasin Plan indicates that continued coho restoration is consistent with the Plan, and that coho can be used as an indicator species for select habitat types.
>
> *Page 79 Section 3.4.6 Fish Focal Species, Rationale for Selection – Coho:* "Historically the Methow River produced more coho than Chinook or steelhead (Craig and Suomela 1941). Mullan (1984) estimated that 23,000-31,000 coho annually returned to the Methow River. Upstream of the Yakima River, the Methow River and Spokane River historically produced the most coho, with lesser runs into the Wenatchee and Entiat (Mullan 1984)..."
>
> "Coho salmon prefer and occupy different habitat types, selecting slower velocities and greater depths than other focal species: Habitat complexity and off-channel habitats such as backwater pools, beaver ponds, and side channels are important for juvenile rearing making coho good biological indicators of these areas."

<u>Page 79 Section 3.4.6 Fish Focal Species, Coho – Representative Habitat:</u> "Currently, coho salmon returning to the Methow Basin are spawning in the mainstem Methow River and small tributaries such as Gold Creek. **As the recovery program continues, <u>reintroduction of coho to tributaries</u> within the Methow Basin will aid in species dispersal."** This statement indicates that continued coho reintroduction is expected in the Methow Subbasin Plan to ensure adequate species dispersal within the Methow subbasin.

<u>Page 81 Section 3.4.6 Fish Focal Species, Coho – Population Management Regimes and Activities:</u> "**The ideal result would be to restore coho populations in these basins [Methow and Wenatchee] to their historic levels. Because of varying degrees of habitat degradation in each of these basins, historical numbers are unlikely ever to be achieved but remain a goal towards which to strive."**

<u>Pages 301-353 Section 5.5 Assessment Unit Summaries:</u> In section 5.5, coho salmon are specifically listed as a focal species for the following Assessment Units: Lower Methow, Middle Methow, Upper-Middle Methow, Upper Methow/Early Winters/Lost River, Black Canyon/Squaw Creek, Gold/Libby Creeks, Beaver/Bear Creeks, Lower Twisp River, Upper Twisp River, Upper Chewuch River, Lower Chewuch River, Goat/Little Boulder Creeks. The proposed geographic distribution of coho under the Proposed Action is consistent with the identification of coho as a focal species for specific Assessment Units in the Subbasin Plan.

<u>Wenatchee Subbasin Plan excerpts:</u>

<u>Page xxi, Section 2.5.2 Key Findings: Aquatic:</u> "Limiting factors are defined as a habitat element that limits the biological productivity and/or life history diversity of a focal species. **The focal species selected for this assessment include spring chinook salmon, late-run chinook salmon, sockeye salmon, <u>coho salmon</u>,** steelhead trout, bull trout, westslope cutthroat trout, and pacific lamprey." As defined in the plan, "focal species will be used to evaluate the health of the ecosystem and the effectiveness of management actions."

<u>Page 27, Section 3.3.3 Guiding Principle 10:</u> "**Restoration of individual populations may not be possible without restoration of other fish and wildlife populations with which they co-evolved."** This statement from the 10th guiding principle directly applies to the reintroduction of coho salmon (extirpated species) which co-evolved with all the other focal species in the basin. The plan acknowledges that restoration of ESA species may not be possible unless the ecosystem and co-evolved fish assemblage is restored.

<u>Page 29, Section 4.1 Focal Species – Aquatic/Fish:</u> "Fish focal species were defined that a) have special cultural significance, b) fulfill a critical ecological function, c) serve as an indicator of environmental health, d) are locally significant or rare as determined by applicable state or federal resource management agencies and/or are federally listed. Eight anadromous and resident fish species were chosen as focal species. Each of these species is considered to be culturally important, three of the species are listed under ESA and each species uniquely represent different and important habitat characteristics." Coho salmon are a focal species in the Wenatchee Subbasin Plan.

<u>Page 29 Section 4.1 Focal Species – Table 12</u>: In Table 12, coho are shown as a focal species with a representative habitat of "lower mid-elevation mainstem and tributaries, side channel and backwater environments." Lower and mid-elevation mainstem includes the

Wenatchee River from the mouth to the Lake. Tributaries include Nason Creek, Chiwawa River, White River, and Little Wenatchee.

Page 70 - Figure 11: The figure on page 70 shows the **current** distribution of coho in the Wenatchee subbasin. At the bottom of the figure the following note is found – "**Note: Coho presence and spawning information is dynamic and is expected to change significantly each year as reintroduction efforts continue."** The Wenatchee Subbasin Plan expects coho reintroduction to continue.

Page 305 Section 7.8.16 Summary of Near-term Opportunities by Focal Species – Coho Salmon: "**Continued development of a locally adapted broodstock is essential to ensure future populations of naturally spawning coho salmon in the Wenatchee River."**

4.6.2 County Comprehensive Plans

The DEIS was submitted to Okanogan County for review, consistent with the comprehensive plan's Policy #4, which recognizes that federal agencies must coordinate their proposed actions with local governments, and in the county's role as the lead agency for review under SEPA. Minor clarifications to this section were provided.

Both counties have comprehensive plans in place. Sites in the Wenatchee basin are for the most part in areas designated as Rural in the Chelan County Comprehensive Plan, although a few might not be. In these areas, the rural character is to be preserved. Rural character is defined as follows:

1. In which open space, the natural landscape, and vegetation predominate over the built environment;
2. That foster traditional rural lifestyles, rural-based economies, and opportunities to both live and work in rural areas;
3. That provide visual landscapes that are traditionally found in rural areas and communities;
4. That reduce the inappropriate conversion of undeveloped land into sprawling, low-density development;
5. That generally do not require the extension of urban governmental services; and
6. That are consistent with the protection of natural surface water flows and groundwater and surface water recharge and discharge areas.

Proposed project sites appear to be consistent with this definition, as well as with goals and policies in the plan. The Draft EIS was submitted to Chelan County for its review; the County did not comment.

The Okanogan County Comprehensive Plan (adopted in 1964) is currently being amended, with adoption of amendments by the Okanogan County Commissioners pending. Most (if not all) of the proposed project sites are in lands designated Rural. While fish acclimation sites are not a specifically permitted activity in either High or Low Density Rural Lands, they are not a prohibited use. The project would not affect the county's transportation network by over-burdening it with traffic or by requiring new infrastructure. The project is consistent with plan policies on private property rights and water rights.

A large portion of the Methow watershed is divided into the "Methow Review District." The 1976 Methow Comprehensive Plan divides this area into 4 geographic areas, or "Sub-Areas" (A, B, C & D). Sub-Area A is also known as "Upper Methow Valley." Most of the project sites in the Methow basin are in the Upper Methow Valley sub-area. The sub-area developed its own subset of visions and policies, which are incorporated as Appendix B in the Comprehensive Plan (Upper Methow Valley Comprehensive Plan, an update of the Community Master Plan, Methow Valley Planning Area Sub Unit A. Adopted on March 6, 2000, by the Okanogan County Board of Commissioners). The proposed project is consistent with those visions and policies.

4.6.3 Permitting Issues

Various federal, state, tribal, and local permits and approvals would be required to implement the Mid-Columbia Coho Restoration Program.

Action on property owned by the Yakama Nation would require approval by the tribal government. Currently, only one backup site, Coulter/Roaring, is on Yakama Nation property (see Chapter 3, Section 3.3.1.2.); it would require no construction.

The hatchery and acclimation ponds are water-dependent uses, so water rights and in-water work permits are required. Elements would be incorporated into project design to assure consistency with the appropriate authorizations once they are known.

In-stream construction requires a Hydraulic Project Approval from Washington State, which would specify when in-water work can occur and what measures would be needed to protect channels, riparian zones and water quality. In addition, a Shoreline Substantial Development Permit may be required from Okanogan County and Chelan County (under authority delegated by WDOE) for working within 200 feet of a waterway. These permits would stipulate conditions for near-water construction activities. Both counties may also require an approval to allow construction within a designated floodplain to assure that appropriate design measures are included. On state-owned aquatic lands, Washington Department of Natural Resources (WDNR) has review and approval authority for any new structures.

4.7 Clean Water Act and Washington Water Laws

4.7.1 Clean Water Act

The Clean Water Act of 1977 (33 U.S.C. 1251 *et seq*.) is the principal federal law governing water pollution control. It regulates discharges into waters of the United States. Two of the primary instruments for implementing this Act are Sections 401 and Section 402, both of which are delegated by the federal government to Washington Department of Ecology (WDOE) to administer.

Under Section 401, a permit to conduct an activity that causes discharges into navigable waters is issued only after the affected state certifies that existing water quality standards would not be violated if the permit were issued. WDOE would review the Proposed Action’s Section 401 and Section 404 permit applications for compliance with Washington’s water quality standards and grant certification if the permits comply with these standards.

Section 402 authorizes National Pollutant Discharge Elimination System (NPDES) permits for the discharge of pollutants, such as stormwater or hatchery effluent discharges (see Section 3.5 Water Quality in this EIS). The NPDES would be required to operate hatchery facilities, while the water quality certification program would define specific construction-related mitigation measures that contractors must follow. Applications would be made to WDOE for both permits when final facility design is developed, including firm construction schedules and quantities and quality of hatchery discharges.

Authorization from the US Army Corps of Engineers (Corps) is required in accordance with the provisions of Section 404 of the Clean Water Act when dredged or fill material is discharged into waters of the United States including wetlands. BPA will coordinate with the Corps to obtain a Section 404 permit for any dredged or fill material placed in wetlands and work with WDOE to obtain Section 401 water quality certification. Potential impacts on wetlands are described in Sections 3.9 and 4.5 of this EIS.

4.7.2 Washington Water Laws

WDOE is also charged with administering state water rights laws. Revised Code of Washington Chapters 90.54 and 90.22 require WDOE to maintain in-stream flows sufficient to protect and preserve fish and wildlife habitat, scenic and aesthetic values, navigation and other environmental values (WDFW and WDOE 2004). The Washington Department of Fish and Wildlife (WDFW) recommends in-stream flows to be conditions of water rights or Clean Water Act Section 401 certification.

When a major water project is planned, WDFW and WDOE request that the project proponent conduct an in-stream flow study to provide adequate information on which to base an in-stream flow recommendation or requirement.[31] The proposed surface water withdrawals for the Proposed Action are greater than 1.0 cfs, but less than 10% of the monthly 90% exceedance flows, and are therefore not considered major water projects.

4.8 Farmland Protection Policy Act

The Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*) directs federal agencies to identify and quantify adverse effects of federal programs on farmlands. The purpose of the act is to minimize the number of programs that unnecessarily contribute to the conversion of agricultural land to non-agricultural purposes.

All sites proposed for construction were evaluated for the presence of designated Farmland; results are listed in Table 4-4. The location and ratings of Prime Farmlands were obtained from the Natural Resources Conservation Service (NRCS) Web Soil Survey website application (NRCS 2011). Farmlands of statewide or unique importance were obtained from the Washington Department of Ecology (WDOE) farm soil maps for Chelan and Okanogan counties (WSDOE 2011). Farmland status was identified for a total of one primary site and three backup sites in the Wenatchee basin (maximum of up to 6.7 acres), and three primary sites and one backup site in the Methow basin (maximum of up to 0.4 acres).

[31] WDFW defines a major water project as a project that: a) diverts at least 1.0 cubic feet per second (cfs), and b) changes flow by at least 10% of the monthly 90% exceedence flow (the flow that is equaled or exceeded 90 percent of the time) at any point along the stream channel.

Table 4-4. Construction sites (primary and backup) designated as farmland

Basin	Site Type – Primary or Backup [a]	Site Name	Soil Classification (NRCS)	Farmland Designation (NRCS, WSDOE)	Affected area (acres)
WEN	Hatchery – Primary	Dryden	Beverly gravelly fine sandy loam	Prime Farmland if irrigated	Up to 4
WEN	Hatchery – Backup	George	Alluvial land	Prime Farmland if irrigated	Up to 2.5
WEN	Acclimate – Backup	Scheibler	Leavenworth fine sandy loam	Prime Farmland if irrigated	Negligible (expand existing pond)
WEN	Acclimate – Backup	Squadroni	Aeric Fluvaquents	Not Prime Farmland; Farmland of statewide/unique importance (WSDOE)	0.2
MET	Acclimate – Primary	MSWA Eightmile	Boesel fine sandy loam	Prime Farmland	Negligible (well only)
MET	Acclimate – Primary	Newby	Boesel fine sandy loam	Prime Farmland if irrigated	0.2
MET	Acclimate – Primary	Twisp Weir	Boesel fine sandy loam	Prime Farmland if irrigated; Farmland of statewide/unique importance (WSDOE)	0.2
MET	Acclimate – Backup	Utley	Boesel fine sandy loam	Prime Farmland if irrigated; Farmland of statewide/unique importance (WSDOE)	Negligible (expand existing pond)

[a] Gray rows are backup sites that would be constructed only if a primary site is infeasible.

Only one site where construction is proposed is designated as Prime Farmland. The MSWA Eightmile primary acclimation site on the Chewuch River in the Methow basin would require the installation of one new well and a water delivery system. The site is managed for wildlife conservation and public recreation, and the proposed well would be located in a privately owned field just east of the existing side channel. The installation of the well and water delivery system would impact a very small area and would not convert any land to non-agricultural purposes; therefore, no Prime Farmland would be adversely affected.

The primary and backup hatchery sites (Dryden and George, respectively) are both designated as Prime Farmland if irrigated; however, neither site has been irrigated, nor have they been developed for agricultural purposes. The Dryden site has been used in the past by the WSDOT as a gravel pit and storage site, and is currently used for access to Dryden Dam and for recreational access to the Wenatchee River. The George site has been logged in the past and is currently undeveloped. Therefore, since neither site has been irrigated or developed for agriculture, construction of a new hatchery facility at either location would not convert agricultural land to non-agricultural purposes, and no Prime Farmland would be adversely impacted.

The remaining sites with some level of designated farmland status are not irrigated and are not developed for agriculture in the areas that would be impacted by construction. Further, these sites would require only minimal construction that would impact an insignificant amount of land. Therefore, it is reasonably certain that program activities would not convert land from agricultural to non-agricultural purposes and thus would not adversely affect any protected farmlands.

4.9 Noise Control Act

The Noise Control Act of 1972 (42 U.S.C. 490 *et seq.*) promotes an environment free from noise that jeopardizes human health and welfare. Federal and state regulations establish guidelines that implement the intent of the act. No local noise standards exist for areas that would be affected by the proposed action, although county comprehensive plans have policies related to noise. No noise in excess of state or federal standards is expected from this project (Section 3.14.1). Temporary construction noise during daylight hours is exempt from state and federal standards.

4.10 Clean Air Act

Emissions produced by construction and operation of the proposed project facilities must meet standards of the Clean Air Act and the amendments of 1970 (42 U.S.C. 7401 *et seq.*). In Washington, the authority for ensuring compliance with this act is delegated to WDOE. The Proposed Action would not violate current clean air standards, as described in Section 3.14.2.

4.11 Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA) and Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)

The federal Resource Conservation and Recovery Act (42 U.S.C. 6901 *et seq.*) regulates the disposal of hazardous wastes. The Toxic Substances Control Act (15 U.S.C. 2601) gives authority to the EPA to regulate substances that present unreasonable risks to public health and the environment. The federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 136 (a-y)) authorizes the EPA to prescribe conditions for use of pesticides.

Construction, operation, and maintenance of the proposed facilities would meet the guidelines for use, handling, storage, and disposal of hazardous substances. Necessary permits would be obtained if regulated pesticide products are used.

The Dryden site, which is owned by the Washington Department of Transportation, is contaminated with lead shot, most likely from activities such as trap shooting at the adjacent gun club. There is also limited soil contamination with pesticides and hydrocarbons (Lahiere 2011). Prior to any construction at the site, if selected, the contamination would be remediated and the toxics either removed or isolated to reduce any risk of further exposure to humans or the environment. Additional environmental review might be necessary as part of the remediation efforts.

Chemicals used at the proposed new hatchery may include chlorine, formalin, iodaphor, and sodium thiosulphate. Staff would be trained in their proper use, transport, handling and storage to minimize dangers of over-exposure or accidental release to the environment. Appropriate safety equipment would be provided, and chemicals would be stored in areas designed to contain the chemical in the event of a spill according to the Washington Industrial Safety and Health Administration regulations, the Uniform Fire Code, and other applicable regulations. Any used absorbent materials containing controlled chemicals would be disposed consistent with the Material Safety Data Sheet and applicable federal, state, and local regulations.

The types and amounts of chemicals used at a hatchery or rearing facility depend upon site-specific conditions, fish culture practices, species of fish, and types of parasites or disease organisms being treated. The types and amounts of chemicals that would be used at the proposed hatchery facility and acclimation ponds are not currently known. However, all chemical handling, application, and disposal would adhere to U.S. Department of Agriculture, state, and other federal regulations to protect human and environmental health.

4.12 Environmental Justice

Executive Order 12898 directs federal agencies to consider the effects of their programs, policies and activities on minority and low-income populations. Federal agencies are required to assess environmental justice concerns in the NEPA analysis. The potential for the Mid-Columbia Coho Restoration Program to affect low-income communities and minority populations is discussed below.

- Population: no change to minority or low income populations is expected.
- Income/employment: some additional jobs and income may be available to local minorities and low-income families during project construction and operations, but no substantial long-term change to employment or income is expected. Most full- or part-time positions for project operations likely would be filled by Yakama Nation staff already involved with the program.
- Housing: no changes to housing availability, costs, or quality in the local communities would occur as a result of Mid-Columbia Coho project.
- Local services: during construction (less than one year), an increase in demand for local services is likely, but demand would be temporary and would not exceed current capacity.
- Power rates: BPA wholesale power rates would not change due to the proposed action, and it is expected that local PUD rates would similarly be unaffected.
- Ceremonial and subsistence and recreational fisheries: the value (non-monetary) of an improved tribal ceremonial and subsistence fishery could increase the quality of life of tribal members in general. An improved recreational fishery for the general public could also benefit other local minorities and low-income families.

The Yakama Nation has enacted a Tribal Employment Rights Ordinance (TERO) requiring all employers subject to the Tribe's jurisdiction to give preference in employment, training, and subcontracting to Indians. Yakama TERO Contacts provide contact lists for Indian-owned construction and construction-related companies, facilitating the employment of these companies for project work. Jobs created by construction of the project could benefit individual Native Americans, but the effect would be short-term and minor.

4.13 Energy Conservation at Federal Facilities

Executive Order 13514 states that federal agencies should "*[identify] and [analyze] impacts from energy usage and alternative energy sources in all Environmental Impact Statements and Environmental Assessments for proposals for new or expanded Federal facilities under the National Environmental Policy Act of 1969, as amended (*42 U.S.C. 4321 *et seq.).*" BPA is proposing to fund the construction, operation, and maintenance of one new small hatchery and a number of acclimation sites. The final designs have not been completed for these facilities; however, the following is a general assessment of energy usage and the potential for using alternative energy sources.

Ground and surface water pumps would use the majority of the energy required for this project. Energy requirements have been minimized in the conceptual design of the project through the use of gravity flow water supplies at as many of the sites as possible. Where pumps would be needed, the primary power source would be nearby power lines, with generators to be used for emergency backup. Energy sources other than electrical power are not likely to be feasible due to the size of the requirement and the constant demand cycle. The use of propane rather than diesel fuel for the generators is being considered, as propane would emit fewer greenhouse gases that would contribute to climate change. Energy efficiency would also be considered in the sizing of the pumps and pipelines. BPA would encourage the Yakama Nation to use and promote energy-efficient designs and operations in the new hatchery buildings; to use incentives for energy conservation from local Public Utility Districts wherever feasible; and where practical, to supply their power needs from existing renewable sources or install on-site renewable power generation such as solar panels.

The Yakama Nation would own and operate the facilities, so the Tribe would ultimately make final decisions for the facility designs and operations. However, BPA would use contractual mechanisms through the funding agreement to encourage design and operation practices in the manner described in EO 13514.

Chapter 5. References

Ames, K.M., D.E. Dumond, J.R. Galm, and R. Minor. 1998. Prehistory of the Southern Plateau. In *Plateau*, edited by Deward E. Walker, Jr., pp. 103-119. Handbook of North American Indians, vol. 12, W. C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Anchor QEA, LLC. 2009. Nason Creek Draft Groundwater Report, prepared for Grant County Public Utility District No. 2.

Andonaegui, C. 2000. Salmon, Steelhead and Bull Trout habitat limiting factors, Water Resource Inventory Area 48. Washington State Conservation Commission, Washington State Department of Ecology, Olympia, WA.

Andonaegui, C. 2001. Salmon, Steelhead and Bull Trout habitat limiting factors, Water Resource Inventory Area 43 and 40. Washington State Conservation Commission, Washington State Department of Ecology, Olympia, WA.

Anthony, R. G., R. J. Steidl, and K. McGarigal. 1995. Recreation and bald eagles in the Pacific Northwest. Pages 223-241 in R. L. Knight, and K. J. Gutzwiller, editors. Wildlife and recreationists: coexistence through management and research. Island Press, Washington, D.C. & Covelo.

Battin, J., M.W. Wiley, M.H. Ruckelshaus, R.N. Palmer, E. Korb, K.K. Bartz, and H. Imaki. 2007. Projected impacts of climate change on salmon habitat restoration. Proceedings of the National Academy of Sciences. 104(16), 6720-6725.

Beck, K. 2011. Rare Plant Survey of the Tall Timbers and Twisp Weir Sites, WA, Mid-Columbia Coho Restoration Project. Prepared for Sea Springs Co. and Bonneville Power Administration. Beck Botanical Services, Bellingham, WA.

BirdWeb (Seattle Audubon Society). 2008. Seattle Audubon's Guide to the Birds of Washington. Available at < http://www.birdweb.org/birdweb/index.aspx> (Accessed December 7 and 9, 2010).

Boyd, Robert T. 1985. The Introduction of Infectious Diseases Among the Indians of the Pacific Northwest, 1774-1874. Unpublished Ph.D. dissertation, Department of Anthropology, University of Washington, Seattle, WA.

BPA (Bonneville Power Administration). 2003. Fish and Wildlife Implementation Plan Environmental Impact Statement. Available at http://efw.bpa.gov/environmental_services/Document_Library/Implementation_Plan/

BPA. 2007. Bonneville Power Administration National Environmental Policy Act Record of Decision for the FY2007-2009 Fish and Wildlife Project Implementation Decision. Available at http://efw.bpa.gov/environmental_services/Document_Library/Implementation_Plan/

BPA. 2009. Supplement Analysis for the Fish and Wildlife Implementation Plan EIS (SA-03). Available at http://efw.bpa.gov/environmental_services/Document_Library/Implementation_Plan/

Browman, David L. and David A. Munsell. 1969. Columbia Plateau Prehistory: Cultural Development and Impinging Influences. American Antiquity 34(3):249-264.

Bruce, Robin, Jeff Creighton, Stephen Emerson, and Vera Morgan. 2001. A Cultural Resources Overview for the Priest Rapids Hydroelectric Generation Project (FERC Project No. 2114), Grant, Chelan, Douglas, Kittitas, and Yakima Counties, Washington. Public Utility District No. 2 of Grant County, Ephrata, WA.

Campbell, Sarah K. 1989. Post Columbian Culture History in the Northern Columbia Plateau: A.D. 1500-1900. Ph.D. Dissertation in Anthropology, University of Washington, Seattle. Published: Garland Publishing Co., New York, NY.

Carroll, J., S. O'Neal, and S. Golding. 2006. Wenatchee River Basin Dissolved Oxygen, pH, and Phosphorus Total Maximum Daily Load Study. Publication No. 06-03-018, Watershed Ecology Section, Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA.

Carroll, J. and R. Anderson. 2009. Wenatchee River Watershed Dissolved Oxygen and pH Total Maximum Daily Load, Water Quality Improvement Report. Publication No. 08-10-062, Water Quality Program, Central Regional Office, Washington Department of Ecology. Yakima, WA.

Chalfant, Stuart A. 1974. Ethnological Field Investigation and Analysis of Historic Material Relative to Coeur d'Alene Indian Aboriginal Distribution. *In* The Interior Salish and Eastern Washington Indians Volume 1. Garland Publishing, Inc., New York, NY.

Chapman, D.W., C. Peven, T. Hillman, A. Giorgi, and F. Utter. 1994. Status of summer steelhead in the mid-Columbia region. Report for the Mid-Columbia PUDs. 235 pp.+ app.

Chapman, D.W., C. Peven, A. Giorgi, T. Hillman, and F. Utter. 1995. Status of spring Chinook salmon in the mid-Columbia region. Report for the Mid-Columbia PUDs. 270 pp.+ app.

Chatters, James C. 1986. A Deductive Approach. *In* Archaeological Predictive Modeling: The Yakima Firing Center (Part III), edited by W.C. Smith and J.C. Chatters. Prepared for U.S. Army, Fort Lewis, Washington, by Central Washington University, Central Washington Archaeological Survey, Geographical Information Systems Laboratory, Ellensburg, WA.

Chatters, James C. (editor). 1989. *Hanford Cultural Resources Management Plan.* Prepared for the U.S. Department of Energy under Contract DF-AC06-76RLO 1830 by Pacific Northwest Laboratory. Richland, WA.

Chelan County Code. 2010. Title 11 Zoning. Chapter 11.78 Fish and Wildlife Habitat Conservation Areas Overlay District (FWOD).

Chelan County Department of Emergency Management. 2006. Chelan County Hazard Inventory and Vulnerability Assessment. Wenatchee, WA.

Chelan PUD (Chelan County Public Utility District). 2009. Unpublished data - upon request this data was received by e-mail from Waikele Hampton on behalf of Chelan County PUD by Carmen Andonaegui of Anchor QEA on Dec 9, 2009.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Fish and Wildlife Service, Washington D.C.

Cramer, S.P., and N.K. Ackerman. 2009. Linking stream carrying capacity for salmonids to habitat features. Pages 225-254 in E.E. Knudson and J.H. Michael Jr., editors. Pacific salmon environmental and life history models: advancing science for sustainable salmon in the future. American Fisheries Society, Symposium 71, Bethesda, MD.

Creighton, Jeff. 2001. Chapter 6: Ethnography of the Project Area. *In* A Cultural Resources Overview for the Priest Rapids Hydroelectric Generation Project, (FERC Project No. 2114), Grant, Chelan, Douglas, Kittitas, and Yakima Counties, Washington. by Robin Bruce, Jeff Creighton, Stephen Emerson, and Vera Morgan. Prepared for Public Utility District No. 2 of Grant County, Ephrata, WA.

Cressman, L.S., in collaboration with D.L. Cole, W.A. Davis, T.M. Newman, and D.J. Scheens. 1960. Cultural Sequences at The Dalles, Oregon: A Contribution to Pacific Northwest Prehistory. *Transactions of the American Philosophical Society* 50(10). Philadelphia, PA.

CRITFC (Columbia River Intertribal Fish Commission). 1995. *Wy-Kan-Ush-Mi Wa-Kish-Wit*, Spirit of the Salmon, The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakama Tribes.

Dampf, Steven, F. Anderson, J. Dellert, F. Haney. 2011. Cultural Resource Inventory for the Mid-Columbia Coho Project, Chelan and Okanogan Counties, Washington. July 2011.

Diamond, J. and H.J. Pribble. 1978. Review of factors affecting seaward migration and survival of juvenile salmon in the Columbia River and ocean. Oregon Department of Fish and Wildlife. Information Report Series, Fisheries. Number 78-7. Portland, OR.

Dunnigan, J. and J. Hubble. August 1998. Results From YKFP and Mid-Columbia Coho Monitoring and Evaluation Studies. Prepared for the Mid-Columbia Technical Work Group.

Dunnigan, J. 1999. Feasibility and risks of coho reintroduction in the mid-Columbia: Monitoring and evaluation. Prepared for Bonneville Power Administration, Portland, OR.

EES Consulting. 2005. Lower Wenatchee River PHABSIM studies. Final Technical Report. Prepared for Chelan County Natural Resources Department and WRIA 45 Watershed Planning Unit. EES Consulting, Inc., Bellingham, WA.

EIA (Energy Information Administration). 2009. Energy and the Environment. Greenhouse Gases Basics. Accessed: July 19, 2010. Available: http://tonto.eia.doe.gov/energyexplained/index.cfm?page=environment_about_ghg

EPA (Environmental Protection Agency). 2005. Office of Transportation and Air Quality. Greenhouse Gas Emissions from a Typical Passenger Vehicle. February, 2005. EPA420-F-05-004

EPA. 2010a. Climate Change – Science: Atmosphere Changes. Accessed July 19, 2010. Available: http://www.epa.gov/climatechange/science/recentac.html

EPA. 2010b. AIRS Database. Accessed April 7, 2010. Available: http://www.epa.gov/air/data/index.html.

EPA. 2010c. The Green Book Nonattainment Areas for Criteria Pollutants. http://www.epa.gov/air/oaqps/greenbk/index.html. Accessed March 31, 2011.

Everest, F.H., R.L. Beschta, J.C. Scrivener, K.V. Koski, J.R. Sedell, and C.J. Cederholm. 1987. Fine sediment and salmonid production: a paradox. Pages 98-142 in Salo and Cundy (1987).

Everett, R., D. Schellhaas, D. Spurbeck, P. Ohlson, D. Keenum, and T. Anderson. 1997. Structure of northern spotted owl nest stands and their historical conditions on the eastern slope of the Pacific Northwest Cascades, USA. Forest Ecology and Management 94:1-14.

Ficken, Robert E. and Charles P. LeWarne. 1988. Washington: A Centennial History. University of Washington Press, Seattle, WA.

Flimlin, G., S. Sugiura, and P. Ferraris. 2003. Examining Phosphorus in Effluents from Rainbow Trout (Oncorhyncus mykiss). Aquaculture, Rutgers Cooperative Extension, Bulletin E287.

Foerster, R. E., and W. E. Ricker. 1953. The coho salmon of Cultus Lake and Sweltzer Creek. Journal of the Fisheries Research Board of Canada 10:293-319.

Fraser, F.J. 1969. Population density effects of survival and growth of juvenile coho salmon and steelhead trout in experimental stream channels. *In*: T.G. Northcote (ed.), Symposium of Salmon and Trout in Streams. H.R. MacMillan Lectures in Fisheries. University of British Columbia, Institute of Fisheries, Vancouver, B.C.

Fuller, T. K., L. D. Mech, and J. F. Cochrane. 2003. Wolf population dynamics. Pages 161-191 *in:* L. D. Mech and L. Boitani, editors. Wolves: behavior, ecology, and conservation. University of Chicago Press, Chicago, IL.

Galm, J.R., G.D. Hartmann, and R.A. Matsen. 1985. *Resource Protection Planning Process, Mid-Columbia Study Unit*. Prepared for the Washington State Department of Community Development, Office of Archaeology & Historic Preservation, Olympia. (Revised and supplemented by M.L. Stillson in 1987).

GeoEngineers. 2009. Hydrogeologic Consultation, Boyce and Youngsman Properties, Chelan County, Washington. Prepared for Jacobs Engineering Group, Inc., December 22, 2009.

GeoEngineers. 2010a. Results of Preliminary Test Pit Exploration at the Dryden Site, memorandum prepared for Sea Springs Company.

GeoEngineers. 2010b. Addendum to Appendix 5 Priority Habitat, Plants, and Animals Impacts Report Mid-Columbia Coho Restoration Project Okanogan County, Washington, File No. 9301-006-02 Prepared for Sea Springs Company. December 10, 2010.

GeoEngineers. 2012. Side-Channel Infiltration Analysis at the Natapoc Site.

Gutierrez, R. J., A. B. Franklin, and W. S. LaHaye. 1995. Spotted owl (Strix occidentalis). *In:* P. A., and F. Gill, editors. The Birds of North America. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington D. C.

Haines, F. 1938. The Northward Spread of Horses Among the Plains Indians. American Anthropologist 3:429-437.

Hicks, B.J., J.D. Hall, P.A. Bisson, and J.R. Sedell. 1991. Responses of salmonids to habitat changes. American Fisheries Society Special Publication 19:483-518.

Hillman, T. W., J. S. Griffith, and W. S. Platts. 1987. Summer and winter habitat selection by juvenile chinook salmon in a highly sedimented Idaho stream. Transactions of the American Fisheries Society 116: 185-195.

Hillman, T., M. Miller, C. Peven, M. Tonseth, T. Miller, K. Truscott, and A. Murdoch. 2008. Monitoring and evaluation of the Chelan County PUD hatchery programs. 2007 Annual Report. Prepared for the HCP Hatchery Committee. Wenatchee, WA.

Hillman, T., M. Miller, C. Peven, J. Miller, M. Tonseth, T. Miller, K. Truscott, and A. Murdoch. 2009. Monitoring and evaluation of the Chelan County PUD hatchery programs. 2008 Annual Report. Prepared for the HCP Hatchery Committee. Wenatchee, WA.

Hollenbeck, Jan L. and Susan L. Carter. 1986. A Cultural Resource Overview: Prehistory and Ethnography, Wenatchee National Forest. Wenatchee National Forest Cultural Resource Management Program, Wenatchee, WA.

Houghton, R. 2010. Carbon Researcher, The Woods Hole Research Center. Understanding the Carbon Cycle. Accessed January 29, 2010. Available: http://www.whrc.org/carbon/index.htm

HSRG (Hatchery Scientific Review Group). 2008. Draft Columbia River Coho Salmon Hatchery Analysis, Vol. 2. May 2008. http://www.hatcheryreform.us/prod/Portals/_default/Documents/Vol%202%20Master%20Columbia%20Coho%20Reports%205-30-08.pdf

Hunn, Eugene S. 1967. Mobility as a Factor Limiting Resource use in the Columbia Plateau of North America. Resource Manager: North American and Australian Hunter-Gatherers. Westview Press for the American Association for the Advancement of Science, Boulder, CO.

Huppert, D., G. Green, W. Beyers, A. Subkoviak, and A. Wenzl. 2004. Economics of Columbia River Initiative, final report to the Washington State Department of Ecology and CRI Economics Advisory Committee. Olympia, WA.

IPCC (Intergovernmental Panel on Climate Change). 2006. Guidelines for National Greenhouse Gas Inventories. Chapter 2: Generic Methodologies Applicable to Multiple Land-Use Categories. Accessed November 8, 2010. Available: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_02_Ch2_Generic.pdf

IPCC. 2007. Climate Change 2007, Working Group I: The Physical Science Basis. Chapter 2: Changes in Atmospheric Constituents and Radioactive Forcing: Atmospheric Carbon Dioxide. Accessed November 8, 2010. Available: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2.html

Isaksson, A., T.J. Rasch, P.H. Po. 1978. An Evaluation of Smolt Releases into a Salmon and a Non-salmon Producing Stream Using Two Release Methods, J. Agr. Res. Icel. 10,2:100-113.

Johnson, S.L., M.F. Solazzi, T.E. Nickelson. 1990. Effects on Survival and Homing of Trucking Hatchery Yearling Coho Salmon to Release Sites, North American Journal of Fisheries Management, 10:427-433.

Johnson, S. L., M. F. Solazzi, and J. D. Rodgers. 1993. Development and evaluation of techniques to rehabilitate Oregon's wild salmonids. Oregon Department of Fish and Wildlife, Fish Research Project F-125-R, Annual Progress Report. Portland, OR.

Karl, Thomas R., Jerry M. Melillo, and Thomas C. Peterson, (eds.). 2009. *Global Climate Change Impacts in the United States*. Cambridge University Press.

Kauffman, J. B., M. Marht, L. A. Mahrt, and W. D. Edge. 2001. Wildlife of riparian habitats. Pages 361-388 in D. H. Johnson and T. A. O'Neil, editors: Wildlife-habitat relationships in Oregon and Washington. Oregon State University Press, Corvallis.

Kennedy, Dorothy I.D., and Randall T. Bouchard. 1998. Northern Okanogan, Lakes, and Colville. *In:* Handbook of North American Indians, Volume 12. William C. Sturtevant, General Editor: Deward D. Walker, Jr., Volume Editor. Smithsonian Institution, Washington, D.C.

Kessavalou, A, J.W. Doran, A.R. Mosier, R.A. Drijber. 1998. Greenhouse Gas Fluxes Following Tillage and Wetting in a Wheat-fallow Cropping System. Journal of Environmental Quality 27:1105–1116.

Konrad, C.P., B.W. Drost, and R.J. Wagner. 2003. Hydrogeology of the unconsolidated sediments, water quality, and ground-water/surface-water exchanges of the Methow River Basin, Okanagon County, Washington. Water Resources Investigations Report 03-4322, United States Geological Survey. Tacoma, WA. 137 pp.

Koski, K.V. 1966. The survival of coho salmon from egg deposition to emergence in three Oregon coastal streams. Master's Thesis. Oregon State University, Corvallis.

Laheire, L. and R.D. Ernst. 2011. Remedial Investigation and Feasibility Study, Dryden Pit Site, Peshastin, Washington. Report 15734-00 prepared for Bonneville Power Administration by Hart Crowser, Inc. October 10, 2011.

Layton, D.F., G. Brown, and M. Plummer. 1999. Valuing multiple programs to improve fish populations. Prepared for Washington State Dept. of Ecology, Olympia, WA.

Leonhardy, Frank C., and David G. Rice. 1970. A Proposed Cultural Typology for the Lower Snake River Region, Southeastern Washington. Northwest Anthropological Research Notes 4:1-29, Moscow, ID.

LHSFNA (Laborer's Health and Safety Fund for North America). 2009. LHSFNA website. Accessed online at http://www.lhsfna.org/index.cfm on December 22, 2009.

Loomis, J. and R.G. Walsh. 1997. Recreation Economic Decisions: Comparing Benefits and Costs. Venture Publishing, State College, PA.

McKenney, Pamela M. and Rebecca A. Stevens. 2005. Cultural Resources Investigations for the Washington State Department of Transportation US 2/97: Peshastin East Interchange Project, Chelan County, Washington. Archaeological and Historical Services, Eastern Washington University, Cheney, Washington. Short Report DOT04-23. Submitted to Washington State Department of Transportation.

McPhail, J.D. and J.S. Baxter. 1996. A review of bull trout (*Salvelinus confluentus*) life-history and habitat use in relation to compensation and improvement opportunities. Department of Zoology, University of British Columbia. Fisheries Management Report No. 104. Vancouver, British Columbia, Canada.

Meehan, W.R., and D.N. Swanston. 1977. Effects of gravel morphology on fine sediment accumulation and survival of incubating salmon eggs. U.S. Forest Service Research Paper PNW-220.

Meinig, D.W. 1995. The Great Columbia Plain: A Historical Geography, 1805-1910. University of Washington Press, Seattle, WA. Reprint.

Michael, J.H. 2003. Nutrients in salmon hatchery wastewater and its removal through the use of a wetland constructed to treat off-line settling pond effluent. Aquaculture 226 (2003) 213-225.

Miller, Jay. 1998. Middle Columbia River Salishans. *In:* Handbook of North American Indians, Volume 12. William C. Sturtevant, General Editor: Deward D. Walker, Jr., Volume Editor. Smithsonian Institution, Washington, D.C.

Millspaugh, J. J., R. J. Woods, K. E. Hunt, K. J. Raedeke, G. C. Brundige, B. E. Washburn, and S. K. Wasser. 2001. Fecal glucocorticoid assays and the physiological stress response in elk. Wildlife Society Bulletin 29:899-907.

Mooney, James. 1928. The Aboriginal Population of America North of Mexico. Smithsonian Miscellaneous Collections 80:7.

Mullan, J.W. 1984. Overview of artificial and natural propagation of coho salmon (*Onchorhynchus kisutch*) on the mid-Columbia River. Fisheries Assistance Office, U.S. Fish and Wildlife Service, Leavenworth, WA. 37 pp.

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

Murdoch, A., and C. Peven. 2005. Conceptual approach to monitoring and evaluating the Chelan County Public Utility District Hatchery Programs. *Prepared for:* Chelan PUD Habitat Conservation Plan's Hatchery Committee.

Murdoch, K. G. and J. L. Dunnigan. 2001. Feasibility and Risks of Coho Reintroduction in Mid-Columbia River Tributaries, 2000 Annual Report. Prepared for Bonneville Power Administration, Project #1996-040-00. Yakama Nation Fisheries Resource Management, Toppenish, WA.

Murdoch, K.G., C.M. Kamphaus, S. A. Prevatte. 2004. Mid-Columbia coho reintroduction feasibility study: 2002 monitoring and evaluation report, project No. 1996-040-000. Bonneville Power Administration, Portland, OR.

Murdoch, K.G., C.M. Kamphaus, S. A. Prevatte. 2005. Mid-Columbia Coho Reintroduction Feasibility Study: 2003 Monitoring and Evaluation Report. Prepared by Yakama Nation Fisheries Resource Management for: Project #1996-040-00 Bonneville Power Administration, Portland, OR.

Murdoch, K. G. and M. LaRue. 2002. Feasibility and Risks of Coho Reintroduction in Mid-Columbia River Tributaries, 2001 Annual Report. Prepared for Bonneville Power Administration, Project #1996-040-00. Yakama Nation Fisheries Resource Management, Toppenish, WA, September 2002.

Murphy, M.L., J. Heifetz, J.F. Thedinga, and K.V. Koski. 1989. Habitat utilization by juvenile Pacific salmon (Onchorynchus) in the glacial Taku River, Southeast Alaska. CJFAS, 46: 1677-85.

NatureServe. 2010. NatureServe Explorer: An Online Encyclopedia of Life. Available at http://www.natureserve.org/explorer/. (Accessed via hyperlink at the USFWS Endangered Species Program Website [http://www.fws.gov/endangered/] on October 21, 2010).

NMFS et al.: National Marine Fisheries Service, U.S. Fish and Wildlife Service, U. S. Forest Service, Washington Department of Fish and Wildlife, Confederated Tribes of the Yakama Indian Nation, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes of the Umatilla Indian Nation, Chelan County Public Utility District, Douglas County Public Utility District, and Grant County Public Utility District. 1998. Aquatic species and habitat assessment: Wenatchee, Entiat, Methow, and Okanogan watersheds. Report available at Chelan County Public Utility District, Wenatchee, WA.

NMFS (National Marine Fisheries Service). 2008a. Biological Opinion on the effects of the Pacific Coast Salmon Plan and U.S. Fraser Panel Fisheries on the Lower Columbia River Coho and Lower Columbia River Chinook Evolutionarily Significant Units Listed Under the Endangered Species Act and Magnuson-Stevens Act Essential Fish Habitat Consultation. NMFS, Sustainable Fisheries Division, Northwest Region. Consultation Number: F/NWR/2008/02438. Seattle, WA.

NMFS. 2008b. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, OR.

NMFS. 2010. Draft Environmental Impact Statement to Inform Columbia River Basin Hatchery Operations and the Funding of Mitchell Act Hatchery Programs. National Marine Fisheries Service, Northwest Region , Seattle WA. Available at http://www.nwr.noaa.gov/salmon-harvest-hatcheries/hatcheries/ma-EIS.cfm

NPCC (Northwest Power and Conservation Council). 2004a. Wenatchee Subbasin Plan. Prepared for the Northwest Power and Conservation Council. May 2004. 427 pp.

NPCC. 2004b. Methow Subbasin Plan. Prepared for the Northwest Power and Conservation Council. November 2004.

NPCC. 2004c. Draft Methow Subbasin Wildlife Assessment and Inventory. Prepared by P.R. Ashley and S.H. Stovali. Available online at: (visited site October 11, 2010) http://www.nwcouncil.org/fw/subbasinplanning/methow/plan/e-Appendix%20L%20Wildlife%20Assessment/MethowSubbasinAssessment.pdf

NPPC (Northwest Power Planning Council). 2001. Three-Step Review Process as approved by Northwest Power Planning Council on October 18, 2001.

NRCS (Natural Resources Conservation Service). 2010. Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app)

NRCS. 2011. Web Soil Survey application. Accessed February 2011. http://websoilsurvey.nrcs.usda.gov/app/

Okanogan County Department of Emergency Management. 2009. All Hazards Mitigation Plan. Okanogan, WA.

Olsen, D., J. Richards, and R.D. Scott. 1991. Existence and sport values for doubling the size of Columbia River Basin salmon and steelhead runs. Rivers 2(1):45-56.

Olsen, D. and T. White. 2004. Economic analysis methodology illustration and review: Estimating the value of water for key resource sectors from the mainstem Columbia River. Pac. NW Project Technical Memorandum (April 2004 Revision) to the Columbia River Initiative Economics Review Team, University of Washington, Kennewick.

Oxendine, Joan, Tucker Orvald, Frank Stipe, and Jenna Farrell. 2006. Methow Transmission Project Cultural Resources Inventory. Tetra Tech EC, Incorporated, Bothell, Washington. Prepared for Public Utility District No. 1 of Okanogan County and the USDA Forest Service, Okanogan and Wenatchee National Forests.

Pearsons, T. D., and A. L. Fritts. 1999. Maximum size of Chinook salmon consumed by juvenile coho salmon. North American Journal of Fisheries Management. 19:165-170.

Pearsons, T., and C. Hopley. 1999. A practical approach for assessing ecological risks associated with fish stocking programs. Fisheries 24(9):16-23.

Petts, G.E. 1980. Long-term consequences of upstream impoundment. Environmental conservation. Volume 7. Pages 325-332.

Peven, C.M. 1992. Population status of selected stocks of salmonids from the Mid-Columbia River Basin. Chelan County Public Utilities Division, Wenatchee, WA. 52 pp.

Portman, S. 1993. The Smiling Country: A History of the Methow Valley. Published by The Sun Mountain Resort, Inc., Winthrop, WA.

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 *in:* P.J. Howell and D.V. Buchanan, eds. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, OR.

RASP (Regional Assessment of Supplementation Project). 1992. Supplementation in the Columbia Basin: summary report series. Final Report DOE/BP-01830-14, Bonneville Power Administration, Portland, OR.

Raufer, Sister Maria Ilma. 1966. Black Robes and Indians on the Last Frontier, a Story of Heroism. The Bruce Publishing Company, Milwaukee, WI.

Ray, Verne F. 1974. Ethnohistorical Notes on the Columbia, Chelan, Entiat, and Wenatchee Tribes. Petitioners Exhibit 471, pp. 377-435 in Interior Salish and Eastern Washington Indians IV: Ethnohistorical Report on Aboriginal Land Use and Occupancy. Commission Findings, Indian Claims Commission. Garland Publishing, Inc., New York, New York and London, England.

Relander, Click. 1956. Drummers and Dreamers: The Story of Smowhala the Prophet and His Nephew Puck Hyah Toot, the Last Prophet of the Nearly Extinct River People, the Last Wanapams. The Caxton Printers, Ltd: Caldwell, ID.

Richardson, C. T., and C. K. Miller. 1997. Recommendations for protecting raptors from human disturbance: A review. Wildlife Society Bulletin 25:634-638.

Ricker, W. E. 1941. The consumption of young sockeye salmon by predaceous fish. Journal of the Fisheries Research Board of Canada 5:104-105.

Roe, J. 1980. *The North Cascadians.* Madrona Publishers, Seattle, WA.

Ruggerone, G. T., and D. E. Rogers. 1992. Predation on sockeye salmon fry by juvenile coho salmon in the Chignik Lakes, Alaska: Implications for salmon management. North American Journal of Fisheries Management 12:87-102.

Scheuerman, Richard D., editor. 1982. The Wenatchi Indians: Guardians of the Valley. Ye Galleon Press, Fairfield, WA.

Schlegel, Trinity and Laurie Mauser. 2008. Class III Cultural Resource Inventory of Selected Tracts of BLM Public Lands for Grazing Lease Inventories in Okanogan and Grant Counties on Lands Administered by the Spokane District Office, Spokane County, Washington. Report prepared for the Bureau of Land Management by North Wind, Inc.

Schwartz, F. and E. Boyd. 1995. Constructed Wetlands for Treatment of Channel Catfish Pond Effluents. The Progressive Fish-Culturist 57:255-266. 1995.

Sexaur, H.M., and P.W. James. 1997. Microhabitat use by juvenile bull trout in four streams located in the eastern Cascades, Washington. Pages 316-370 *in:* Mackay, W.C., M.K. Brewin and M. Monita. Friends of the bull trout conference proceedings. Calgary, Alberta, Canada.

Sindilariu, P., C. Wolter, R. Reiter. 2008. Constructed wetlands as a treatment method for effluents from intensive trout farms. Aquaculture 277 (2008) 179–184.

Smith, D.L., E.L. Brannon, T.W. Bumstead, D.L. Mayer, D.M. Rodgers, B.F. Russel. 2004. An Engineered Natural Channel for Coho Salmon Habitat Development and Rearing. In Review, Fisheries Bioengineering Symposium IV.

Snow, C., C. Frady, A. Fowler, and A. Murdoch. 2008. Monitoring and evaluation of Wells and Methow Hatchery Programs in 2007. Prepared for Douglas County Public Utility District and Wells Habitat Conservation Plan Hatchery Committee, Twisp, WA.

Solazzi, M. F., T. E. Nickelson, S. L. Johnson, and J. D. Rodgers. 1998. Development and evaluation of techniques to rehabilitate Oregon's wild salmonids. Oregon Department of Fish and Wildlife, Fish Research Project F-125-R-13, Final Report. Portland, OR.

Spaulding, J.S., T.W. Hillman, J.S. Griffith. 1989. Habitat use, growth, and movement of chinook salmon and steelhead in response to introduced coho salmon. Pages 156-208 *in*: Don Chapman Consultants, Inc. Summer and winter ecology of juvenile chinook salmon and steelhead trout in the Wenatchee River, Washington. Chelan County Public Utility District, WA.

Spaulding, J.S., T.W. Hillman, D.W. Chapman, and J.S. Griffith. 1994. Habitat selection, growth, and movement of Chinook salmon and steelhead trout in response to introduced coho salmon in the Wenatchee River, Washington. Chelan County Public Utility District, WA.

Spier, Leslie. 1936. Tribal Distribution in Washington. General Series in Anthropology, No. 3. George Banta Publishing Co. Agent, Menasha, WI.

Stewart, N., G. Boardman, L. Helfrich. 2006. Treatment of rainbow trout (Oncorhynchus mykiss) raceway effluent using baffled sedimentation and artificial substrates. Aquacultural Engineering 35 (2006) 166–178.

Stinson, D. W. 2001. Washington state recovery plan for the lynx. Washington Department of Fish and Wildlife, Olympia, WA. 78 pp. + 5 maps.

Swanson, Earl H., Jr. 1962. *The Emergence of Plateau Culture*. Occasional Papers of the Idaho State University Museum, Pocatello, ID.

Tacha, T. C., S. A. Nesbitt and P. A. Vohs. 1992. Sandhill Crane (Grus canadensis), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/031.

Teit, James A. 1928. The Middle Columbia Salish. Franz Boas, ed. University of Washington Publications in Anthropology 2(4):83-128. Seattle, WA.

Thompson, R. B. 1966. Effects of predator avoidance conditioning on the post-survival rate of artificially propagated salmon. Ph.D. dissertation submitted to University of Washington, Seattle.

True, B., W. Johnson, S. Chen. 2004. Reducing phosphorus discharge from flow-through aquaculture I: facility and effluent characterization. Aquacultural Engineering 32 (2004) 129–144.

Tyus, H.M. 1990. Effects of altered stream flows on fishery resources. Fisheries. Volume 3. Pages 18-20.

UCRTT (Upper Columbia Regional Technical Team). 2003. A biological strategy to protect and restore salmonid habitat in the Upper Columbia Region. A report to the Upper Columbia Salmon Recovery Board. Wenatchee, WA.

UCSRB (Upper Columbia Salmon Recovery Board). 2007. Upper Columbia spring Chinook salmon and steelhead recovery plan. 307 pp.

USDOE/BPA (U.S. Department of Energy, Bonneville Power Administration). 1999. *Mid-Columbia Coho Reintroduction Feasibility Project Final Environmental Assessment and Finding of No Significant Impact*. USDOE/EA-1282, Portland, OR.

USDOE/BPA. 2001a. *Mid-Columbia Coho Reintroduction Feasibility Project Supplement Analysis*. USDOE/EA-1282-SA-01, April 23, 2001, Portland, OR.

USDOE/BPA. 2001b. *Mid-Columbia Coho Reintroduction Feasibility Project Supplement Analysis*. USDOE/EA-1282-SA-02, October 5, 2001, Portland, OR.

USDOE/BPA. 2002. Supplement Analysis for the Mid-Columbia Coho Reintroduction Feasibility Project EA (DOE/EA-1282/SA-03), November 18, 2002, Portland, OR.

USDOE/BPA. 2003. Supplement Analysis for the Mid-Columbia Coho Reintroduction Feasibility Project EA (DOE/EA-1282/SA-04), August 5, 2003, Portland, OR.

USFS (U.S. Forest Service). *In prep*. Methow Sub-basin bull trout redd survey report 2008. Draft report provided by Gene Shull, U.S. Forest Service. Winthrop, WA. 15 pp.

USFWS (U.S. Fish and Wildlife Service). 2002. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR. 137 pp.

USFWS. 2003a. Bull Trout monitoring results. Unpublished Wenatchee Basin annual redd survey report provided by Barbara Kelly Ringel, USFWS Mid Columbia River Fishery Resource Office. 15 pp.

USFWS. 2003b. 2001 National survey of fishing, hunting, and wildlife-associated recreation, state overview, Washington. Washington, D.C.

USFWS. 2004. Bull Trout monitoring results. Unpublished Wenatchee Basin annual redd survey report provided by Barbara Kelly Ringel, USFWS Mid Columbia River Fishery Resource Office. 17 pp.

USFWS. 2008. National Wetlands Inventory: Wetlands Geodatabase. Available at: http://wetlandsfws.er.usgs.gov/NWI/download.html.

USFWS. 2009a. Eastern Washington endangered species status and listing information by county. URL: http://www.fws.gov/easternwashington/species/countySppLists.html Searched on April 5, 2009.

USFWS. 2009b. USFWS Wetlands Mapper for National Wetlands Inventory Map Information. Accessed online at http://wetlandsfws.er.usgs.gov on April 5, 2009.

USFWS. 2009c. USFWS Threatened and Endangered Species System (TESS). URL: http://ecos.fws.gov/tess_public/TESSSpeciesReport (visited December 15, 2009).

USFWS. 2010a. Listed and Proposed Endangered and Threatened Species and Critical Habitat; Candidate Species; and Species of Concern in Okanogan County. U.S. Fish and Wildlife Service, Central Washington Field Office. Revised September 29, 2010. Available at http://www.fws.gov/wafwo/species_EW.html

USFWS. 2010b. Listed and Proposed Endangered and Threatened Species and Critical Habitat; Candidate Species; and Species of Concern in Chelan County. U.S. Fish and Wildlife Service, Central Washington Field Office. Revised September 29, 2010. Available at http://www.fws.gov/wafwo/species_EW.html.

USGCRP (United States Global Change Research Program). 2009. Global Climate Change Impacts in the United States. National Oceanic and Atmospheric Administration (Lead Agency), Washington, D.C., 2009. Available: http://www.globalchange.gov/usimpacts

Van Dyke, E.S., D.L. Scarnecchia, B.C. Jonasson, and R.W. Carmichael. 2009. Relationship of winter concealment habitat quality on pool use by juvenile spring Chinook salmon (Oncorhynchus tshawytscha) in the Grande Ronde River Basin, Oregon USA. Hydrobiologia 625:27-42.

Vannote, R.L., G.W. Minshall, K.W. Cummins, J.R. Sedell, and C.E. Cushing. 1980. The river continuum concept. Can. J. Fish. Aquat. Sci. (37)130-137.

Walker, Deward E. 1998. Introduction. *In:* Handbook of North American Indians, Volume 12. William C. Sturtevant, General Editor: Deward D. Walker, Jr., Volume Editor. Smithsonian Institution, Washington, D.C.

Walker, Deward E., Jr., and Roderick Sprague. 1998. History Until 1846. *In:* Plateau, edited by D. Walker, pp. 120-138. Handbook of North American Indians, Vol. 12, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Warren, Claude N. 1968. *The View From Wenas: A Study in Plateau Prehistory*. Occasional Papers of the Idaho State University Museum, No. 24, Pocatello, ID.

WAC (Washington Administrative Code). 2006. Water quality standards for surface waters of the State of Washington, Chapter 173-201A WAC, Internet reference: http://apps.leg.wa.gov/wac/default.aspx?cite=173-201A

WDFW (Washington Department of Fish and Wildlife). 2009. Priority Habitats and Species (PHS) Maps in Chelan and Okanogan Counties. Report Date March 18, 2009.

WDFW/ODFW (Washington Department of Fish and Wildlife/Oregon Department of Fish and Wildlife). 1995. Status Report, Columbia River Fish Runs & Fisheries, 1938-94. Washington Department of Fish and Wildlife; Oregon Department of Fish and Wildlife. August 1995.

WDFW/ODFW. 1998. Status Report, Columbia River Fish Runs and Fisheries, 1938-97. Washington Department of Fish and Wildlife; Oregon Department of Fish and Wildlife. June, 1998.

WDFW and WDOE (Washington Department of Fish and Wildlife and Washington Department of Ecology). 2004. Instream flow guidelines: Technical and habitat suitability issues including fish preference curves. Error correction update 2/12/2008. Olympia, WA.

WDNR (Washington Department of Natural Resources). 2000. Field guide to Washington's rare plants. Olympia, WA.

WDNR. 2008. Forest Practices Application and Review System Database. Washington State Department of Natural Resources, Olympia, WA. http://fortress.wa.gov/dnr/app1/Fpars/viewer.htm.

WDNR. 2009. Washington Natural Heritage Program (NHP) database. January 1, 2009.

WDOE (Washington Department of Ecology). 2011. Washington Farm Soil Maps. Accessed February 2011. http://www.ecy.wa.gov/services/gis/maps/county/soils/soils.htm

Whitesel, T., P. Lofy, R. Carmichael, R. Mesamer, M. Flesher, D. Rondorf. 1994. A Comparison of the Performance of Acclimated and Direct Stream Released, Hatchery-Reared Steelhead Smolts in Northeast Oregon. P 87-92, Proceedings of High Performance Fish, University of British Columbia.

Wiles, G. J., H. Allen, and G. Hayes. 2011. Final recommended wolf conservation and management plan for Washington. Washington Department of Fish and Wildlife, Olympia, WA. 298 pp.

Wisdom, M. J., A. A. Ager, H. K. Preisler, N. J. Cimon, and B. K. Johnson. 2004. Effects of off-road recreation on mule deer and elk. *In:* Proceedings of Transactions of the 69th North American Wildlife and Natural Resources Conference.

WSDOT (Washington State Department of Transportation). 2007. Advanced Training Manual: Biological Assessment Preparation for Transportation Projects. www.wsdot.gov/Environment/Biology/BA/default.htm#BAManual. February 2007.

Yakima/Klickitat Fisheries Project. 2003. Yakima Coho Master Plan.

YN (Yakama Nation Fisheries Resource Management). 2010. Mid-Columbia Coho Restoration Master Plan. Prepared for Northwest Power and Conservation Council.

YN. 2010a. Hatchery and Genetics Management Plan for Mid-Columbia Coho Restoration Program. Submitted to National Marine Fisheries Service, April 2010.

Chapter 6. Definitions and Acronyms

6.1 Definitions

Alevin: The third stage of the salmonid life cycle, between eyed eggs and fry. Alevin are larval salmonids, typically about one inch long, that have hatched from the egg but have not yet fully absorbed their yolk sac, and generally have not emerged from the spawning gravel (redd). Alevins remain in the redd for approximately one month until their yolk sac is completely digested, and then emerge from the gravel as fry to hunt for food on their own.

Confined aquifer: A confined aquifer has limited continuity with other aquifers and surface waters.

Domestication selection: In a hatchery, fish are selected for genetic traits (growth, behavior, physiology and survival) that increase their survival in the hatchery (domestic) environment.

Drawdown cone: Area beyond a groundwater well that, when in use, could cause other wells in the vicinity to have more than one foot of reduction in water level; the area of influence of a groundwater well.

Escapement: The proportion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds.

Eutrophic/Eutrophication: Refers to water that has a high level of nutrients (e.g., nitrogen, phosphorous) that stimulate the excessive growth of plant life with a high demand for oxygen (e.g., algae), resulting in the depletion of dissolved oxygen content in the water and potentially lethal conditions for fish and other aquatic organisms.

Excursion: The word used to indicate that a water quality limit has been exceeded.

Extirpation: The loss of a local or regional population of a species (local extinction).

Eyed eggs: The second stage of the salmonid life cycle, between embryos and alevin. Eyed eggs develop approximately one month after eggs have been fertilized when the embryo inside the egg develops an eye. This stage typically lasts for one month until the eyed eggs hatch and alevin emerge.

Fry: The fourth stage of a salmonid life cycle, between alevin and parr. Fry move in schools and actively feed in the river on zooplankton until they grow large enough to eat aquatic insects and other larger food. Some species begin their downstream migration to the ocean as fry, while other species stay in the freshwater for up to three years.

Green eggs: Eggs that have been harvested from an adult female salmon or steelhead in a hatchery but have not yet been fertilized.

Hydraulic continuity: A scientific term that describes how easily water flows between groundwater and surface water (streams, rivers, lakes, and wetlands).

Integrated Hatchery Program: A hatchery program that manages wild and hatchery fish as one gene pool (natural-origin fish are included in the broodstock and hatchery-origin fish are allowed to spawn in the wild). Integrated hatchery methods are most appropriate for programs with conservation goals or when the risks of naturally spawning hatchery-origin fish need to be minimized.

Local adaptation: The process of naturalization that addresses the loss of fitness that occurs with hatchery stocks by emphasizing selection in the natural environment; the population becomes adapted to habitats within each basin.

Mitchell Act: Enacted in 1938 and amended in 1946 (16 U.S.C. 755-757; 52 Stat. 345). Authorizes the Secretary of the Interior to implement activities for the conservation of fishery resources in the Columbia River Basin, and specifically directs the establishment of salmon hatcheries, ongoing engineering and biological surveys and experiments, and installation of fish protective devices. It also authorizes agreements with State fishery agencies (Oregon, Washington, and Idaho) and the construction of facilities on State-owned lands. Federal activities in the Columbia River Basin are carried out by the Department of Commerce (NOAA).

Montane: A category of biogeographic zones for regions located in the highlands below the sub-alpine zone. Montane regions are typically forested and have cooler temperatures and higher rainfall than the adjacent lowland regions, and support distinct communities of plants and animals.

Morphology/Morphometrics: Refers to the form and structure of an organism, with special emphasis on external features.

Non-Target Taxa of Concern (NTTOC): These are species that are not the species targeted by the program—in this case coho—but are of concern due to potential impacts to them from program activities.

Parr: The fifth stage of the salmonid life cycle, between fry and smolt. Parr have distinct markings (parr marks) to camouflage them from predators as they feed on aquatic insects and other larger prey in a stream environment.

Passerine birds: Perching birds or songbirds.

pH: The level of acidity/alkalinity of a solution, on a scale from 0 (most acidic) to 14 (most alkaline or basic), with 7 being neutral. Each point on the scale equals a 10-fold change in the magnitude of acidity or alkalinity. Source: http://en.wiktionary.org

Redd: The nest dug in the gravel substrate of streams for egg deposition during spawning by salmonids.

Recharge boundary: Where the drawdown cone (area of influence of a groundwater well) intersects a stream. The drawdown cone cannot spread beyond the recharge boundary.

Recruits: Fish that have survived long enough to become part of (i.e., recruited into) a population at a defined age (e.g., a natural-origin fish that survives to spawn in the wild is a natural-origin recruit). The number of recruits per spawner is a method of analyzing population productivity.

Riparian: Adjacent to or living on river banks.

Salmonid: A fish belonging to the family Salmonidae, which includes salmon, trout and chars. Some species of salmonids are anadromous (e.g., coho salmon, Chinook salmon, steelhead trout), and some species remain in freshwater throughout their life cycle (e.g., rainbow trout, bull trout).

Scale analysis: The process of counting annual growth bands on scales collected from fish in order to estimate the age of the fish.

Smolt: The sixth stage of the salmonid life cycle, between parr and ocean-stage adult. Smolts undergo physiological and behavioral transformations as they migrate downstream that prepare them for the transition to the saltwater environment.

Supplementation: The generally accepted definition of supplementation was developed by the Regional Assessment of Supplementation Project (RASP): *"Supplementation is the use of artificial propagation in the attempt to maintain or increase natural production while maintaining the long-term fitness of the target population, and keeping the ecological and genetic impacts on non-target populations within specified biological limits"* (RASP 1992).

Transmissivity: A measure of the ability of groundwater to flow in a horizontal direction.

U.S. v. Oregon: A 1969 federal court decision that legally upheld the reserved fishing rights of the Columbia River treaty tribes (Nez Perce, Umatilla, Warm Springs and Yakama tribes) and ruled that the tribes had reserved rights to fish at "all usual and accustomed" places whether on or off reservation. In 1975, the ruling was amended to quantify the "fair and equitable share" of the resource as 50% of all harvestable fish destined for the tribes' traditional fishing places.

6.2 Acronyms and Abbreviations

7Q10: lowest or highest stream flow for 7 consecutive days that occurs on average once every 10 years

BPA: Bonneville Power Administration (under the Department of Energy)

CCPUD: Chelan County Public Utility District - funds WDFW to operate the Rock Island Hatchery Complex among other facilities

cfs: cubic feet per second (a measure of water flow)

CWT: Coded Wire Tag

DCPUD: Douglas County Public Utility District - funds WDFW to operate the Wells and Methow hatcheries, and the Methow, Twisp and Chewuch acclimation ponds (among other hatchery facilities)

DO: Dissolved Oxygen (the amount of gaseous O^2 in an aqueous solution)

EDT: Ecosystem Diagnosis and Treatment (system for rating the quality, quantity and diversity of habitat along a stream relative to the needs of a specific species)

EIS: Environmental Impact Statement (an analysis of the environmental effects of major federal actions as required under the National Environmental Policy Act of 1969)

ESA: Endangered Species Act of 1973

FH: Fish Hatchery (non-federal program)

GCPUD: Grant County Public Utility District - funds WDFW to operate the Wells and Methow hatcheries, and the Nason and White acclimation ponds (among other hatchery facilities)

gpd/ft: gallons per day per foot (a measure of the ability of groundwater to flow in a horizontal direction [transmissivity]).

gpm: gallons per minute (generally a measure of the rate at which groundwater can be pumped, but also relates to water flow)

HCP: Habitat Conservation Plan

HSRG: Hatchery Scientific Review Group

ISEMP: Integrated Status & Effectiveness Monitoring Program (BPA project #2003-017-00)

ISRP: Independent Science Review Panel

m^3/s: cubic meters per second

µg/m: micrograms/meter

mg: milligrams

mg/L: milligrams per liter

M&E: Monitoring and Evaluation

MSRF: Methow Salmon Recovery Foundation

MSWA: Methow State Wildlife Area

NFH: National Fish Hatchery (federal hatchery program). The 12 NFHs in the Columbia River Basin are Eagle Creek, Carson, Little White Salmon, Willard, Spring Creek, Warm Springs, Leavenworth, Entiat, Winthrop, Dworshak, Kooskia, and Hagerman NFHs.

NMFS: NOAA's National Marine Fisheries Service, also known as NOAA Fisheries.

NOAA: National Oceanic and Atmospheric Administration (in the Department of Commerce)

NPDES: National Pollutant Discharge Elimination System

NEPA: National Environmental Policy Act of 1969

NOR: Natural-Origin Recruits

NPCC: Northwest Power and Conservation Council; formerly known as Northwest Power Planning Council (NPPC). Usually referred to as "the Council" in this EIS.

NTTOC: Non-Target Taxa of Concern

NWI: National Wetland Inventory

ODFW: Oregon Department of Fish and Wildlife

pHOS: Proportion of Hatchery-Origin fish on Spawning grounds

PHS: Priority Habitat and Species, a Washington State list of habitat and species of concern.

PIT tag: Passive Integrated Transponder tag

PNI: Proportionate Natural Influence: The proportion of natural-origin fish in the population.

pNOB: Proportion of Natural-Origin fish in Broodstock

POTW: Publicly-Owned Treatment Works (i.e., municipal water and sewage treatment plants)

PUD: Public Utility District

SHPO: State Historic Preservation Office; State Historic Preservation Officer

TMDL: Total Maximum Daily Load

TP: Total Phosphorus

TWG: Technical Work Group

USFWS: United States Fish and Wildlife Service (under the Department of the Interior)

USGS: United States Geological Survey (under the Department of the Interior)

WAC: Washington Administrative Code

WDFW: Washington Department of Fish and Wildlife

WDOE: Washington Department of Ecology

YN: Yakama Nation

Chapter 7. List of Preparers and Reviewers

Preparers

Name	EIS Section or Appendix	Experience and Education
Carmen Andonaegui, Anchor QEA	Floodplains, wetlands, priority species and habitat, water quality	15 years in fish passage and habitat restoration B.S. Wildlife Biology
Katherine Beck	ESA-listed plants	25 years as a botanist and field biologist in Washington, Oregon, Idaho, Alaska, and California
Ian Courter, Cramer Fish Sciences	Water discharge effects on steelhead, bull trout, and Chinook salmon	5 years quantifying flow and temperature effects on salmonids B.S. Environmental Science, M.S. Fisheries Science
Calvin Douglas, Anchor QEA	Wetlands, endangered species, aquatic habitat	11 years in natural resources analysis B.S. Wildlife Biology
Randolph Ericksen, Cramer Fish Sciences	Project impacts on ESA-listed fish	30 years in salmonid research and management, technical reporting, evaluating impacts of land use activities on fish and fish habitat B.A. Biology, M.S. Fisheries Science
Greg Ferguson, Sea Springs Company	Project engineer Facilities location, analysis, design	38 years in engineering and design of fish production facilities M.S. Engineering
Bruce Hollen, BPA	Project manager PHS species, socio-economic effects	19 years of natural resource management and analysis B.S. Biology
Marcelle Lynde, GeoEngineers	Wetlands, priority species & habitats	25 years in natural resource management B.S., Fisheries, M.M.A. Marine Resource Management
Fiona McNair, GeoEngineers	Wetlands, priority species & habitats	14 years in environmental analysis M.S. Resource and Environmental Management
James A. Miller, GeoEngineers	Geologic and hydro-geologic review, ground-water impact evaluation	35 years in geotechnical and environmental projects B.S. Geological Engineering; M.S. Environmental Geology
Pradeep Mugunthan, Anchor QEA	Water quality impacts of discharges	10 years in water quality and contaminant fate and transport modeling and analysis; TMDL and nutrient issues Ph.D. Civil and Environmental Engineering
Simon Page, Anchor QEA	Floodplain analysis	23 years in environmental analysis and NEPA document preparation B.S. Soil and Water Science
James Rhea Anchor QEA	Water quality	20 years in water quality analysis Ph.D., Civil & Environmental Engineering
John Small, ASLA, Anchor QEA	Wetlands, priority habitats	10 years in ecological restoration, wetlands science MLA Landscape Architecture
Nancy Weintraub, BPA	Project coordination	32 years in environmental analysis B.S. Ecosystems Analysis, M.S. Zoology
Judith Woodward, Crossing Borders Communications	Writing, editing, critical review	35 years in environmental writing and analysis B.A. Geography and Arts & Letters
Lisa Wright, Contract Environmental Protection Specialist, BPA	Visual quality, recreation, climate change, farmlands	10 years as Fishery Biologist for USGS, NOAA Fisheries, Corps of Engineers B.S. Biology

Reviewers

Bonneville Power Administration
Kevin Cannell – Archaeologist
Kathy Pierce – NEPA Compliance Officer
Donald Rose – Supervisory Environmental Protection Specialist
Nancy Weintraub – Senior Environmental Protection Specialist
Lisa Wright – Contract Environmental Protection Specialist, CIBER, Inc.
Ben Zelinsky – Fish Biologist, Mid-Columbia Coho Project Manager (BPA)
Roy Beaty, Project Manager, Mid-Columbia Coho Project (BPA)

Yakama Nation
Greg Ferguson – Contract Project Engineer, Sea Springs Co.
Cory Kamphaus – Fisheries Biologist, Mid-Columbia Coho Program
Keely Murdoch – Fisheries Biologist, Mid-Columbia Coho Program
Tom Scribner – Manager, Mid-Columbia Coho Program

Chapter 8. List of Agencies, Organization and Persons Contacted

Tribes or Tribal Groups

- Columbia River Inter-Tribal Fish Commission
- Confederated Tribes and Bands of the Yakama Nation
- Confederated Tribes of the Colville Reservation

Federal Agencies

- Advisory Council on Historic Preservation
- Environmental Protection Agency
- US Department of Agriculture - Forest Service
- US Department of Commerce – National Oceanic and Atmospheric Administration Fisheries Service
- US Department of Defense – Army Corps of Engineers
- US Department of the Interior - Fish and Wildlife Service; Bureau of Indian Affairs; Bureau of Land Management; National Park Service

Washington Public Officials

- Office of Governor Gregoire
- State Senator Cantwell
- State Senator Murray
- Washington State Representatives of Districts 12 and 14

Washington State Agencies

- Department of Ecology
- Department of Fish & Wildlife
- Department of Natural Resources

Local Governments

- Chelan County PUD No. 1
- County of Chelan
- County of Okanogan
- Douglas County PUD
- Grant County PUD
- Cities of Cashmere, Chelan, Leavenworth, Okanogan, Wenatchee and Yakima

Libraries

- Cashmere Public Library
- Chelan Public Library
- Colville Tribe Library
- County of Okanogan Public Library
- Entiat Community Library
- Leavenworth Public Library

- North Central Regional Library, Wenatchee
- Okanogan Community Library
- Peshastin Community Library
- Wenatchee Public Library
- Wenatchee Valley College Library
- Winthrop Community Library
- Yakama Nation Library

Business, Special Interests and Organizations

- AAA Auto Club of Washington
- Alpine Lakes Protection Society
- American Fisheries Society
- American Forestry Association
- Apple Company Snowmobile Club
- Apple Valley Kiwanis Club
- Audubon Society
- Back Country Bicycle Trail Club
- Backcountry Horsemen Association
- Backcountry Horsemen of Washington
- Burlington Northern & Santa Fe Railroad Company
- Cascade Orchards Irrigation
- Cashmere Valley Bank
- Chelan County Conservation District
- Ellensburg Cross Country Ski
- Environmental Law Support Association
- Ephrata Sportsmen's Association
- Grays Electric Inc.
- Kahler Glen Golf & Ski Resort
- KOHO Radio
- Methow Valley Sports Trail Association
- Nature Conservancy
- NCW Audubon
- Northwest Power & Conservation Council
- Pine River Ranch #2
- Round Mountain Corporation
- Strutzel's Sportsman LLC
- Trout Unlimited
- Washington Trout
- Wenatchee Outdoors
- Wenatchee World
- White River Lodging
- WICO

Appendices

Eleven appendices were issued with the Draft EIS. Of these, only Appendix 5 is being reissued, in order to make minor corrections and to include the list of references that was inadvertently left out of the DEIS version.

For the Final EIS, two additional appendices are included.

Appendix 12 is the summary of public comments made on the Draft EIS and BPA's responses to them. It also includes copies of all the comment letters and public meeting comments with comment numbers identified.

Appendix 13 is the new water quality evaluation of program impacts on Icicle Creek at Leavenworth National Fish Hatchery, as requested by the Department of Interior and the Environmental Protection Agency.

Appendix 5. Monitoring and Evaluation Plan

Table of Contents

Summary

Table 5-1 summarizes the Monitoring and Evaluation (M&E) Plan for the Mid-Columbia Coho Restoration Program. References to activities for Broodstock Development Phase 1 (BDP1) are left in the table to show the monitoring that was done for that phase, which is now completed in both basins, and the continuity of program monitoring.

Table 5-1. Summary of M&E activities

M&E Activity	Indicator Measured	Strategy	Restoration Phases[1]	Coordinated with other programs?
Release-to-McNary survival	Project Performance	PIT tags	BDP1, BDP2, NPIP, NPSP[2]	No
In-pond survival	Project Performance	PIT tags Predation control	BDP1, BDP2, NPIP, NPSP[2]	No
Pre-release fish condition	Project Performance	Physical examination	BDP1, BDP2, NPIP, NPSP	No
Volitional release run-timing and tributary residence	Project Performance / Species Interaction	PIT tags Smolt trapping	BDP1, BDP2, NPIP, NPSP[2]	Yes: Integrated Status & Effectiveness Monitoring Program (ISEMP) (BPA project #2003-017-00); CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Spawning escapement and distribution	Project Performance	Redd counts Carcass recovery Radio-telemetry Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	No
Natural smolt production	Project Performance	Smolt trapping Coded Wire Tag	BDP1, BDP2, NPIP, NPSP[3]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Egg-to-emigrant survival	Project Performance	Smolt trapping Redd counts Coded Wire Tag	BDP1, BDP2, NPIP, NPSP[3]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Adult-to-adult survival	Project Performance	Adult trapping Redd counts Carcass recovery Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	No
Adult-to-adult productivity	Project Performance	Adult trapping Carcass recovery Coded Wire Tag Scale analysis	NPIP, NPS	No
Harvest rates	Project Performance	Coded Wire Tag Scale analysis Database queries	BDP1, BDP2, NPIP, NPSP	Yes: Coordinated with harvest management agencies

1. BDP 1 = Broodstock Development Phase 1; BDP2 = Broodstock Development Phase 2; NPIP = Natural Production Implementation Phase; NPSP = Natural Production Support Phases
2. PIT tags will be used during NPSP if smolt-to-adult rates are not meeting program goals and further investigation into survival is warranted.
3. Natural smolt production and egg-to-emigrant survival estimates will be specific to release tributaries during NPIP and NPSP, and basin-wide during BDP1 and BDP2.

Table 5-1 (continued)

M&E Activity	Indicator Measured	Strategy	Restoration Phases	Coordinated with other programs?
Non-target Taxa of Concern (NTTOC) – Size structure	Species Interactions	Smolt trapping	BDP1, BDP2, NPIP, NPSP[4]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
NTTOC – Abundance and survival	Species Interactions / Status of NTTOC	Smolt trapping Underwater observation	BDP1, BDP2, NPIP, NPSP[4]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
NTTOC – Distribution	Species Interactions / Status of NTTOC	Redd counts Underwater observation	BDP1, BDP2, NPIP, NPSP[4]	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Competition	Species Interactions / Mechanisms of Interaction	Underwater observation Enclosures Size and growth	NPIP	No
Predation by naturally produced coho on spring Chinook fry	Species Interactions / Mechanisms of Interaction	Smolt trapping Emergence and emigration timing	NPIP	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Morphometrics and life history traits	Genetic Adaptability	Adult trapping Redd counts Carcass recovery Smolt trapping Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	Yes: ISEMP; CCPUD/ DCPUD HCP Hatchery Programs; GCPUD Hatchery Programs
Genetic monitoring	Genetic Adaptability	Genetic sampling Coded Wire Tag	BDP1, BDP2, NPIP, NPSP	No

4. Baseline NTTOC monitoring during BDP1 and BDP2, effects monitoring during NPIP and NPSP.

M & E Plan Details

The goal of the M&E program is to monitor and evaluate the results of reintroduction so that operations can be adaptively managed to optimize hatchery and natural production while minimizing any negative ecological impacts. Pursuing this goal, research data collection and analysis endeavors to: 1) demonstrate when the reintroduction program is meeting the established phased restoration goals; 2) determine whether a change in status of sensitive species is occurring and whether it is a result of coho reintroduction; and 3) provide science-based recommendations for management consideration.

The M&E plan is organized into three distinct categories: Project Performance Indicators, Species Interactions, and Genetic Adaptability. Project performance indicators are intended to evaluate how well reintroduced hatchery fish and the resulting naturally produced fish are surviving and adapting, whether certain reintroduction or hatchery practices can be modified to improve benefits achieved, and whether harvest levels threaten project success. Monitoring of project performance indicators will allow for adaptive management and evaluation of project progress toward successful reintroduction. Species interaction evaluations include monitoring the status of non-target taxa of concern (NTTOC) and investigating mechanisms of interaction (i.e., predation and competition). The species interactions evaluations described in this plan expand on issues examined during the feasibility phase and are integrated with other species monitoring ongoing or proposed in the two basins. Monitoring of genetic adaptability to local conditions is designed to determine whether the project is successfully creating a local broodstock distinct from lower Columbia River stocks in terms of genetic divergence and life history traits; and to determine the biological significance of the changes.

M&E results and plan objectives will be reviewed and revised every six years (two generations) to allow for modification of actions and adaptive management. NTTOC monitoring will continue until program termination, 5 generations (15 years) after starting the natural production phases.

Note: We have left references to Broodstock Development Phase 1 in the text, even though BDP1 has been completed in both subbasins, to show the continuity of the M&E program throughout the project.

5.1 Project Performance Indicators

5.1.1 Release-to-McNary Smolt Survival

Objective: To estimate smolt-smolt survival (release to McNary Dam) for hatchery coho released in mid-Columbia tributaries.

Metric*:* Smolt-to-smolt survival index (Neeley 2004)

$$\text{Smolt-to-Smolt Survival Index to McNary} = \frac{\sum_{\text{Strata}} \text{Estimated Number of tagged Fish passing McNary during stratum}}{\text{Number of Fish tagged or released}}$$

Rationale: Mullan et al. (1992) and Chapman et al. (1994a; 1994b; 1995a; 1995b) recognize that a central limitation to building self-sustaining populations of anadromous fish in

Wenatchee and Methow subbasins is the high smolt and adult mortalities incurred at the numerous hydropower facilities on the mainstem Columbia River. Mortalities related to hydropower facilities can severely reduce the escapement numbers. Salmon abundance is also heavily influenced by ocean conditions. Freshwater conditions reflect variability within a broader spectrum of population abundance that is largely controlled by ocean conditions (Mullan et al. 1992; Nickelson 1986). Therefore, we feel it is important to monitor survival of hatchery juveniles in freshwater to help partition smolt-to-adult survival of hatchery reared program fish into the components of freshwater and marine mortality.

Smolt-to-smolt survival rates will be used to compare the "quality of smolt" produced by different rearing strategies, acclimation sites, acclimation duration, and time of release. Smolt-to-smolt survival indices will be used to evaluate rearing strategies and rearing facilities, to include current and proposed facilities, evaluations of growth rates, acclimation length, and smolt size. Knowing how rearing and environmental conditions affect smolt survival allows researchers to adaptively manage the reintroduction effort to maximize survival. Smolt-to smolt survival indices will be used to parse out that portion of mortality that is occurring during emigration.

Restoration Phases: BDP1, BDP2, NPIP. Smolt-to-smolt survival rates will be measured during the Support Phases if smolt-to-adult rates are not meeting program goals and further investigation into survival is warranted.

Methods: Groups of juvenile coho, ranging from 3,500 to 8,000 individuals, depending upon release location, will be PIT-tagged 3-6 months prior to release. PIT-tagged coho will be released from a minimum of one upper Wenatchee River acclimation site (Leavenworth National Fish Hatchery [LNFH]), and a Methow River site. PIT groups will also be released from ponds which have not previously been used for coho acclimation and from sites where smolt-to-adult survival rates are below expectations. All PIT tagging will follow protocols described in the PIT TAG Marking Procedures Manual (CBFWA 1999). When possible, volitional releases will be monitored for PIT tags. Survival estimates will be calculated based on subsequent PIT detections at McNary, John Day, and Bonneville Dams following methods described in Neeley 2007.

5.1.2 In-Pond Survival

Objective: To estimate in-pond (transport-to-release) survival of hatchery coho.

Metric: In-pond survival estimate based on PIT tag releases (Neeley 2007) or predator and mortality observations (Kamphaus et al. 2008).

Rationale: In-pond survival estimates will increase the accuracy of smolt-to-adult and smolt-smolt survival estimates. In-pond survival estimates will be used to evaluate the success of acclimation ponds and predator control strategies, allowing researchers to maximize survival through adaptive management.

***Restoration Phases*:** All phases.

Method: Groups of approximately 3,500 to 8,000 juvenile coho will be PIT tagged 3-6 months prior to release (see **Section 5.1.1 Release-to McNary Smolt Survival**). In-pond survival estimates based on PIT tags are possible only in ponds with monitored releases. In-pond survival based on PIT tags will be calculated following methods described in Neeley 2007. In-pond survival rates from acclimation sites that do not have PIT tag detection capability will be estimated based on moribund fish, numbers of predators observed, and predator consumption rates (Kamphaus et al. 2008).

5.1.3 Pre-Release Fish Condition

Objective: To provide a comparative measure of fish condition and stage of smoltification prior to release.

Metric: Stage of smoltification will be measured as the proportion of fish which, upon visual examination, appear to be smolts, transitional (in the process of becoming a smolt), or parr. Fish condition will be assessed not only on size and growth accrued during acclimation but also on morphological and physiological measures such as overall condition of fins and eyes; of internal organs (e.g., kidney, liver, spleen, etc.); and of mesenteric fat levels and blood components (% volume of red and white blood cells, plasma protein levels).

Rationale: Pre-release fish condition examinations are intended to assess the normality or overall health of the population. These examinations will allow researchers to compare fish condition between ponds and between years as a measure that may affect survival.

Restoration Phases: All phases.

Methods: A random sample of 100 fish from each acclimation pond will be used to measure stage of smoltification and growth weekly until release. The pre-release fish condition assessment will be done once within 72 hours of release. Detailed methods describing how stage of smoltification is determined and how pre-release fish condition examinations are conducted can be found in Kamphaus et al. 2008.

5.1.4 Volitional Release Run-Timing and Tributary Residency

Objective: To describe volitional release patterns, peak migration from acclimation ponds, duration of time spent in tributaries post-release, and run timing to McNary Dam.

Metric: Run timing, in hours, calculated from PIT tag detections during monitored releases to recapture in tributary traps (i.e., smolt traps), in-stream PIT tag arrays, and Columbia River PIT detection facilities.

Rationale: Knowing tributary residence time will enable researchers to better understand the potential for interaction between hatchery coho and listed and sensitive species (see **Section 7.2 Species Interactions**). We will examine the relationship between volitional exit date and tributary residence time, allowing for programmatic changes to minimize potential negative interactions. The correlation between volitional exit date and smolt-smolt survival may also enable researchers to maximize survival of hatchery fish by releasing hatchery coho at an optimal time.

Run timing is a life history attribute which may change with the development of a local broodstock (see **Section 5.3.1 Morphometrics and Life History Traits**). As natural production increases during the NPIP and Support Phases, run timing will be measured for both naturally produced and hatchery coho based on the distribution of migrating naturally produced coho captured in tributary smolt traps.

Method: Using the same groups of 3,500 to 8,000 PIT-tagged juvenile coho as described in **Section 5.1.1 Release-to-McNary Smolt Survival**, tributary residence time will be calculated from ponds with PIT tag detection capabilities (e.g., Butcher Creek Pond, Rohlfing's Pond, Beaver Creek Pond Coulter Creek Pond, Winthrop NFH back-channel and Lower Twisp Ponds). Dates and times of reported recaptures in tributary traps and Columbia River PIT tag interrogation facilities will be used to calculate residence time and run timing.

5.1.5 Spawning Escapement and Distribution

Objective: To estimate in-basin spawning escapement and distribution for both hatchery-origin returns (HORs) and natural-origin returns (NORs).

Metric: Annual redd counts, escapement estimates and spawning ground composition.

Purpose: Redd counts will provide an estimate of spawning escapement and distribution of reintroduced coho salmon. The counts, along with spawning composition (pNOS and pHOS) and distribution, will allow researchers and managers to determine the efficacy of the reintroduction effort, collect empirical productivity data and determine whether spawning ground composition goals for each phase are being met.

Hypotheses:

- Implementation Phase – H_o: pHOS $\leq$ 90%
- Support Phase (1) – H_o: pHOS $\leq$ 75%
- Support Phase (2) – H_o: pHOS $\leq$ 65%

Restoration Phases: All phases.

Method: Spawning escapement and distribution will be evaluated in terms of redd counts and an estimate of fish per redd (based on sex ratio observed at in-basin trapping facilities). Spawning ground surveys will be conducted in all tributaries where juvenile coho have been released and other tributaries that have coho spawning attributes such as low gradient, adequate winter flow and small gravel (about 25 mm) (Quinn 2005). Radio-telemetry or PIT tagging techniques could be used, particularly during the natural production phases, to identify previously unknown coho spawning locations, to ensure that all spawning reaches are surveyed, and to identify spawning locations of straying coho. A description of protocols for both spawning ground surveys and radio telemetry can be found in Murdoch et al. 2005.

5.1.6 Natural Smolt Production

Objective: To provide a population estimate of naturally produced coho smolts emigrating from the Wenatchee and Methow rivers.

Metric: Population estimates of both spring and fall emigrating coho with 95% confidence intervals.

Rationale: Natural smolt production estimates are a measure of productivity. Smolt production estimates will be used to evaluate program progress and success in terms of egg-to-emigrant survival rates and smolt-to-adult survival rates. Natural smolt population estimates during all phases are essential to accurately measure key project performance indicators, such as smolt-to-adult survival rates.

While the broodstock development phases primarily focus on the development of a local broodstock rather than on natural production, some natural production will occur during these early phases, likely in a geographically limited area. Fish trapping facilities at Dryden Dam are not 100% efficient, presumably resulting in some natural production on a limited geographical scale. It is important to collect data regarding natural production during the broodstock development phases because early measures of productivity (e.g., smolts per spawner, egg-to-emigrant survival, etc.) on a basin-wide scale will provide a rough baseline measure of the success of natural spawners prior to the natural production phases.

Restoration Phases: All Phases.

Methods: Operation of rotary smolt traps, protocols for fish handling, and data analysis will proceed as described in Murdoch et al. (2005) and Hillman (2004). Traps will be operated annually between March 1 and November 30.

Broodstock Development Phases: During broodstock development phases we will coordinate with ongoing monitoring activities to reduce duplication of activities. Currently in the Wenatchee basin, WDFW operates a rotary smolt trap near the town of Monitor. Through a cooperative effort, this trap will be used to provide population estimates for naturally produced coho as it was during the feasibility phase. The YN-operated smolt trap in Nason Creek will provide a tributary-specific population estimate. Similar coordination with WDFW in the Methow basin should provide a basin-wide coho population estimate for the Methow.

Natural Production Phases: All monitoring efforts, including population estimates during the natural production phases, will be coordinated with other co-managers and recovery processes to avoid unnecessary duplication of efforts and cumulative handling effects. In tributaries currently without means of estimating smolt production, the YN proposes to operate either a rotary smolt trap or other sampling equipment during the spring and fall emigration periods to estimate the number of natural coho emigrants.

5.1.7 Egg-to-Emigrant Survival Rates

Objective: To estimate egg-to-emigrant survival rates for naturally produced coho salmon in mid-Columbia tributaries.

Metric: Egg-to-Emigrant Survival (S) will be expressed as the ratio of the estimated number of emigrant coho (C_e) and the estimated number of eggs deposited (E_d).

$$S = C_e/E_d$$

Rationale: The egg-to-emigrant survival rate will provide data to determine which tributaries are most productive for coho production. The relationship between egg-to-emigrant survival and seeding level will assist researchers in developing tributary-specific empirically derived estimates of carrying capacity.

We assume that the freshwater productivity (expressed as an egg-to-emigrant survival rate) will increase as domestication selection is reduced, local adaptation is emphasized and habitat improvement projects are implemented.

Hypothesis:

- H_o: Egg-to-Emigrant Survival $_{\text{Broodstock Development Phases}}$ $\geq$ Egg-to-Emigrant Survival $_{\text{Implementation Phase}}$ $\geq$ Egg-to-Emigrant Survival $_{\text{Support Phase}}$

Restoration Phases: Egg-to-emigrant survival rates will be calculated on a basin-wide scale during the broodstock development phases (i.e., total number of redds vs. total number of emigrants). During the natural production phases we will calculate egg-to-emigrant survival independently in each tributary of reintroduction.

Methods: The number of emigrant coho will be estimated from tributary trap data as described in **Section 5.1.6 Natural Smolt Production**. The number of eggs deposited will be calculated from the number of redds observed (see **Section 5.1.5 Spawning Escapement and Distribution**). Both basin-wide and tributary specific estimates will be calculated.

5.1.8 Smolt-to-Adult Survival (SAR)

Objective: To measure smolt-to-adult survival for hatchery and natural origin coho.

Metric: Smolt-to-adult survival will be calculated as follows:

$$S_{\text{smolt-adult}} = \text{Adults and Jacks}_{\textbf{broodyear X}} / \text{Smolts}_{\textbf{broodyear X}}$$

Where $S_{\text{smolt-adult}}$ is the estimated smolt-to-adult survival rates; Adults and Jacks $_{\textbf{broodyear } X}$ is the number of adult coho to return from broodyear X; Smolts $_{\textbf{broodyear } X}$ is the population of emigrating smolts.

Rationale: For hatchery fish, smolt-to-adult survival will be used to test the premise that SARs will increase with the development of a local broodstock. SARs will also be used to compare the “quality of smolt” produced by different rearing strategies, acclimation sites, acclimation duration, and time of release. Knowing how smolt-to-adult survival indices correlate with rearing and environmental conditions will allow researchers to adaptively manage the reintroduction effort to maximize survival. The SARs will be used to evaluate rearing strategies and rearing facilities to maximize survival. Evaluations will include facility comparisons (currently ongoing), comparisons of growth rates, smolt size, and acclimation length (currently ongoing).

We assume that the survival of Wenatchee and Methow coho will increase as domestication selection is reduced, local adaptation is emphasized and habitat improvement projects are implemented.

Hypothesis:

- H_o: Smolt-to-Adult Survival $_{\text{Broodstock Development Phases}} \geq$ Smolt-to-Adult Survival $_{\text{Implementation Phase}} \geq$ Smolt-to-Adult Survival $_{\text{Support Phases}}$

Methods: SARs will be calculated for both naturally and hatchery produced coho. We plan to mark 100% of the hatchery fish released under this program with CWTs. CWTs will be used to calculate SARs from each release group and location, and will be used to distinguish hatchery from natural fish (no CWT). Pre-release CWT retentions will be used to estimate the number of fish with CWTs released. To verify origin, scale samples will be taken from all adult coho that do not have a CWT. During the broodstock development phases, SARs for hatchery and naturally produced coho will be calculated based upon the number of smolts released (hatchery), smolt emigration estimates from WDFW’s Methow and Wenatchee river smolt traps, and CWTs recovered from hatchery and naturally produced coho collected at Dryden Dam for broodstock. During the natural production phases, tributary-specific SARs may be based on carcass recovery and tributary population estimates, in addition to the basin-wide metric described above.

5.1.9 Adult-to-Adult Productivity

Metric: Adult productivity will be measured in the Wenatchee and Methow broodstock collection facilities and on the spawning grounds (through carcass recovery) for naturally spawning fish. Adult-to-adult survival will be calculated as follows:

$$P_{adult} = S_2/S_1$$

Where P_{adult} is the estimated adult-to-adult survival; S_2 is the number of returning adults (including jacks); and S_1 is the number of adults from the parent brood year producing the S_2 returning adults. A P_{adult} value that averages greater than 1.0 over several generations indicates that the population is increasing.

Rationale: The adult-to-adult survival rate measures the productivity of reintroduced coho, providing an overall indicator of project success. During the NPIP, P_{adult} may indicate which tributaries are the most productive.

We assume that the productivity of Wenatchee and Methow river coho salmon will increase as domestication selection is reduced, local adaptation is emphasized and habitat improvement projects are implemented.

Hypothesis:

- H_o: $P_{\text{Broodstock Development Phases}} \geq P_{\text{Implementation Phase}} \geq P_{\text{Support Phases}}$

Restoration Phases: Natural Production Phases

Methods: Coho collected for broodstock and naturally spawning coho carcasses will be interrogated for the presence of CWTs. Scales will be taken from coho that are not marked with a CWT to confirm origin. These data will be used in calculations described under ***Metric.***

5.1.10 Harvest Rates

Objective: Estimate out-of-basin harvest rates of program fish in order to determine if harvest rates are likely to limit project success.

Rationale: Harvest may have been a significant factor in the disappearance or reduced number of coho in both the distant and recent past. Currently, the majority of coho in the Columbia River are produced and released below Bonneville Dam. The historical intent of this production was to supply coho for the 80-90% exploitation rate by ocean and lower Columbia River fisheries. However, since the period 1988-1993, harvest rates of coho (commercial ocean troll and recreational) have decreased by approximately 25% (PFMC 1999). Harvest reductions were the result of mixed stock fishery issues related to the Endangered Species Act. Coho released under this project are subject to the following fisheries: ocean commercial troll fisheries, ocean recreation fisheries, Buoy 10 recreational fisheries, lower Columbia River commercial fisheries, lower Columbia River recreational fisheries, Zone 6 (Bonneville to McNary dams) Treaty Indian commercial fisheries, and above-Bonneville Dam recreational fisheries. All recreational fisheries and the ocean commercial troll fisheries are selective for adipose-fin-clipped fish. Harvest mortality for project fish in these fisheries will primarily be limited to incidental mortality, so we have no ability to recover CWTs from these fisheries. The Columbia River commercial coho fisheries (Buoy 10 to Bonneville Dam) do intercept both adipose-clipped and non-clipped fish. All coho captured in this fishery are examined for the presence of a CWT, with an approximate sampling rate of 20%. Presently, harvest monitoring of Treaty Indian fisheries does not include recovery of CWT. Although the total harvest rate on adipose-clipped fish could be as high as 50-60%, the total harvest rate on non-adipose-fin-clipped fish is substantially lower (20-25%) due to the selective fisheries that are likely to remain in place for many years as a result of ESA constraints.

Restoration Phases: All phases.

Methods: We will coordinate with agencies responsible for harvest management (WDFW, ODFW, USFWS, CRITFC, etc.) to estimate the harvest rates of target stocks by querying existing databases that may contain harvest or stray information for program fish.

5.2 Species Interactions

During the feasibility phase, the YN completed several studies to evaluate predation and competition by hatchery coho with listed and sensitive species (Dunnigan 1999; Murdoch and Dunnigan 2002; Murdoch and LaRue 2002; Murdoch et al. 2004; Murdoch et al. 2005). Results of these studies indicate low predation rates and species-specific habitat segregation (see **Chapter 3**). Stream dwelling salmonids that have evolved in sympatry have developed mechanisms to promote coexistence and to partition the available habitat. Studies with coho salmon and steelhead trout (Hartman 1965; Johnston 1967; Fraser 1969; Allee 1974), Chinook salmon and steelhead trout (Everest and Chapman 1972), Chinook salmon and coho salmon (Lister and Genoe 1970; Stein et al. 1972; Murphy et al. 1989), coho salmon and cutthroat trout (Bjornn 1971; Bustard and Narver 1975; Sabo and Pauley 1997) and coho salmon and dolly varden (Dolloff and Reeves 1990) all support this statement.

Mechanisms to measure negative interactions between hatchery fish and other species have been studied by others (Larkin 1956; Fraser 1969; Stein et al. 1972; Glova 1986; Marnell 1986; Cannamela 1993; Riley et al. 2004), but impacts to non-target species in terms of abundance, distribution and size have not been conclusively measured (Fresh 1997; Pearsons et al. 2004) on a basin-wide scale. Interactions between reintroduced coho and listed and sensitive species will be evaluated through an integrated NTTOC monitoring program. A basin-wide NTTOC monitoring program has been implemented in the Yakima River (Busak et al. 1997, Hubble et al. 2004; Pearsons et al. 2004).

NTTOC status monitoring (**Section 5.2.1**) answers the question “Are there adverse changes in the status of NTTOC in tributaries where coho have been introduced?” NTTOC status monitoring does not answer questions of whether coho caused the changes in NTTOC status or the mechanism of change (e.g., predation, competition, etc.). The studies outlined in **Section 5.2.2** address those causal questions.

Species interaction monitoring will continue for a minimum of six years (two coho generations) during the Support Phases, but may continue longer pending results.

5.2.1 Status of Non-Target Taxa of Concern (NTTOC)

During the feasibility phase of the Mid-Columbia Coho Reintroduction Program, the HGMP (YN et al. 2002) and the mid-Columbia Coho Technical Workgroup (TWG) identified a number of critical uncertainties associated with coho reintroduction and species interactions. Studies implemented during the feasibility phase (see Chapter 3) answer many of those uncertainties, including the rates of predation by hatchery coho on spring Chinook fry and on sockeye fry. One main question remains unanswered, that of the predation rate of naturally produced coho on spring Chinook fry. As stated in Chapter 3, numbers of naturally producing coho were not sufficient to undertake a meaningful study (Murdoch et al. 2005). The study described in **Section 5.2.2.2** proposes to address this remaining question.

With most of the critical uncertainties answered, the proposed NTTOC monitoring plan is designed to integrate the coho reintroduction effort with other ongoing programs to monitor the status of listed and sensitive species. The non-target taxa monitoring program will focus on the status and freshwater residence of spring Chinook and steelhead, but data on all other species encountered, such as bull trout, cutthroat trout, lamprey and sockeye, will also be collected.

We define status as the interaction of abundance, distribution, and size. A change in status is the deviation from baseline conditions. **A change in status does not indicate causation, but if coho reintroduction has a negative impact on listed and sensitive species, decline in status would occur. If a decline in status is detected, further investigations into the mechanism of interaction and source of decline are warranted** (see **Section 5.2.2**).

To provide baseline data for evaluating effects of coho reintroduction, monitoring will begin during the broodstock development phases when the hatchery coho are released on a geographically limited scale and numbers of naturally spawning coho in tributaries containing spring Chinook and steelhead will be minimal. Baseline monitoring will be done in most tributaries proposed for future coho releases during the natural production phases. Monitoring of changes in tributaries with no previous coho release will occur during the Implementation Phase. The study design will include both a temporal and spatial control. Baseline data collected prior to coho reintroduction will function as a temporal control from which to compare any change in NTTOC status.

The NTTOC monitoring plan builds on, and will be coordinated with, ongoing monitoring efforts in the Wenatchee, Entiat and Methow basins, thus avoiding duplication of efforts and minimizing cumulative handling effects and costs. Existing programs currently collecting data that may be used to help determine a change in status for NTTOC include the Chelan and Douglas County PUD HCP hatchery compensation monitoring and evaluation programs, the developing Grant County PUD hatchery monitoring and evaluation program, and the Integrated Status and Effectiveness monitoring program (ISEMP) (BPA project # 200301700).

This NTTOC monitoring program is designed to provide data to measure the effects of both Type I and Type II interactions. Type I interactions are those that occur between hatchery fish and wild fish, while Type II interaction may occur between NTTOC and the naturally produced offspring of hatchery fish (Pearsons and Hopley 1999).

5.2.1.1 NTTOC Risk Assessment

As one part of the Monitoring and Evaluation Plan for HCP Hatchery Compensation programs (Murdoch and Peven 2005; DCPUD 2005) and the Monitoring and Evaluation Plan for Grant PUD Salmon and Steelhead Supplementation programs (GCPUD 2009), coho salmon will be included in a NTTOC risk assessment. An expert panel will conduct the assessment to evaluate risks associated with potential effects of supplemented Plan Species (including coho salmon) on non-target taxa using an approach similar to that used in the Yakima Basin (Ham and Pearsons 2001). The process is intended to focus on assessing the risks to NTTOC and on identifying interactions, the actions that could be taken to minimize risks, and the level of uncertainty. Both positive and negative species interactions are included in the assessment; a list of interactions and species considered is shown in Table 5-1. The list of species was decided upon by consensus of the Chelan and Douglas County PUD HCP Hatchery Committees.

Table 5-1. List of species and interactions to be considered in the NTTOC risk assessment

NTTOC	Negative Interactions Considered	Positive Interactions Considered
Spring Chinook Steelhead Sockeye	Competition Behavioral anomalies Pathogenic Predation	Prey Nutrient Enhancement

5.2.1.2 Reference Stream Comparisons

For a spatial control, we propose to use the Entiat River as a reference population of Chinook and steelhead from which any observed changes in abundance (as measured through egg-to-emigrant survival rates), distribution, or size can be gauged.

The Entiat River has been proposed by the resource managers (NOAA, WDFW, YN, USFWS, Colville Tribe), Chelan PUD and Douglas PUD as a potential reference stream for both spring Chinook and steelhead, to measure the success of the PUDs' HCP hatchery programs (Murdoch and Peven 2005). As such, analysis to determine the ultimate suitability of the Entiat River as a reference stream for spring Chinook and steelhead, along with the data required to compare changes in size, abundance and distribution would be collected by the HCP monitoring activities funded by CCPUD and DCPUD hatchery compensation programs (Murdoch and Peven 2005). Reference stream suitability criteria have been adapted from the Chelan and Douglas HCP hatchery compensation program M&E plan (Murdoch and Peven 2005) and include the following:

- No recent (within the last 5-10 years) hatchery releases directed at target species
- Similar information of hatchery contribution on the spawning grounds
- Similar fluvial-geomorphologic characteristics
- Similar out-of-subbasin effects
- Similar historic records of productivity
- Appropriate scale for comparison
- Similar in-basin biological components, based upon analysis of empirical information.

The USFWS generates population estimates of juvenile salmonids through rotary trap operation, uses underwater observation techniques to estimate juvenile rearing distribution, and conducts spawning ground surveys for spring Chinook, summer Chinook, and steelhead in the basin. The use of the Entiat River as a potential reference stream for steelhead and spring Chinook precludes the release of these species in the Entiat basin, making the Entiat River similarly a reference stream to gauge potential NTTOC interactions as a result of coho reintroduction in the Wenatchee and Methow.

The continued status of the Entiat River as a reference from which to gauge changes in the status of NTTOC in the Wenatchee and Entiat rivers is currently unknown. Spring Chinook spawning habitat is upstream of the ENFH, and the USFWS rotary smolt trap used to calculate population abundance is located near the facility. A portion of the steelhead production and likely all bull trout production also are upstream of the ENFH.

Use of the Entiat River as a reference stream may also be complicated due to the intensive habitat restoration that is currently ongoing and planned. The ISEMP is testing the effectiveness of habitat restoration actions in the Entiat River. The ISEMP is supporting an accelerated schedule for the implementation of 75-80 in-stream habitat actions defined in Entiat Watershed Plan (CCCD 2004) within a short time frame (goal of 5 years). In relation to the size of the Entiat basin, this is a substantially faster rate of habitat improvement than will take place in the Wenatchee or Methow basins, potentially resulting in a population increase that could preclude the use of the Entiat River as a reference stream.

If it is later determined that the Entiat River is not suitable as a spatial reference, we may need to rely solely on the temporal control to gauge changes in NTTOC status.

5.2.1.3 Status of NTTOC

We define a change in status of NTTOC as a change in size, abundance, or distribution. The following sections describe how we plan to monitoring any change in status of NTTOC as we proceed with coho restoration in the Wenatchee and Methow basins.

The Integrated Status and Effectiveness Monitoring Program (ISEMP), BPA project #2003-017-00, is a statistically robust intensive monitoring framework that builds on current status and trend monitoring infrastructures in the upper Columbia. The intent of the ISEMP project is to efficiently collect data to address multiple management objectives over a broad range of scales, including evaluating the status and trends for anadromous salmonids in their habitat. Since 2004, ISEMP in the Wenatchee and Entiat basins has focused on the design and implementation of a sampling regime and status and trend monitoring program with 67 monitoring indicators (Hillman 2004). This monitoring project targets salmon and steelhead populations and habitat and is implemented in collaboration with the Upper Columbia Regional Technical Team.

Data collected in this intense Status, Trend, and Effectiveness monitoring program will give statistically robust status updates for spring Chinook and steelhead on 5-year intervals. By coordinating with the ISEMP program, we minimize a duplication of sampling effort.

Size Structure

Objective: To monitor size (growth and K-factor) of NTTOC and juvenile coho in all tributaries proposed for coho reintroduction.

***Rationale*:** The size, condition, and growth of NTTOC and juvenile coho, combined with abundance and distribution data, will be used to evaluate the effect, if any, of coho reintroduction. Baseline monitoring during the broodstock development phases will establish trends in size, abundance and distribution of NTTOC prior to the natural production phases. During the natural production phases, the rotational release schedule of the NPIP will provide a means to compare size, abundance, and distribution of NTOCC in coho release tributaries with those same factors in tributaries without coho releases. Baseline monitoring in all tributaries with proposed coho releases will provide a temporal control in which to evaluate any changes in NTTOC size.

Hypotheses:

- H_o: NTTOC Size $_{\text{before reintroduction}}$ < NTTOC Size $_{\text{after reintroduction}}$
- H_o: NTTOC Size $_{\text{treatment stream}}$ < NTTOC Size $_{\text{reference stream}}$

Restoration Phases: Baseline monitoring during broodstock development phases; change monitoring during the natural production phases.

Methods: The importance of monitoring size and growth of NTTOC in both the treatment and reference streams prior to reintroduction of coho is emphasized. Because seeding levels and intra-specific competition can influence the size structure of each population, a careful analysis of the relationship between seeding levels, survival, and growth should be established in each tributary (treatment and reference) in order to gauge the change.

We will collect size and condition factor information from the various smolt traps operating within the Wenatchee, Entiat and Methow basins (Nason Creek, Chiwawa River, White River, Upper Wenatchee River, Entiat River, Twisp River and Methow River). Currently the Nason Creek smolt trap is operated by the YN as a cost-sharing effort between two BPA projects (Project # 1996-040-00 and #2003-017-00) and Grant County PUD. The White River smolt trap is operated by the YN and funded by Grant County PUD. The Chiwawa River trap is operated by WDFW. In the Methow basin, the Twisp and Methow rivers traps are both operated by WDFW. The USFWS operates two rotary smolt traps in the Entiat River (reference populations). Additional baseline and post-reintroduction data will be provided through the ISEMP status and trend monitoring program.

Abundance and Survival

Objective: To measure the abundance and corresponding survival rates for NTTOC in target tributaries.

Rationale: See **Size Structure** above. Abundance of NTTOC, in-terms of population size and survival rates (egg-to-emigrant survival), will be used to evaluate the effect, if any, of coho reintroduction. Baseline monitoring during the broodstock development phases will establish trends in abundance and survival prior to the natural production phases. Abundance and survival monitoring for spring Chinook and steelhead in Nason Creek, Chiwawa River, White River, Wenatchee River, Twisp River, Methow River, and Entiat River are currently on-going or proposed under other programs. We propose to continue this monitoring as baseline and effect monitoring throughout the broodstock development and natural production phases.

Baseline monitoring in all tributaries with proposed coho releases will provide a temporal control. Inclusion of the Entiat River in the monitoring plan will allow for a spatial control or reference stream.

Hypotheses:

- H_o: NTTOC Egg-to-Emigrant Survival $_{\text{before reintroduction}}$ < Egg-to-Emigrant Survival $_{\text{after reintroduction}}$

- H_o: NTTOC Egg-to-Emigrant Survival $_{\text{treatment stream}}$ < NTTOC Egg-to-Emigrant Survival $_{\text{reference stream}}$

Methods: It is important to monitor NTTOC abundance in terms of egg-to-emigrant survival in both the treatment and reference streams before reintroduction of coho. Currently, such monitoring is ongoing in Nason Creek, Chiwawa River, White River, Peshastin Creek, Twisp River, Methow River, and Entiat River. Because seeding levels and intra-specific competition directly influence the egg-to-emigrant survival rate (stock-recruitment curve) of each population, a careful analysis of the relationship between seeding levels, survival, and growth should be established in each tributary (treatment and reference) in order to gauge the change.

Current on-going smolt trapping programs in Nason Creek, Chiwawa River, White River, Wenatchee River, Twisp River, Chewuch River, Methow River and Entiat River will form the basis for the NTTOC abundance and survival estimates. Similar traps on the Little Wenatchee may be proposed for coho natural production monitoring during the natural production phases and will also be used to collect abundance and survival data for the NTTOC monitoring program.

In addition, ISEMP has implemented a PIT tagging program for natural origin juvenile spring Chinook and steelhead in the Wenatchee and Entiat basins. All Chinook and steelhead longer than 60 mm captured at all smolt traps are currently being PIT tagged. Parr rearing in the tributaries captured either by seine nets, electro-fishing, or hook and line are also being PIT tagged. This intensive tagging effort is expected to provide life-stage-specific survival rates for spring Chinook and steelhead rearing in tributary streams over time.

Smolt trap operation for emigrant population analysis will proceed as described in Hillman (2004) and Prevatte and Murdoch (2004). We will follow protocols for underwater observation as described in Thurow (1994) and for electro-fishing in Temple and Pearsons (2004). The same index sites will be monitored annually. Any correlation between egg-seeding level, indexed rearing density, egg-to-emigrant survival, and emigrant population estimates will be analyzed using multiple regression techniques (Zar 1999).

In order to avoid duplication of efforts, NTT abundance and survival monitoring will be closely coordinated with ongoing monitoring and evaluation programs in the Wenatchee and Methow basins, including but not limited to BPA project #2003-017-000 (ISEMP) and M&E activities funded by the mid-Columbia PUDs.

Restoration Phases: Baseline monitoring will proceed as described above during the broodstock development phases in all tributaries proposed for future coho releases. Monitoring of changes will be done during the natural production phases. Any change in NTTOC status during this monitoring will be closely evaluated in subsequent studies such as those described Section 5.2.2, to determine if the coho reintroduction efforts are causing the observed change or if other factors may be involved.

Distribution of NTTOC

Objective: To evaluate the status of NTTOC in terms of their distribution throughout each basin.

Rationale: Data on the distribution of NTTOC and juvenile coho, in combination with abundance and size data, will enable researchers to evaluate changes in NTTOC status during the coho reintroduction process.

Baseline monitoring in all tributaries with proposed coho releases will provide a temporal control. Inclusion of the Entiat River in the monitoring plan will allow for a spatial control or reference stream.

Hypotheses:

- H_o: NTTOC Distribution $_{\text{before reintroduction}}$ < NTTOC Distribution $_{\text{after reintroduction}}$
- H_o: NTTOC Distribution $_{\text{treatment stream}}$ < NTTOC Distribution $_{\text{reference stream}}$

Restoration Phases: Same as for size and abundance monitoring.

Methods: It is important to monitor NTTOC spawning and rearing distribution in both the treatment and reference streams before reintroduction of coho. Currently NTTOC monitoring is ongoing in Nason Creek, Chiwawa River, White River, Peshastin Creek, Twisp River, Methow River, and Entiat River. A careful analysis of the relationship between seeding levels, survival, and distribution should be established in each tributary (treatment and reference) in order to gauge the change.

Distribution will be evaluated in terms of adult spawning distribution (adult spawning distribution data are collected by WDFW and CCPUD) and juvenile rearing distribution, through the annual snorkel and electro-fishing surveys conducted under ISEMP.

5.2.2 Mechanism of Interaction

5.2.2.1 Competition

Objective: To continue to evaluate competition for space and food between naturally produced coho and NTTOC.

Rationale: If the status of NTTOC is determined to have declined, continued investigations into competition between reintroduced coho and NTTOC will help determine the cause of the decline and, if necessary, programmatic changes that can be made to minimize negative interactions between coho (hatchery and/or natural) and NTTOC.

Hypotheses: Possible hypotheses to investigate include the following:

- H_o: NTTOC microhabitat $_{\text{with coho}}$ = NTTOC microhabitat use $_{\text{without coho}}$
- H_o: NTTOC growth $_{\text{with coho}}$ = NTTOC growth $_{\text{without coho}}$
- H_o: Coho microhabitat use = NTTOC microhabitat use

Methods: Competitive interactions between species are often investigated using two general techniques: controlled field studies or laboratory investigations (using aquaria or enclosures). Field studies can lack statistical power but are seldom criticized for lacking relevance to actual conditions. Studies in aquaria or enclosures more easily achieve statistical power through replication, but the natural conditions which closely parallel the stream ecosystem are difficult to duplicate.

To investigate competition, a combination of approaches may be used, including field studies similar to those conducted during the feasibility phase (Murdoch et al. 2004, Murdoch et al.

2005) or direct measures of competition such as growth and condition of NTTOC in small-scale enclosures with varying abundance of competitors under differing habitat and environmental conditions. Together competition studies may help ascertain conditions under which competition may have a negative effect on NTTOC.

5.2.2.2 Predation by Naturally Reared Coho on Spring Chinook Fry

Objective: To quantify predation rates by naturally produced coho on spring Chinook fry.

Rationale: The extent to which naturally produced coho may prey upon NTTOC in the Wenatchee and Methow rivers is largely unknown. Preliminary investigations during the feasibility phase documented that some naturally produced coho smolts will consume fry-sized fish. Due to the low numbers and abundance of naturally produced coho in areas of ESA-listed spring Chinook production during the feasibility phase, it was not possible to accurately measure incidence of predation (Murdoch et al. 2005).

Restoration Phases: Predation evaluations will occur during the NPIP. The tributary(s) chosen for the predation evaluation(s) will be based on the natural production rates and resources for fish capture.

Methods: A study to determine the incidence of predation and an estimate of the total number of spring Chinook fry consumed will follow methods described in Murdoch et al. (2005). The study may be replicated in more than one tributary as deemed necessary to adequately assess the extent that predation may occur.

5.3 Genetic Adaptability

Few opportunities in the Columbia Basin exist to investigate the local adaptation process required for a species reintroduction project to be completely successful. This coho reintroduction plan presents such an opportunity to understand the natural selection intensities on naturalized coho. Success of this coho reintroduction program relies on the use of hatchery fish to develop naturalized spawning populations. Until recently the project has relied entirely upon the transfer of lower Columbia River hatchery coho to produce adult coho returns. If a viable self-sustaining population of coho is to be re-established in the Wenatchee and Methow basins, parent stocks must possess sufficient genetic variability to allow the newly founded population to respond to differing selective pressures between environments of the lower Columbia River and the mid-Columbia region. Some changes in the life history characteristics of the introduced broodstock are likely, due to multiple factors such as longer migration distance, differing environmental conditions of inland rivers, and historical artificial selection on donor stocks. Several of the life history characteristics that might be expected to differ could be endurance, run timing, sexual maturation timing, fecundity, egg size, length at age, juvenile migration timing, sex ratio, and allele frequencies of non-neutral loci. Therefore, a long-term monitoring effort will be continued to track changes over several generations.

Implementation of the proposed study plan would be a valuable contribution to the science of salmon recovery by quantitatively addressing the following questions:

1) Is divergence at neutral and adaptive SNP (Single Nucleotide Polymorphism)[1] loci a useful measure of reproductive isolation and adaptation?

2) Is phenotypic divergence (if observed) a useful proxy for local adaptation, or are observed differences simply the result of phenotypic plasticity?

3) What is the biological significance to perceived local adaptation/naturalization?

4) What is the mechanism leading to local adaptation, and how quickly can stocks react to alternative natural selection regimes?

5.3.1 Morphometrics and Life History Traits

Metric: We will measure traits such as fecundity, body morphometry, run timing, maturation timing, length-at-age and spawn timing.

Rationale: Because conditions in mid-Columbia tributaries are likely to be different from coastal streams and the lower Columbia River where the broodstock used for reintroduction originated, life history characteristics of reintroduced coho are likely to change. For one, the migration distance is much greater between the ocean and the mid-Columbia than, for example, between the ocean and Cascade Fish Hatchery. Optimal maturation rates and spawn timing are likely to be different between these two areas. In order to determine if the stock used has adequate genetic variance and phenotypic plasticity to adapt to local conditions, the life history characteristics of the coho broodstock should be monitored over the length of the program.

Monitoring life history traits and morphometrics of mid-Columbia coho will contribute to answering broader questions about the rate of genetic drift when a broodstock is established in a subbasin.

Methods: Through sampling efforts in the Wenatchee and Methow basins, we will collect morphometric and life history data from the reintroduced population. From adult coho captured for broodstock (HORs and NORs) we will collect data from phenotypic traits such as fecundity, body morphometry and maturation timing. Similar data will be collected from HORs and NORs recovered on the spawning grounds. Trend monitoring will be used to ascertain changes in life history or morphometry for each generation.

5.3.2 Phenotypic Traits at Tumwater and Dryden Dams

Metric: We will measure traits such as lipid levels, run timing, state of maturation (measured by hormone levels), fish size, fish shape, and gender.

Rationale: In addition to tracking any changes in phenotypic traits over time for the population as a whole, during Broodstock Development Phase 2 (BDP2) we plan to assess whether there is any measurable difference in phenotypic traits between coho salmon that are able to ascend Tumwater Canyon and those that cannot. Knowledge of any potential phenotypic difference between fish that can ascend the canyon and those that cannot, could be used to revise our broodstock collection efforts if we are unsuccessful in completing BDP2 as described in Section 5.2 of the Master Plan. However, because targeting

[1] SNP – Single nucleotide polymorphism: an alteration of one base in the genome of an organism (e.g., A⇔G or C⇔T).

broodstock collection for certain traits would reduce genetic diversity and could also result in the inadvertent selection for deleterious traits, such measures would be a last resort.

Hypotheses: Possible hypotheses to investigate include the following:

- H_o: Lipid Levels $_{\text{successful coho}}$ = Lipid Levels $_{\text{unsuccessful coho}}$
- H_o: State of Maturation $_{\text{successful coho}}$ = State of Maturation $_{\text{unsuccessful coho}}$
- H_o: Run Timing $_{\text{successful coho}}$ = Run Timing $_{\text{unsuccessful coho}}$
- H_o: Morphometrics $_{\text{successful coho}}$ = Morphometrics $_{\text{unsuccessful coho}}$

Methods: Coho smolts released upstream of Tumwater Dam will be marked with a blank wire in the adipose fin. Upon return, adults headed upstream of Tumwater Dam will be identifiable at downstream trapping sites. During broodstock collection efforts at Dryden Dam, all coho destined for the upper Wenatchee basin will be scanned for a PIT tag; if no PIT tag is found, a tag will be applied. Phenotypic data described above will be collected. Fish that successfully ascend Tumwater Canyon to the dam will either be re-collected or detected on the antenna arrays (2) within the fishway. Phenotypic data from fish that have arrived at Tumwater Dam will then be compared to the data collected from the fish that did not successfully ascend the canyon.

5.3.3 Genetic Monitoring

Objective: To determine whether the project is successfully creating a local broodstock distinct from lower Columbia River coho salmon stocks; to measure the rate of divergence at neutral markers, and to determine the biological significance of local adaptation.

Metric: We will measure the rate and direction of divergence in neutral and adaptive allele frequencies of coho stocks that are used for reintroduction in mid-Columbia rivers.

Rationale: A sound understanding of the genetic structure of the species is a prerequisite for the assessment of the genetic impacts of human activities such as introductions, transfers, or stock enhancement on natural populations. A measure to assess the impact of human activities on natural populations is the degree to which the population structure responds to applied management action. This can be done by measuring the frequencies of alleles at specific loci through time in a population (Allendorf and Phelps 1981; Utter 1991; Allendorf 1995). Such a database permits the determination of temporal and geographic (degree of isolation) variance components.

Within the body of peer-reviewed literature, scientific views remain mixed regarding the scale and biological significance of perceived local adaptations (Taylor 1991; Purdom 1994). Utilizing both neutral and adaptive SNP loci provides the opportunity to evaluate the biological significance of genetic differentiation among stocks. The coho reintroduction effort in the mid-Columbia provides an ideal framework for studying rates of genetic and phenotypic divergence.

Restoration Phases: Broodstock development phases will focus on collecting genetic samples from hatchery returns to measure the rate of divergence. Genetic analysis during natural production phases will include naturally spawning coho as described above.

Methods: We propose to measure genetic divergence using 35 SNP markers. To do so, we intend to sample tissue from a minimum of 60 adult coho from each of four study groups:

1) adults destined for natural spawning; 2) adults collected for broodstock; 3) naturally produced smolts; and 4) hatchery-origin smolts. Over time the data will allow us to estimate three types of genetic drift:

1) Changes in allele distribution between parent and progeny life history stages (e.g., drift occurring between the adult spawning population and their progeny) relative to the amount of genetic divergence expected to result from genetic sampling error attributed to reproductive events (Weir 1996). In addition, by measuring changes in composite haplotype[2] frequencies we can quantify variation in reproductive success on a very broad scale. These data will be used to scale the relevance of statistical tests of genetic differentiations (e.g., genetic sampling error will be included as a component of variance when assessing differentiation between hatchery and natural-origin adults and progeny).

2) Genetic variation present in the hatchery broodstock compared to the naturally spawning population component. This will allow us to determine whether broodstock collection methods are effectively achieving a representative sample of returning adults. These data will be helpful in optimizing broodstock collection protocols.

3) Over time, as broodstock development progresses, we will be able to determine the length of time necessary to genetically recognize mid-Columbia coho salmon as a distinct spawning population from the lower river source populations.

5.3.4 Reproductive Success

Objective: To measure changes in reproductive success over generations as an indicator of local adaptation.

Metric: Individual recruits per spawner as assessed through parental assignment.

Rationale: Initially we expect the reproductive success of reintroduced coho salmon do be low because a domesticated hatchery stock was used for the reintroduction. This Master Plan describes a phased approach to first develop a local broodstock and then to focus on natural production and local adaptation to the natural environment (rather than hatchery environment). As we proceed with the phased reintroduction effort, we would expect the reproductive success of the population to improve. Because the program is designed to be an integrated hatchery program, we would not expect the reproductive success to be different between natural and hatchery produced fish; however, as our reliance on hatchery production diminishes in the NPS phases, we would expect an increase in reproductive success for the population.

Hypotheses: Possible hypotheses to investigate include the following:

- H_o: Reproductive Success $_{\text{BDPII (baseline)}}$ = Reproductive Success $_{\text{NPS2 (locally adapted)}}$

Restoration Phases: During the broodstock development phases, we will focus on collecting baseline reproductive success data which would be compared to the reproductive success of reintroduced coho at the conclusion of the Natural Production Phases.

Methods: The reproductive success of reintroduced populations is a CRITFC-sponsored evaluation (Accord Project #200900900). We plan to coordinate with CRITFC researchers

---

[2] Haplotype: The composite genotype of multiple loci that can provide a “fingerprint” for various lineages, populations, or individuals.

for the implementation of this study. A small fin clip will be taken from all coho ascending Tumwater Dam (and possibly Wells Dam). Genetic profiles acquired for each fish will be compared to the profiles for adults in its respective brood year to permit parentage assignment.

Individual productivity (R/S) estimates will be calculated for each adult within brood years as well as average productivity and relative reproductive success among parental types. We will then compare the reproductive success of hatchery and naturally produced coho during the broodstock development phases (baseline) to data collected near the completion of the natural production phases.

References

Allee, B.J. 1974. Spatial requirements and behavioral interactions of juvenile coho salmon and steelhead trout. Doctoral Dissertation, University of Washington, Seattle.

Allendorf, F.W. 1995. Genetics: Defining the units of conservation. American Fisheries Society Symposium 17:247-248.

Allendorf, F.W. and S.R. Phelps. 1981. Use of allelic frequencies to describe population structure. Canadian Journal of Fisheries and Aquatic Sciences. 38:1507-1514.

Bjornn, T.C. 1971. Trout and salmon movements in two Idaho streams as related to temperature, food, stream flow, cover, and population density. Trans. Am. Fish. Soc.: 100:423-438.

Busak, C., T. Pearsons, C. Knudsen, S. Phelps, B. Watson, M. Johnston. 1997. Yakima Fisheries Project Spring Chinook Supplementation Monitoring Plan. *Prepared for*: Project Number 1995-064-000 Bonneville Power Administration, Portland, OR.

Bustard, D.R., and D.W. Narver. 1975. Preferences of juvenile coho salmon (Oncorhynchus kisutch) and cutthroat trout (Salmo clarki) relative to simulated alteration of winter habitat. J. Fish. Res. Board Can. 19(6): 1047-1080.

Cannamela, D.A. 1993. Hatchery steelhead smolt predation of wild and natural juvenile Chinook salmon fry in the upper Salmon River, Idaho. Idaho Department of Fish and Game. 36 pp.

CBFWA. 1999. PIT Tag Marking Procedures Manual. Version 2.0. Columbia Basin Fish and Wildlife Authority, PIT Tag Steering Committee.

CCCD (Chelan County Conservation District). 2004. Entiat Water Resource Inventory Area (WRIA) 46 Management Plan. *Prepared for:* the Entiat WRIA Planning Unit by the Chelan County Conservation District. Wenatchee, WA.

Chapman D., A. Giorgi, T. Hillman, D. Deppert, M. Erho, S. Hays, C. Peven, B. Suzumoto, R. Klinge. 1994a. Status of summer/fall chinook salmon in the mid-Columbia region. Don Chapman Consultants, Inc. Boise, ID.

Chapman, D., C. Peven, T. Hillman, A. Giorgi, F. Utter. 1994b. Status of summer steelhead in the mid-Columbia River. Don Chapman Consultants, Inc. Boise, ID.

Chapman, D., C. Peven, A. Giorgi, T. Hillman, F. Utter. 1995a. Status of spring chinook salmon in the mid-Columbia River region. Don Chapman Consultants, Inc. Boise, ID.

Chapman, D.W., C. Peven, A. Giorgi, T. Hillman, F. Utter, M. Hill, J. Stevenson, M. Miller. 1995b. Status of sockeye salmon in the mid-Columbia region. Don Chapman, Consultants, Inc. Boise, ID.

DCPUD (Douglas County Public Utility District). 2005. Conceptual approach to monitoring and evaluating the Douglas County Public Utility District Hatchery Programs. *Prepared for:* Douglas PUD Habitat Conservation Plan's Hatchery Committee.

Dolloff, C.A., and G.H. Reeves. 1990. Microhabitat partitioning among stream-dwelling juvenile coho salmon, *Oncorhynchus kisutch*, and Dolly Varden, *Salvelinus malma*. Can. J. Fish. Aquat. Sci 47:2297-2306.

Dunnigan, J. 1999. Feasibility and risks of coho reintroduction in mid-Columbia Tributaries: 1999 annual monitoring and evaluation report, project No. 1996-040-000. Bonneville Power Administration, Portland, OR.

Everest, F.W. and D.W. Chapman. 1972. Habitat selection and spatial interaction by juvenile chinook salmon and steelhead trout in two Idaho streams. J. Fish. Res. Board Can. 29:91-100.

Fraser, F.J. 1969. Population density effects on survival and growth of juvenile coho salmon and steelhead trout in experimental stream channels. Pages 253-266 *in* T. G. Northcote (ed.), Symposium on Salmon and Trout in Streams. H.R. MacMillan Lectures in Fisheries. Univ. British Columbia, Institute of Fisheries, Vancouver, BC.

Fresh, K.L. 1997. The role of competition and predation in the decline of Pacific salmon and steelhead. Pages 245-275 in D.J. Stouder, P.A. Bisson, and R.J. Naiman editors, Pacific salmon and their ecosystems: Status and future options. Chapman and Hall, New York, NY.

GCPUD (Grant County Public Utility District). 2009. Draft monitoring and evaluation plan for Grant County PUD Salmon and Steelhead Supplementation Programs. *Prepared for:* The Priest Rapids Coordinating Committee.

Glova, G.J. 1986. Interaction for food and space between experimental populations of juvenile coho salmon (*Oncorhynchus kisutch*) and coastal cutthroat trout (*Salmon clarki*) in a laboratory stream. Hydrobiologa 132, 155-168.

Ham, K.D. and T.N. Pearsons. 2001. A practical approach for containing ecological risks associated with fish stocking programs. Fisheries Vol. 26, no. 4, pgs 15-23.

Hartman, G.F. 1965. The role of behavior in the ecology and interaction of underyearling coho salmon and steelhead trout. Journal of the Fisheries Research Board of Canada 22:1035-1081.

Hillman, T.W. 2004. Monitoring strategy for the Upper Columbia Basin: Draft Report February 1, 2004. Prepared for Upper Columbia Regional Technical Team, Wenatchee, WA.

Hubble, J., T. Newsome, J. Woodward. 2004. Yakima Coho Master Plan. Prepared by the Yakama Nation in cooperation with the Washington Department of Fish and Wildlife. Toppenish, WA.

Johnston, J.M. 1967. Food and feeding habits of juvenile coho salmon and steelhead trout in Worth Creek, Washington. Masters of Science Thesis, University of Washington, Seattle.

Kamphaus C.M., K.G. Murdoch, C.H. Strickwerda, M.B. Collins. 2008. Mid-Columbia Coho Reintroduction Feasibility Study: 2007 Annual Report October 1, 2006 through September 30, 2007. Prepared by Yakama Nation Fisheries Resource Management for Project # 1996-040-00 Bonneville Power Administration Public Utility District No. 1 of Chelan County, and Public Utility District No. 2 of Grant County. Toppenish, WA. March 6, 2008.

Larkin, P.A. 1956. Interspecific Competition and Population Control in Freshwater Fish. Journal of Fisheries Research Board of Canada. Vol. 13, No. 3, pp 327-342.

Lister, D.B., and H.S. Genoe. 1970. Stream habitat utilization by cohabitating underyearling of chinook and coho salmon in the Big Qualicum River, B. C. J. Fish Res. Board Can. 27:1215-1224.

Marnell, L.F. 1986. Impacts of hatchery stocks on wild fish populations. Pages 339-347 in R. H. Stroud, editor. Fish culture in fisheries management. American Fisheries Society, Fish Culture Section and Fisheries Management Section, Bethesda, MD.

Mullan, J.W., K.R. Williams, G. Rhodus, T.W. Hillman, and J.D. McIntyre. 1992. Production and habitat of salmonids in mid-Columbia River tributary streams. U.S. Fish and Wildlife Serv. Monograph I. Leavenworth, WA 489 pp.

Murdoch, A. and C. Peven. 2005. Conceptual approach to monitoring and evaluating the Chelan County Public Utility District hatchery programs. *Prepared for:* Chelan PUD Habitat Conservation Plan's Hatchery Committee, July 2005. Wenatchee, WA.

Murdoch, K., and J. Dunnigan. 2002. Feasibility and risks of coho reintroduction in mid-Columbia tributaries: 2000 annual monitoring and evaluation report, project No. 1996-040-000. Bonneville Power Administration, Portland, OR.

Murdoch, K.G., C.M. Kamphaus, S. A. Prevatte. 2004. Mid-Columbia coho reintroduction feasibility study: 2002 monitoring and evaluation report, project No. 1996-040-000. Bonneville Power Administration, Portland, OR.

Murdoch, K.G., C. M. Kamphaus, S. A. Prevatte. 2005. Mid-Columbia coho reintroduction feasibility study: 2003 draft monitoring and evaluation report, project No. 1996-040-000. Bonneville Power Administration, Portland, OR.

Murdoch, K. and M. LaRue. 2002. Feasibility and risks of coho reintroduction in mid-Columbia tributaries: 2001 annual monitoring and evaluation report, project No. 1996-040-000. Bonneville Power Administration, Portland, OR.

Murphy, M.L., J. Heifetz, J.F. Thedinga, S.W. Johnson, and K.V. Koski. 1989. Habitat utilization by juvenile Pacific salmon in the glacial Taku River, southeast Alaska. Can. J. Fish. Aquat. Sci. 46:1677-1685.

Neeley, D. 2004. Release-to-McNary Survival Indices of 2004 Releases into the Wenatchee and Methow Basins. *Prepared for*: Yakama Nation Fisheries Resource Management, Toppenish, WA.

Neeley, D. 2007. Release-to-McNary Survival Indices of 2007 Releases into the Wenatchee and Methow Basins. *Prepared for*: Yakama Nation Fisheries Resource Management, Toppenish WA.

Nickelson, T.E. 1986. Influence of upwelling, ocean temperature, and smolt abundance on marine survival of coho salmon (*O. kisutch*) in the Oregon production area. Canadian Journal of Fisheries and Aquatic Sciences. 43:527-535.

Pearsons, T., and C. Hopley. 1999. A practical approach for assessing ecological risks associated with fish stocking programs. Fisheries 24(9):16-23.

Pearsons, T., A. Fritts, G. Temple, C. Johnson, T. Webster, and N. Pitts. 2004. Yakima River Species Interactions Studies; Yakima Klickitat Fisheries Project Monitoring and Evaluation Report 7 of 7: 2003-2004 Annual Report, Project No. 199506325. Bonneville Power Administration, Portland, OR. BPA report DOE/BP-00013756-7.

PFMC (Pacific Fisheries Management Council). 1999. Review of 1998 Ocean Salmon Fisheries. Pacific Fishery Management Council. Portland, OR. February 1999.

Prevatte, S.A., and K.G. Murdoch. 2004. Integrated status & effectiveness monitoring program, expansion of existing smolt trapping program in Nason Creek: 2004 Draft Annual Report. *Prepared for* Bonneville Power Administration, Portland OR. Project No. 2003-017-00.

Purdom, C. 1994. Book Review: Genetic Conservation of Salmonid Fishes. Journal of Experimental Marine Biology and Ecology. 182:141-142.

Quinn, T.P. 2005. The Behavior and Ecology of Pacific Salmon and Trout. American Fisheries Society, Bethesda Maryland, *in association with* University of Washington Press, Seattle and London. 320 pages.

Riley, S.C., H.J. Fuss, L.L. LeClair. 2004. Ecological effects of hatchery-reared juvenile chinook and coho salmon on wild juvenile salmonids in two Washington streams. North American Journal of Fisheries Management 24: 506-517.

Sabo, J.L., and G.B. Pauley. 1997. Competition between stream-dwelling cutthroat trout (*Oncorhynchus clarki*) and coho salmon (*Oncorhynchus kisutch*): effects of relative size and population origin. Can. J. Fish. Aquat. Sci. (54)2609-2617.

Stein, R.A., P.E. Reimers, J.D. Hall. 1972. Social Interaction Between Juvenile Coho and Fall Chinook Salmon in Sixes River, Oregon. Journal Fisheries Research Board of Canada, Vol. 29, No. 12.

Taylor, E.B. 1991. A review of local adaptation in Salmonidae, with particular reference to Pacific and Atlantic salmon. Aquaculture 98:185-207.

Temple, G.M, and T.N. Pearsons. 2004. Comparison of Single vs. Multiple Pass Electrofishing Effort to Monitor Fish Populations in Wadeable Streams. Pages 32-54 *in* Yakima/Klickitat Fisheries Project Monitoring and Evaluation Report 7 of 7: Annual Report 2003-2004. Project No. 199506325 Bonneville Power Administration, Portland, OR. BPA Report DOE/BP-00013756-7.

Thurow, R.F. 1994. Underwater Methods for Study of Salmonids in the Intermountain West. United States Department of Agriculture, Forest Service, Intermountain Research Station. General Technical Report INT-GTR-307. 28pgs.

Utter, F., R. Waples, and D. Teel. 1992. Genetic isolation of previously indistinguishable chinook salmon population of the Snake and Klamath Rivers: limitations of negative data. Fishery Bulletin. 90:770-777.

Weir, B.S. 1996. Genetic Data Analysis II: Methods for Discrete Population Genetic Data. Sinauer Associates, Sunderland, MA. 445 pp.

YN, WDFW, BPA (Yakama Nation, Washington Department of Fish and Wildlife, Bonneville Power Administration). 2002. Hatchery and Genetics Management Plan: Mid-Columbia Coho Reintroduction Feasibility Project. December 2002.

Zar, J. 1999. Biostatistical Analysis, fourth edition. Prentice Hall, New Jersey.

Glossary

Fish Tags

PIT Passive Integrated Transponder

CWT Coded Wire Tag

Project Phases

BDP1 Broodstock Development Phase 1

BDP2 Broodstock Development Phase 2

NPIP Natural Production Implementation Phase

NPSP Natural Production Support Phases

Public Utility Districts

CCPUD Chelan County Public Utility District funds WDFW to operate the Rock Island Hatchery Complex among other facilities

DCPUD Douglas County Public Utility District funds WDFW to operate the Wells and Methow hatcheries, and the Methow, Twisp and Chewuch acclimation ponds (among other hatchery facilities)

GCPUD Grant County Public Utility District funds WDFW to operate the Wells and Methow hatcheries, and the Nason and White acclimation ponds (among other hatchery facilities)

Other Projects and Programs

ISEMP Integrated Status & Effectiveness Monitoring Program (BPA project #2003-017-00)

HCP Habitat Conservation Plan or Hatchery Compensation Program

Other Acronyms

HOR hatchery-origin returns

NOR natural-origin returns

NTTOC Non target taxa of concern. In this program, coho are the target species. Non-target taxa of concern include other species that might be affected by program activities, including ESA-listed spring Chinook, steelhead and bull trout. Other sensitive species might also be considered non-target taxa of concern, including sockeye salmon and lamprey.

Morphology/Morphometrics Refers to the form and structure of an organism, with special emphasis on external features.

Appendix 12 Public Comments on the Draft EIS and BPA Responses

This appendix records and categorizes all the comments received concerning the Mid-Columbia Coho Restoration Program during the public comment period on the Draft Environmental Impact Statement.

The Draft EIS was issued for public review in June 2011. Public meetings were held in Leavenworth and Twisp, Washington, on July 13 and 14, 2011, respectively. Bonneville Power Administration (BPA) and Yakama Nation (YN) staff presented an overview of the project and summarized the impacts. Oral and written questions and comments were recorded at those meetings, and written comments were accepted until August 22, 2011.

The appendix summarizes comments received at the meetings and in written correspondence. Individual comment letters were given a unique number, and the comments within the letters were also numbered. Comments from all the sources were summarized and grouped into categories to more efficiently respond to similar issues. Comments that are not enclosed by quotation marks are from the handwritten summaries of questions and comments that were heard at the two public meetings, indicated by the number 10: Comment #10-1, 10-2, 10-3, etc. Because these comments were not electronically recorded, only written by hand as individual or group discussions proceeded, they cannot be considered exact quotations but represent a summary of what BPA and YN representatives heard. The complete letters and the public meeting summary, with the comment numbers identified, are reproduced at the end of this appendix.

The response to each comment includes an indication of whether changes were made to the Final EIS and where those changes can be found.

Alternatives

Comment #3-1: "I think they should set goals to try to accomplish this in as few at 10 years. I think any longer would not be reasonable."

Response: The program likely will be able to tell in 10 years if success can truly be achieved; however, the 15-year period proposed is what biologists think is reasonable to ensure that a naturally reproducing population is firmly established.

Comment #13-12: "…CEQ NEPA Regulations…[require an agency] to rigorously explore and objectively evaluate all reasonable alternatives, including reasonable alternatives not within the lead agency's jurisdiction or congressional mandate. …[S]ubstantial treatment should be devoted to each alternative so that reviewers may evaluate their comparative merits. The current DEIS analyzes only one 'action alternative'. As such, the DEIS does not provide a clear basis for choice by decision makers and the public.…We [EPA] encourage BPA to include a clear rationale within the FEIS as to why no additional alternatives were analyzed within the EIS."

Response: The Northwest Power Act established a statutory structure that "makes it clear that the [Council's Fish and Wildlife] Program was to be developed through a detailed and deliberate process of consultation with fishery managers who have great experience and expertise with fish and wildlife protection" (*Northwest Resource Info. Ctr. v. NPCC*, 35 F.3d 1371, 1388 (9th Cir. 1994)). BPA's duties under the Northwest Power Act include protecting and mitigating fish and wildlife affected by the Federal Columbia River Power System (FCRPS) dams and taking the Council's program into account to the fullest extent possible (16 U.S.C. §§ 839b(h)(10)(A), (11)(A)(i)). BPA developed its proposed action based on a recommendation from the Northwest Power and Conservation Council (Council). BPA ultimately selected the Proposed Action and the No Action Alternative for detailed analysis for the reasons explained below.

The Council requires project proponents such as the Yakama Nation to follow a three-step process to assess the feasibility and scientific soundness of major new hatchery proposals.[1] The first step requires that the proponent submit a Master Plan which must examine alternatives to solving the resource problem. As is the case for all such projects, the Master Plan prepared for the Mid-Columbia Coho Restoration Program was available for public review and was subjected to independent review by the Independent Scientific Review Panel.[2] In the Master Plan and appendices, which this EIS incorporated by reference in their entirety, the Yakama Nation examined numerous alternatives, including alternative rearing and acclimation systems; and the proposed action was modified several times in response to comments from the ISRP and from a Technical Work Group made up of BPA and federal, state, tribal, and other entities' staff (see Chapter 1 of the EIS). On March 9, 2010, the Council approved the Master Plan and recommended that BPA and the Yakama Nation move to Step 2 of the Council's process, which includes BPA's NEPA review and drafting of preliminary designs. Thus, by the time the Council recommended the YN's coho project to BPA for NEPA analysis, the project had already been subject to a rigorous and lengthy planning and review process.

[1] The Three-Step Process: http://www.nwcouncil.org/library/2001/2001-29.pdf

[2] An amendment to the Northwest Power Act in 1996 created the Independent Scientific Review Panel to help the Council ensure the scientific integrity of proposed projects and to ensure that the projects were consistent with the Program. 16 U.S.C. § 839b(h)(10)(D)(iv).

At the beginning of Section 2.4 (Alternatives Considered but Eliminated from Detailed Evaluation), we have added more explanation of the Council's process that led to the single action alternative in this EIS, as well as the additional detail on the alternatives examined during the Master Plan process (two new sections: 2.4.1 and 2.4.2).

BPA did not develop detailed alternatives that include specific locations and designs, or attempt a detailed review of the environmental consequences of such alternatives at a level commensurate with the proposed action. The alternative rearing systems and acclimation systems examined in the Master Plan were deemed not reasonable because of scientific problems, prohibitive costs, greater environmental impacts, or a combination of those factors. Ultimately, no scientifically acceptable and environmentally superior alternative that also meets the need was suggested during the COUNCIL's Step 1 phase or during scoping or review of the EIS.

Comment #10-6: Could egg containers be used?

Response: Egg boxes were suggested as an alternative during scoping but would not be feasible. See Section 2.4.4.

Comment #10-16: Would egg transportation still occur?

Response: Yes, under the proposed program, some of the eyed egg production would be transported to lower Columbia hatcheries for rearing to pre-smolt size.

Comment #10-4: Why was the Entiat basin excluded from the program?

Response: As stated in the Master Plan (YN 2010), Section 4.2.2, although the Entiat basin was part of the YN's long-term vision for coho restoration, due to limited resources for the coho program and the limited natural production potential in the Entiat, the program chose to focus on the basins with more habitat potential—the Wenatchee and Methow. The Entiat basin was also being considered by resource managers from several agencies as a reference stream for steelhead and spring Chinook; these entities did not support reintroducing coho into the Entiat. We have added a brief discussion to Section 2.4 of the EIS.

Comment #10-10: How did you identify acclimation sites? **Comment #10-11:** Does the DEIS include other river sites as alternatives?

Response: Factors considered in facility location are discussed in Section 2.2.2.2. The EIS includes several backup acclimation sites in both basins. See Section 2.2.2.1.

Comment #10-26: If adaptive management is used, then will the 24 ponds and 2 adult sites change (as more data/information is known)?

Response: The possibility exists that sites could be changed, particularly if monitoring shows limited success with a particular site. However, without further environmental review under NEPA, only sites evaluated in the EIS could be used.

Comment #10-46: Are you adding to the Chinook acclimation pond in Twisp? Would coho be there at the same time and released at same time?

Response: The proposed new pond at Twisp Weir would be a separate pond from the existing Chinook acclimation pond. Coho and spring Chinook would be reared in separate ponds but during similar time periods and released at similar times.

Comment #10-49: Are there plans to keep ponds open or drained?

Response: In-channel ponds that have a permanent water source or ponds with a natural connection to a stream would be available to other fish during periods when coho are not being acclimated there. In cases where the water is supplied from an artificial intake, the intake would be screened so that other fish do not access the site and become stranded. In a few cases, ponds are not accessible to fish due to natural barriers or limited flows during the late season.

Comment #10-55: How long will acclimation sites be used? Would you move to plant coho directly in off-channel habitat?

Response: Depending on the site, acclimation sites would be used between 6 weeks and 6-7 months each year until project goals are met (expected in 2028). At the end of that period, the program hopes to be able to discontinue acclimation because it is expected that a self-sustaining, naturally reproducing population of coho would be established. Except for the two adult plant sites (one in each basin), there are no plans to directly plant coho outside of proposed acclimation sites. See Section 3.7 for acclimation site use and 2.2.1.2 Phased Reintroduction.

Comment #10-53: Any plans for species/program monitoring?

Response: The Proposed Action includes an extensive monitoring and evaluation program. See Section 2.2.3 and Appendix 5.

Comment #10-27: Will the proposed project ramp up all at once?

Response: The project has been ongoing since 1996, so that many processes and several sites are already in place and in use. If the Proposed Action is approved, the new facilities proposed in this EIS would be put into use within the next couple of years. The numbers of fish acclimated and released would be at the proposed maximum also within that period, and then would be gradually reduced.

Comment #10-28: Does the Draft EIS include an alternative that improves habitat for all T&E [Threatened and Endangered] species?

Response: To the extent that other species would use the new and improved acclimation sites, habitat could benefit other species. It is expected that the reintroduction of coho would be prey for threatened species such as grizzly bears and could provide marine-derived nutrients to other aquatic species. See Section 3.7 in the EIS.

Mitchell Act Funding

Comment #13-9: "The MCRP [Mid-Columbia Coho Restoration Program] EIS also makes reference to sharing the rearing costs of the current program with NMFS, and states that if the proposed action is implemented, cost sharing is expected to continue (page 2-27). It is not clear, however, whether that cost share is funded through the Mitchell Act."

- We [EPA] recommend that the FEIS clarify the extent to which BPA has coordinated with NMFS with regard to the status of Mitchell Act Funded Hatcheries and Programs.
- If uncertainty exists around the future of Mitchell Act funding, we recommend that that be disclosed in the document and any impacts to the proposed action be accounted for."

Response: All cost sharing with NMFS is through the Mitchell Act-funded hatcheries. BPA is aware of the NMFS review of Mitchell Act hatcheries and has participated in that process. The coho project is one of the projects included in the analysis for that EIS. To address the uncertainty regarding Mitchell Act funding, BPA has included an option in the Proposed Action that addresses the unlikely event that all Mitchell Act funding of Cascade and Willard hatcheries is terminated. See Section 2.2.2.1.

No Action Alternative

Comment #13-11: "When the proposed action involves updating or expanding an existing management plan or program, the 'no action' alternative is generally the continuation of the current management plan or program.…In the current DEIS, the 'no action' alternative is essentially a 'no funding alternative'…Because defunding the program would result in changes to the program, this alternative is not a 'no action' alternative in the traditional sense. That said, we agree that it is important to the decision making process to understand the effect that defunding would have on the overall coho restoration program."

- We [EPA] recommend that the FEIS clarify whether any funding would be available through BPA for the MCRP [Mid-Columbia Coho Restoration Program] in the absence of the proposed action. If zero funding would be available, that should be disclosed as the basis for your rationale to not include a true 'no action' alternative in the DEIS."

Response: The No Action Alternative has been revised to show that BPA has committed in the 2008 Columbia Basin Fish Accords to funding the existing coho program at existing levels through 2018. Therefore, immediate defunding is not an option. The description of the alternative has been changed (see Section 2.3), and the effects analyses in Chapter 3 have been revised as appropriate.

NEPA Process

Comment #7-3: "Footnote 'b' to Table 2-6 (Page 2-15) indicates that the environmental review under NEPA for the 'Lincoln' site is '*done under a different program; impacts are evaluated in other NEPA processes*.'

It is not clear whether this alternate environmental review has been completed, or will be completed at some time in the future. Additionally, it is not clear why this Draft EIS does not include an analysis of the environmental impacts of the proposal at this site given the purpose of NEPA as a tool for identifying and mitigating cumulative environmental impacts."

Response: The construction impacts of the Lincoln site were evaluated in a separate process because the site was proposed for construction and use under a different program: the Multi-Species Acclimation Project for acclimation of steelhead and spring Chinook.

The coho project proposes to use the Lincoln site when it is available, and the impacts of its use to acclimate coho *are* evaluated in the Mid-Columbia Coho Restoration Program EIS. See, for example, Sections 3.5 (Water Quality), 3.7 (Fish), 3.8 (Priority Plants, Habitat, and Wildlife), where operational impacts at individual sites, including Lincoln, are identified as well as the combined and cumulative impacts. Where *operational* impacts on a particular resource are considered negligible, as for wetlands or aesthetics, impacts at individual sites are not assessed. The footnote cited by the commenter said in full that "*Construction* at Rohlfing and Lincoln is done under a different program; impacts are evaluated in other NEPA processes." We have clarified in the footnote to that table (Table 2-8 in the Final EIS) that it is "construction *impacts*" that were evaluated in the separate process and have cited the relevant documents.

A section has been added to Section 3.15 assessing the cumulative impacts of using some of the coho sites for multi-species acclimation.

BPA has provided additional information to the commenter regarding this matter.

Conservation Easements

Comment #7-1: "The Draft EIS notes on page 3-8 that the Methow Conservancy holds a conservation easement on the 'Lincoln' site but does not identify the other potential acclimation sites where the Methow Conservancy currently holds a conservation easement interest. It appears that Goat Wall, Hancock, Heath, and Mason sites are also on properties where the Methow Conservancy currently holds a conservation easement interest. . . . We encourage BPA and the Yakama Nation to contact us to determine if a conservation easement has been recorded. For any sites with recorded easements, BPA and/or Yakama Nation will need to coordinate with Methow Conservancy to ensure that the values protected by the easement are not adversely affected."

Comment #7-2: "Many of the Methow Conservancy's conservation easements, including those noted as potential acclimation sites, were secured with funding from one or more third-party entities, including the Washington Salmon Recovery Board, the Chelan and Douglas PUD Tributary Committee, BPA and others. The Conservancy's review process will need to include these third party entities to develop policy guidance relating to the proposed project."

Response to Comments 7-1 and 7-2: Yakama Nation staff are working with Methow Conservancy staff and others to determine consistency of the proposed program with conservation easements. Other sites besides Lincoln that have or will have recorded conservation easements are Heath, Mason, and Goat Wall. These have been identified in Section 3.3.2 of the Final EIS.

Biological Rationale for Proposed Action

Comment #11-15: "Pages 2-8 and 2-9 The draft EIS states that 'Broodstock compositions would be managed to increase the proportion of natural influence (PNI) in the population, with the goal of having a PNI value greater than 0.5; that is, the natural environment must have a greater influence on the population than the hatchery environment.' However, it is not clear how 'natural influence' is measured or defined. The Department [of Interior] recommends that the final EIS define 'natural influence' as well as describe the tests the fish will undergo to determine whether definition is met."

Response: PNI or proportionate natural influence has become a key theory in hatchery reform planning to address the loss of fitness commonly associated with hatchery programs. Proportionate natural influence is defined as the interaction between the proportion of hatchery fish on the spawning ground (pHOS) and the proportion of natural-origin fish in the broodstock (pNOB). PNI or proportionate natural influence is measured with the following formula:

$$\text{PNI} = \frac{pNOB}{pNOB + pHOS}$$

It is a simple mathematical gene flow model within an integrated population. When PNI is less than 0.50, the hatchery environment has greater selective pressures on the population; when PNI is greater than 0.50, the natural environment is driving selection in the population.

The Natural Production Support phases of the proposed program are designed to use the PNI theory to increase local adaptation to the natural environment (PNI > 0.50). The Support Phases capitalize on returns of initial releases into new areas during the Natural Production Implementation Phase by systematically reducing release numbers, which will allow YN to more easily increase pNOB while decreasing pHOS, which in turn increases the PNI of the population.

There are no "tests the fish will undergo" to determine PNI. Data that is already routinely collected annually from the broodstock and the run at large provides the information on the numbers of hatchery and natural spawners needed to calculate PNI. Data collection techniques include spawning ground surveys and redd counts, and the results of PIT tagging and radio telemetry. See Appendix 5 Monitoring and Evaluation Plan, particularly Section 5.1.5, for details.

Comment #10-12: What ecological indicators drive production/timing?

Response: The biological approach to the project, including the measurable goals and indicators of success for each project phase, are described in Section 2.2.1. Information has been added to Section 2.2.1.2 describing the results of habitat modeling that informed proposed release numbers in the various watersheds.

Comment #10-3: What happens when you do not meet your goals?

Response: A contingency plan has been developed, as discussed in Section 2.2.1.2. This decision-making process would evaluate the reasons the goal was not achieved, determine if the causes can be ameliorated, and consider alternate courses of action. The process is outlined in detail in Section 4.3.5 of the Master Plan (YN 2010).

Coho Status

Comment #11-13: "Page 1-3, Section 1.3.1 The draft EIS describes the construction and operation of Columbia dams as a reason for declines in mid-Columbia coho salmon populations. The Department [of Interior] recommends that the final EIS mention that the mainstem dam that was removed in the Methow was the major reason for decline of the coho in the Methow River. The final EIS should discuss how the removal of this dam this affected populations, including the rational[e] for adding fish."

Response: The information about the dam has been added to what is now Section 1.4.1, which discusses how all factors, including this dam and others, affected coho populations. The rationale for attempting to restore coho to both basins is described in Chapter 1.

Comment #10-1: Are coho fish returning now? **Comment #10-2:** Are coho capable of returning for spawning and rearing: are they "smart" fish?

Response to Comments 10-1 and 10-2: Yes, coho are returning now and spawning naturally. See Section 3.4 Coho Population Status.

Comment #10-40: There are coho showing up in traps in the Upper Wenatchee.

Response: Yes, juvenile coho are caught in the Nason Creek trap. Adult coho are trapped at Tumwater Dam. The proposed program would, if successful, increase the numbers and distribution.

Comment #10-35: Will they [coho] be self-sustaining in the future? How savvy are they—do they have adaptive management instincts? **Comment #10-57:** Will we have a natural population [of coho]?

Response: The ultimate goal of the program is to establish a self-sustaining natural population by 2028. As seen in the success to date of the broodstock development program, the lower Columbia River coho used for the initial broodstock were able to adapt to the much longer migrations to the mid-Columbia region. See Sections 1.5 and 2.2.1 of the EIS.

Comment #10-34: When do the eggs and young fish imprint?

Response: The science on when fish imprint is still being debated. So far as biologists know, eggs do not have imprinting capabilities. Salmonids may do some imprinting at the fingerling stage, but most experts believe that the majority of imprinting occurs as a pre-smolt and while smolting. As smolts migrate to sea, scientists believe that imprinting is occurring on the water sources the fish pass through during migration. Other cues may also play a part but are even less certain.

Comment #10-60: DNA data confirms that there are coho/summer-Chinook hybrids. Would this create a problem for the coho program in maintaining the integrity of the coho stock?

Response: Biologists do not believe that this will be a problem. They believe that such hybridization is occurring because the coho broodstock is still adapting to the longer migration. Some returning coho adults that do not have the energy to return further upstream in the Methow likely are spawning on summer Chinook redds in the mainstem Columbia and in the lower basins. The fitness of coho for the long migration back to the upper tributaries is expected to be improved as part of the proposed program. See Section 2.2.1.2 of the EIS for the biological rationale for this expectation.

Comment #10-5: Are coho in the Chiwawa? When do they emerge from redds?

Response: There has been limited coho spawning in the lower Chiwawa, particularly during larger return years. In general, coho salmon emerge from eggs February through April. For more information on the coho life cycle, see Section 3.4.3 of the EIS.

Comment #10-42: Why were coho extirpated in the Methow but steelhead and Chinook are still present?

Response: The likely reasons are discussed in Section 1.4.1.

Comment #10-43: Is there any location on the west coast where coho are now, or are coho in the oceans now that will eventually come back up river? **Comment #10-44:** Where else are they listed?

Response to Comments 10-43 and 10-44: This program used hatchery broodstock from lower Columbia River populations to develop a broodstock adapted to the longer migrations upriver; however, lower Columbia coho populations would not migrate as far upriver as mid-Columbia basins without having imprinted on upper river waters as smolts. Coho salmon are listed under the Endangered Species Act in coastal areas of central and northern California and Oregon, and in the lower Columbia River.

Water Quality Issues

Comment #13-2: "The 2009 Wenatchee River TMDL [Total Maximum Daily Load] for pH and Dissolved Oxygen allocates to LNFH [Leavenworth National Fish Hatchery] 5.7 µg/L [microgram per liter] (maximum concentration) and 0.52 kg/day [kilogram per day] of total phosphorus during the critical periods of March through May and July through October. This wasteload allocation (WLA) represents a 60% reduction from 2002 levels. Because nutrient data were not included in the DEIS for the LNFH, it is not clear whether those nutrient reduction goals are being met. If phosphorus levels cannot be maintained at levels at or below the WLA, the TMDL provides zero further allocation for growth in lower Icicle Creek."

Comment #13-7: "We note that while existing NPDES [National Pollutant Discharge Elimination System] discharge reports do not contain nutrient data, nutrient data have been collected in association [with] efforts to issue a new NPDES permit for the LNFH. We [EPA] recommend that BPA work with LNFH operators to incorporate that data into the FEIS."

Comment #11-6b: "The Department [of Interior] recommends that the final EIS include an analy[s]is of the existing water quality data from LNFH to determine what impact the proposed action will have on the existing Wenatchee River water quality requirements, particularly in regards to phosphorus, pH, and dissolved oxygen in Icicle Creek."

Response to Comments 13-2, 13-7, and 11-6: The water quality analysis for Leavenworth National Fish Hatchery was revised to incorporate data collected at the hatchery. See Section 3.5.3 and the next response.

Comment #13-3 and #13-5: "It is not clear whether LNFH would see an increase in the number of fish released during this phase [natural production phase]. We [EPA] recommend that the FEIS clarify whether the LNFH would acclimate and release additional fish during the natural production phase, and whether the LNFH could meet its WLA [Waste Load Allocation] targets through all phases of the proposed project."

Response: The current smolt release numbers, as shown in Table 2-1, are 500,000 annually from Icicle Creek (Leavenworth NFH). Beginning in approximately 2013, release numbers for Icicle Creek (all from Leavenworth NFH) would be reduced to 100,000 annually during the Natural Production Implementation Phase (1 generation beginning in 2013); to 70,000 during Natural Production Support Phase 1 (3 generations); and to 35,000 during Natural Production Support Phase 2 (2 generations). Two tables from the Master Plan have been added to Section 2.2.1 to show how smolt release numbers into the targeted streams in each basin change through the three natural production phases.

A new analysis of water quality effects of the coho program at Leavenworth NFH was prepared. The hatchery provided nutrient data collected at the hatchery's main outfall, the pollution abatement pond outfall, and at the hatchery intake collected from 2009 through 2011. The hatchery also provided Chinook production data for the same period. In addition, production data for ongoing coho acclimation was obtained from the Yakama Nation over this period.

An approach was developed to quantify the increase in total phosphorus (TP) load from the proposed coho acclimation using the hatchery effluent nutrient data and the fish production data. The revised analysis for Leavenworth NFH used the 100,000 fish production figure in order to identify the maximum water quality impact attributable to the proposed project. The details of this analysis are presented in Appendix 13 and summarized in Section 3.5.3.1, Icicle Creek-

Leavenworth National Fish Hatchery. The analysis indicates that it is unlikely that the proposed acclimation program would increase hatchery loads enough to result in measureable changes in water quality conditions in Icicle Creek. However, proposed new hatchery load limits are calculated based on gross values; incoming river loads are not subtracted from hatchery contributions to calculate the facility's load limits. Under these conditions, coho acclimation combined with upstream loads could contribute to violations of the permit conditions.

Comment #13-4: "...we do note that in the case of LNFH, the draft 401 Certification issued by the Washington Department of Ecology did not authorize mixing zones for any parameters. Therefore, the FEIS should discuss pollution concentrations at the source rather than downriver."

Comment #13-8: "The FEIS should recognize that the State of Washington has not authorized a mixing zone for LNFH. The analysis should therefore demonstrate that all WLAs [Wasteload Allocations] can be met at the point of discharge rather than downstream."

Comment #11-27: "Water quality requirements described in the Draft NPDES permit are measured at the points of discharge, therefore, flows in Icicle Creek and the Wenatchee River cannot be considered as a means of reducing their impacts to the environment."

Response to Comment 13-4, 13-8, and 11-27: The revised water quality analysis for Leavenworth NFH shows total phosphorus (TP) concentrations at the point of discharge. See Section 3.5.3 of the Final EIS.

Comment #11-25: "Appendix 7, page 38, Table 6, row 9 and column 8: Based on the information provided in the draft EIS, this was estimated based on actual data collection. The Department [of Interior] recommends that the final EIS provide information on how many data points were used, the time of the year that the data was collected, and whether the data collection was conducted over multiple years. It may also be helpful to include a column with TP load limits identified in the Wenatchee basin total maximum daily loads study. In addition, the final EIS should include a note that the coho program reared at LNFH is part of its NPDES permit."

Response: The table row and column in the appendix to which the commenter refers in fact did specify in footnote #6 "Loads for the receiving stream (Icicle Creek) represent the total load at the mouth of Icicle Creek for 2002 as determined in WDOE [Washington Department of Ecology] TMDL." Appendix 6 of the EIS provides in detail the data that were collected at existing and proposed acclimation sites. The information about the coho program being part of the hatchery's NPDES permit has been added to Section 3.5.3 of the Final EIS.

Comment #13-6: "The existing NPDES permit for the LNFH expired in 1979. We [EPA] recommend that the FEIS discuss the current status of NPDES permitting, CWA [Clean Water Act] 401 certification and TMDL implementation. This should include an assessment of the ability of the LNFH to meet its WLA targets through all phases of the proposed project."

Response: The NPDES permit status for the Leavenworth NFH is under review at EPA and WDOE. The Yakama Nation has been involved in this review process and has provided input. The proposed coho rearing plans at the hatchery could be affected by discharge regulations imposed on the hatchery (see Comment #11-6 below). For that reason, a backup option to use of Leavenworth NFH was added to the Proposed Action. See Section 2.2.2.1.

Comment #11-26: "Coho salmon being reared at the hatchery by the Yakama Nation are considered part of the hatchery's production program by EPA and is described in its NPDES permit. The hatchery's new draft NPDES permit also describes the coho program as being part of its fish rearing program. The draft permit will impose limits on the levels of phosphorus in the hatchery's discharge water during the spring (March, April, and May) and summer (July, August, and September). The TP limits will be difficult to achieve, especially during the spring months. The TP data collected thus far indicates the hatchery would greatly exceed the spring TP limits required in the Draft permit. The on-station coho rearing program is contributing to the TP load discharged from the hatchery. The proposed reduction of coho being reared at the hatchery from the current 500,000 to 100,000 will continue to contribute phosphorus to the hatchery discharge water. A continued coho program at the hatchery will have an effect on the total number of fish being reared should the draft permit be implemented as is."

"The Department [of Interior] recommends that the final EIS analyze the LNFH coho rearing program and available water quality data and not use the Nason Creek rearing program as a substitute. The Nason Creek program more resembles extensive fish culture while the LNFH coho program is considered intensive. Differences exist in water quality, temperature, feeding methods, fish health, pond/raceway cleaning, fish cover (from the sun and predators), and can influence water quality at the point of discharge in different ways."

Comment #11-6a: "If we [Dept. of Interior] cannot meet water quality standards for Icicle Creek by 2019 (the TMDL compliance timeline), we may reconsider supporting the current and proposed level of coho salmon production from LNFH. Because the fish food is the primary source of phosphorus, the only option for reducing phosphorus discharge to the level of the TMDL is to reduce production and/or the amount of food fed to the fish. The Service [U.S. Fish and Wildlife Service] and the Environmental Protection Agency are seeking clarification from the Washington Department of Ecology on the interpretation of the TMDL requirements."

Response: The revised water quality analysis for Leavenworth NFH uses different discharge data, as recommended by the Department of Interior. See Section 3.5.3. A backup option to using Leavenworth NFH for rearing is described in Section 2.2.2.1. It should be noted that by 2016, the number of coho proposed to be reared at Leavenworth NFH would be reduced to 70,000, as part of a gradual reduction from the current 500,000 annually to 100,000 annually during the Natural Production Implementation Phase (1 generation beginning 2013); to 70,000 during Natural Production Support Phase 1 (3 generations); and to 35,000 during Natural Production Support Phase 2 (2 generations). However, the revised water quality analysis for Leavenworth NFH in the Final EIS was based on the maximum number of coho to be produced in the initial phase of the program (100,000), in order to predict the maximum potential impact.

Comment #11-28: "The draft EIS indicates that '...The effluent from the hatchery is expected to undergo treatment...', however, it is not clear what type of treatment is being discussed. This point should be more thoroughly described in the final EIS."

Response: A description of the proposed effluent treatment process at Dryden is included in Section 3.5.3.3. The process includes using lower-phosphorus fish food, settling ponds and constructed wetlands.

Comment #11-29: "The estimates for effluent phosphorus loads for the proposed hatchery at Dryden appear to be low. The LNFH has more accurate numbers that may benefit the analysis."

Response: The estimates for phosphorus loads from the proposed Dryden Hatchery are lower than for Leavenworth NFH because the effluent treatment system proposed for Dryden is newer and more sophisticated than that used at Leavenworth NFH, and thus would remove more nutrients. See Section 3.5.3.3.

Comment #11-20: "Page 3-35 The draft EIS indicates that lack of water quality data prevented a detailed evaluation of localized impact associated with smaller streams, such as Beaver (Balky Hill and Parmley), Gold, and Wolf (Biddle) creeks. These small steams are known producers of listed steelhead, bull trout, and Chinook. The Department [of Interior] recommends that the final EIS include model predictions for the impact of the addition of 50,000 coho."

Response: The sites mentioned by the commenter are in the Methow basin. As stated in the EIS, a model similar to that used in the Wenatchee is not available for the Methow and it would be prohibitively expensive to develop one. The Methow basin has limited historical information on phosphorus concentrations for the acclimation months. Therefore, to determine the potential for the acclimation-related phosphorus loads to dominate background conditions in the Methow, the analysis was based on a comparison to the impacts assessed for the Wenatchee basin. This method is reasonable because the characteristics of the Wenatchee and Methow basins are comparable (see Section 3.5.3.7 for a detailed discussion of the similarities). Environmental conditions at the Methow sites without water quality data are similar to those that do have that data. Effects at sites with water quality data were negligible, making the conclusion of negligible impacts at similar sites reasonable.

Comment #10-13: Has Ecology determined where P [phosphorus] is coming from in the upper [Wenatchee] basin? Disappointed if ponds/program didn't occur because of human influence up river. **Comment #10-29:** Are the higher phosphorus levels from manmade or natural causes?

Response: The upriver sources of phosphorus include natural sources as well as those from human activity; the same is true for the entire river. However, because the water quality in the lower Wenatchee River is threatened, the coho program, as a new program in the area, must comply with the limits set by Washington Department of Ecology, regardless of the sources of phosphorus already in the river. See Section 3.5.1 for an explanation of the water quality standards with which the program must comply.

Comment #10-45: Do fish in ponds require supplemental feeding? Is there any concern about the feed entering the water system, i.e. extra nutrients?

Response: Yes, coho being acclimated require supplemental feeding. The water quality analysis in Section 3.5 discusses the effects of the nutrients from feed entering the water system.

Comment #10-50: What about the ponds' contribution to increased water temperatures?

Response: The water quality analysis showed no measurable increase in water temperature from the acclimation ponds. See Section 3.5.

Comment #10-39: One stream not mentioned that would be impacted by the proposed project is the [Peshastin?] in the lower Wenatchee.

Response: This comment from the Leavenworth public meeting was recorded by hand and the stream name mentioned in the comment was not clear. We believe it was meant to be Peshastin Creek. The proposed new hatchery at Dryden Dam is at the mouth of Peshastin Creek, and a backup site (Allen) is near Peshastin Creek. The effects of those facilities on Peshastin Creek are evaluated in several sections of the EIS, including 3.5 Water Quality.

Habitat and ESA-Listed Fish

Comment #9-1: Phase coho reintroduction with habitat restoration. Consider not releasing as many coho if habitat is not in place.

Comment #10-52: Concerned that there is limited off-channel habitat, especially below Winthrop and Twisp. Concerned that the addition of coho to this area will increase competition with other fish for the limited off-channel habitat. The project should look at the amount of off-channel habitat available and link coho release numbers to the amount of available habitat.

Comment #11-9: "Based on the information provided in the draft EIS, it appears that the reintroduction project and the project's projected impacts on other fish species is predicated on an assumption that target watersheds are currently below carrying capacity with respect to food and space, and that additional food and space are available to sustain the recovery of coho salmon populations. Although evidence is provided to suggest that coho populations were historically substantial (Mullen [sic] 1984, Mullen [sic] et al. 1992), these estimates are based on available habitat, and may not be sufficient to address carrying capacity under current conditions. In addition, reductions in marine derived nutrients may have reduced carrying capacity to below historic conditions, even in systems where habitat remains largely intact. Assumptions about carrying capacity could have important consequences on the fate of threatened and endangered species, particularly those individuals displaced from coho acclimation sites. The Department [of Interior] recommends that the final EIS contain a more thorough analysis of the carrying capacity of the areas where coho will be introduced and the relationship between the number of stocked fish and that capacity."

Response to comments 9-1, 10-52, and 11-9:

The proposed coho restoration program does not directly tie coho releases to habitat improvements in the basins. A separate YN habitat program is working to develop projects by 2018 and is coordinating with other agencies to implement a habit improvement schedule. See Appendix M of the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan[3] (UCSRB 2007). This plan relied heavily on the priority of habitat actions identified in the Upper Columbia Regional Technical Team (UCRTT) Biological Strategy (UCRTT 2003). The implementation schedule reflects those priorities. Therefore, the implementers (including YN) are tackling those habitat actions that were deemed most important by the Regional Technical Team first. While these habitat actions are not specifically for coho, they will benefit coho. If habitat actions are not being implemented in a given area immediately it is because they are likely lower on the habitat priority list (meaning that the habitat is likely intact or it is in an area that is not currently supporting Chinook or steelhead).

Proposed coho release numbers were based on results of habitat analyses and the All-H's Analyzer model, as discussed in Section 2.2.1.2 of the EIS and below. The predictions of carrying capacity actually are based on current habitat conditions as predicted by the Ecosystem Diagnosis and Treatment model (EDT) described in Mobrand et al. 1997 (YN 2010, Section 5.4). The proposed coho release numbers are less than the estimated capacity, precisely to limit potential adverse effects on other species (YN 2010). However, to achieve the long-term goal of the proposed program, some habitat improvement will need to occur, as documented in the modeling and analyses in the Mid-Columbia Coho Restoration Program Master Plan (YN 2010).

[3] http://www.ucsrb.com/theplan.asp The plan also targets bull trout.

We are unaware of a model that addresses carrying capacity for multiple species. We believe the proposed release numbers, the methods used to develop them, and the extensive monitoring and evaluation program (see Appendix 5 of the EIS, Section 5.2) will effectively minimize adverse interactions among fish species.

In addition, coho, Chinook, and steelhead all have different habitat preferences. Coho, more than the other species, do best in slow water. In a given reach of stream, there will be more total salmon biomass with multiple species than with one species because they will largely segregate based on habitat preference. As stated in the EIS, Section 3.7.3.1 "Combined Effects," in the natural environment, coho prefer slower velocity habitats above other habitats with stronger current (Solazzi et al. 1998). While other salmonid parr use these habitats, many prefer pools in streams or other channel habitats with more velocity (Cramer and Ackerman 2009).

These three species evolved together and co-exist throughout their range. The EIS analysis also suggests that increased numbers of coho spawning naturally in the two basins would increase the amount of marine-derived nutrients that currently could be well below historical levels, thus improving carrying capacity; however, that expected improvement is not part of the models.

We have added a detailed explanation to Section 2.2.1.2 to summarize how the release numbers were developed. It is summarized below.

The habitat analysis used two different models. One is based on a method described by Zillges (Zillges 1977); the other is the Ecosystem Diagnosis and Treatment model (EDT) (Mobrand et al. 1997). These two models were used to predict an individual stream's capacity for coho production. In cases with a discrepancy between the capacity estimates, YN used the mid-point between the two values (YN 2010). A third model, the All H's Analyzer was used, with the habitat capacities predicted from Zillges and EDT, plus harvest and survival rates, to predict the numbers of coho needed to achieve a sustainable population.

The habitat capacity analysis addresses the capacity for only one species, not multiple species, and we are unaware of a model that addresses carrying capacity for multiple species. The analysis is based on published and unpublished data and information on the habitat attributes of 119 stream reaches in the Wenatchee and 148 stream reaches in the Methow. As described in the Master Plan (YN 2010), Section 2.4.3.1, the process for developing the inputs to the EDT diagnosis for coho in each of the basins included work by a group of biologists from WDFW, USFWS, USFS, tribes, counties, and several environmental consulting firms. These processes are described in more detail in the Upper Columbia Salmon Recovery Plan (UCSRB 2007) and the Methow Subbasin Plan (NPCC 2004b).

As stated in the Master Plan (YN 2010 Section 5.3.1), the capacity values produced in the analysis were used as the upper limits for the proposed program. To minimize potential species interactions, the actual smolt release numbers beginning in 2013 would result in seeding levels below the estimated capacity, but are predicted to result in an adequate spawning escapement for which natural selection would begin the local adaptation process (YN 2010). After three years, the program proposes to reduce the smolt release numbers by 30%, and then to reduce them again after six years by 50%.

The habitat analyses and All-H models are extremely complex. The predictions resulting from them rely on the accuracy of the information and data that goes into them. As discussed in Appendix F of the Recovery Plan (USCRB 2007), predictions can vary substantially depending on the assumptions about only one factor, such as survival rates. However, these are the best sources available at this time.

Comment #11-22: "Page 3-62: The number of juvenile Chinook and steelhead potentially displaced from proposed acclimation sites was calculated to be low and assumed to be relatively insignificant. The calculations themselves may or may not be fine, and it is true that the potential number of fish displaced would likely be low compared to total populations. However, off-channel aquatic habitats, such as side channels and wetlands, may be disproportionately important rearing habitats for sensitive species. These habitats likely provide differential growth conditions for species such as Chinook and steelhead, which may be important for sustaining life-history diversity and long-term population productivity. For example, at a larger spatial scale, Hilborn et al. (2003) found that the overall portfolio of habitats was essential for sockeye salmon productivity in the Bristol Bay region. The Department [of Interior] recommends that the final EIS describe the effects of losing these rearing habitats for sensitive species if the habitats are at carrying capacity."

Response: The Interior Department's use of the term "losing" habitats causes us to be concerned that the Department believes that sensitive species will be permanently displaced from coho acclimation sites. As discussed in Section 3.7 of the EIS, no habitat would be permanently lost, and not all the proposed sites would displace fish from habitat currently accessible to them. Some sites will be new ponds and others are in areas that are not now accessible to salmonids or other fish. Three sites in each basin could displace listed and other fish from habitat currently accessible to them for 6-7 months each year; 4 sites in the Wenatchee and 5 in the Methow could displace other fish from sites currently accessible to them for up to 2 months each year. The acres involved are 0.49 acre total for the 3 winter sites in the Wenatchee; 0.38 acre total for the 3 winter sites in the Methow; 0.8 acre total for one spring site in the Wenatchee that is not currently in use; and 0.58 acre for the 5 spring sites in the Methow.

As discussed in the response to the comments 9-1, 10-52, and 11-14 above, we know of no method that allows analysis of carrying capacity for multiple species. Release numbers were developed based on the best available models, and designed to minimize potential effects to sensitive species. However, in an effort to address the concern that the proposed coho acclimation sites are in areas of limited off-channel habitat, we attempted to identify, based on existing survey data, the percentage of off-channel habitat in the vicinity of coho sites and to determine the percentage of that habitat excluded from use by other fish for either 2 months or 7 months. That analysis appears in a new subsection in Section 3.7.3.1 "Effects on the amount of side channel habitat at individual coho acclimation sites."

Comment #10-48: What about loss of rearing habitat for Chinook? Other salmon?

Response: See response to Comment 11-22 above. No rearing habitat for any fish will be lost. Some fish might be temporarily displaced from a very small amount of rearing habitat, but no habitat will be permanently lost. Project activities will add a small amount of habitat. See Section 3.7.

Comment #10-30: Table ES-6 indicates that fish other than coho will be excluded from passing upstream—is that true?

Response: As indicated in the analysis in Section 3.7 of the EIS, some fish might be temporarily displaced from a small amount of habitat that that they use for migration or rearing. None of the acclimation sites would prevent any fish from moving to upstream or downstream habitat: in other words, no stream would be completely blocked off due to coho acclimation activity.

Comment #11-12: "The Bureau of Reclamation has plans, along with the Yakama Nation, to restore floodplain connectivity in a large swath of the mainstem Methow River. An assessment of the numbers of fish that use these existing and potential off-channel habitats is a major objective of ongoing studies funded by the Bureau of Reclamation in the Methow basin, with the U.S. Geological Survey conducting the fisheries studies. …The Department [of Interior] proposes that the Yakama Nation biologists and managers meet with USGS in an effort to identify potential areas of collaboration and information sharing among these efforts."

Comment #10-59: The monitoring report for the Methow will be available for all species in 2012. [This is the report from the monitoring program discussed in comment #11-12.] Will this be included in the EIS?

Response to comments 11-12 and 10-59: Thank you for your suggestion. Yakama Nation biologists and managers have been meeting with the U.S. Geological Survey on this issue. The EIS will be published before the monitoring report is published.

Comment #10-56: What habitat work is going on now?

Response: A number of entities are doing habitat restoration in both basins. Information, including maps, was added to Section 3.15.3 describing some of these projects. See also the response to comments 9-1, 10-52, and 11-9 above.

Comment #11-11: "Page ES-11: Table ES-6, row 7; Page 3-71, Sections 3.7.5.1, 3.7.5.2, and 3.7.5.3 bulleted lists: The draft EIS states that listed fish will be blocked off from potentially limited habitat (i.e., off-channel habitat for juvenile spring Chinook) in the preferred alternative. The Department [of Interior] recommends that the final EIS include a description of avoidance measures to minimize impacts to listed fish from construction activities. Also, the Department recommends that the final EIS describe mitigation measures to be taken for loss of habitat, how the numbers of each species that would be excluded were derived, and any control measures that may be implemented, including thresholds that invoke them."

Comment #11-8: "The Department [of Interior] recommends that the final EIS include a discussion of when and if it may be appropriate to implement control measures to limit coho expansion as well as identify potential options. If harvest is expected to be a primary tool, the final EIS should describe the likelihood that listed fish will be included in this harvest as by-catch."

Response to Comment 11-11 and 11-8: As stated in the response to Comment #11-22 above, no habitat is permanently blocked to use by other fish. A new subsection has been added to Section 3.7.3.1, entitled "Effects on the amount of side channel habitat at individual coho acclimation sites" to address concerns raised during review of the Draft EIS about the amount of side-channel habitat.

The mitigation measures that would be used to minimize construction impacts to listed fish were listed in Section 3.7.5.1 and have been expanded upon in the Final EIS. As well, BPA is funding other habitat improvements in these basins as described in Section 3.15.3 "Cumulative Impacts/Fish."

The description of the method used to calculate the number of fish excluded has been expanded from what was originally in Section 3.7.3.1, under "Combined Effects of Excluding Listed Fish from Incubation/Rearing and Acclimation Sites."

A terminal harvest is a tool to control the numbers of coho, and in fact has already been used. As described in the Master Plan (YN 2010), specific numbers of hatchery-origin and natural-origin fish are proposed for escapement as well as for broodstock in order to meet the final goal of PNI >0.5. Tables showing those target numbers appear in Section 5.4 of the Master Plan. If coho return numbers are large, as they were in 2011, YN would recommend a sport fishery on coho to Washington Department of Fish and Wildlife (WDFW) or would implement a tribal fishery when it is clear the target numbers for broodstock and escapement would be met. WDFW holds the ESA permit for sport fisheries in these basins and can approve or disapprove the fishery, which is strictly regulated. Because the run timing of coho and steelhead overlap, the coho fishery would coincide with the steelhead fishery. WDFW's permit #1395 specifies that the fishery must close down after a 2% hooking mortality on listed fish (natural-origin steelhead) in a normal run year. (The allowed mortality can increase to 4 – 5% in years with particularly large runs.) In the event a terminal coho fishery could not be held, a mainstem coho fishery could be implemented or excess coho could be removed at the dams, although the latter is considered an undesirable option, since the ultimate program goal is to provide sufficient coho for harvest. A subsection has been added to Section 3.7.3.2 "Impacts of increased numbers of coho in the basins" that addresses the issue of impacts on listed fish of a coho harvest.

The Department of Interior suggests that this would be a tool to limit interactions with listed species. The Yakama Nation proposes a detailed monitoring effort to determine baseline status of listed species in the release areas, to monitor whether that status changes, and to determine if the changes are due to coho. See Sections 3.7.3.2 and 3.7.5.3 and Appendix 5, Section 5.2.

Comment #11-19: "Page 3-3, Table 3-1, row 2 The table states that 'Listed species would be monitored to determine if adverse effects occur with increasing densities.' The Department [of Interior] recommends that the monitoring program be described in the final EIS."

Response: This part of the monitoring and evaluation program was discussed in Section 3.7.5.3, with details presented in Appendix 5, Section 5.2. A summary table showing the monitoring program has been added to Section 2.2.3.

Comment #11-23: "Page 3-62, Table 3-22 The Department [of Interior] recommends that the table provide more specific information for those streams that are more important to listed fish rather than a basin-wide approach."

Response: The stream-specific information was supplied on the next page in Table 3-23 and Table 3-24.

Comment #10-47: Did you look at density effects on juvenile Chinook? **Comment #10-51:** Were coho released as part of the feasibility study, and are there any concerns about current coho in the system? Are they going to compete with other species' habitat?

Comment #11-14: "Page 1-6, Table 1-1 row 2 Based on the information provided in the draft EIS, competition for food and space was assessed by tracking habitat use and fish condition in a single tributary by supplementation of hatchery coho. Potential problems with this approach include:

1. The use of hatchery instead of naturally spawned fish.

2. Study looks at habitat overlap, not overlap in food resources.
3. Results show no differences in fish condition and growth, but does not address survival, abundance, and emigration.
4. Food web interactions were not evaluated.
5. Over-winter habitat use and potential competition were not assessed.

The Department [of Interior] recommends that the final EIS address the potential limitations to this approach and how that may affect inferences about competition with other species."

Response to Comments 10-29, 10-47, and 11-14: The table cited in Comment 11-14 is a brief summary of the conclusions from detailed studies designed to answer the specific feasibility questions described in that section. The purpose of that table and that section was to report the status of the feasibility studies and the types of questions addressed, not to provide an analysis of impacts. Results of several studies from several annual reports are summarized in somewhat more detail in Section 3.7.3.2. Feasibility studies did examine competition and predation impacts to listed and sensitive species from releases of coho. The analysis acknowledged the limitations of the studies due to the low densities studied, which were due to the small population of naturally reared coho. The Technical Work Group (see footnote to Table 1-1) that advised the YN on feasibility study designs agreed that meaningful studies of competition between naturally produced coho and sensitive fish species could not be undertaken until naturally produced coho populations increased. The planting of hatchery coho parr and assessing their habitat use compared to spring Chinook was an attempt to provide a surrogate for the naturally produced coho in an important spring Chinook stream, to determine during the feasibility phase if there were serious competition effects that would suggest that the program should not pursue the attempt to establish a natural population of coho. Such effects were not found, but the YN acknowledges the need to study effects at higher densities with naturally produced fish. A detailed monitoring effort is proposed to determine baseline status of listed and sensitive species in the release areas, to monitor whether that status changes, and to determine if the changes are due to increased numbers of naturally reared coho. See the new summary table in Section 2.2.3 and Appendix 5, Section 5.2.

Comment #10-58: Will there be monitoring of competition effects in the Methow? What numbers of coho would be required to begin the monitoring studies on competition?

Response: The status of ESA-listed and sensitive species will be monitored in both the Wenatchee and Methow basins. Appendix 5, Section 5.2, explains in detail the program to study interaction effects. Monitoring of the baseline status of other species is ongoing and would continue through the Natural Production Support phases. It is recognized that, if reintroduced coho were having an adverse effect on other species, the status of those species (e.g., numbers, condition, etc.) would change. However, as pointed out in Section 5.2.1, a change in status of other species does not explain what caused it. If a decline in status is detected, further investigations into the source of the decline and the mechanism of interaction between coho and the other species are warranted. Techniques and protocols of such studies are described in Section 5.2.2 of Appendix 5.

Comment #10-24: Coho releases should be limited until studies determine what adverse impacts to other fish would be. Concerned that it is too late to consider alternatives to the proposal and that everything has been decided already.

Response: As stated in the response to Comment 10-58 and in previous responses, studies have already been done on the impacts to other fish. Adverse effects were not found, but the YN acknowledges the need to study effects at higher densities with naturally produced fish. A detailed monitoring effort is proposed to determine baseline status of listed and sensitive species in the release areas, to monitor whether that status changes, and to determine if the changes are due to increased numbers of naturally reared coho. See the description of the monitoring and evaluation program in Appendix 5, Section 5.2. Alternatives to the proposal have been examined extensively through the Northwest Power and Conservation Council's Fish and Wildlife Program, and this project would be managed to adapt to the results of the monitoring program, to ensure that the program does not cause significant adverse effects.

Comment #11-21: "Page 3-55, Section 3.7.3 The South Fork of Gold Creek is one of the biggest producers of steelhead in Gold Creek and blocking the stream may impact a large portion of Gold Creek steelhead. In addition, steelhead are likely to be affected if coho are introduced into Beaver Creek in the Methow River watershed. Also, significant work has been undertaken to open up fish passage in Beaver Creek, specifically for ESA-listed steelhead. The addition of 50,000 hatchery coho may impact recovering steelhead populations; therefore, the Department [of Interior] recommends that the final EIS describe measures that will be taken to eliminate the risk to ESA-listed steelhead."

Response: The Department of Interior does not say how coho would affect steelhead. As we stated in the EIS (Section 3.7.3.2), only spring Chinook and bull trout would be small enough to be prey for coho during rearing and acclimation. However, feasibility studies showed that coho rarely prey on other fish after they are released as smolts, and they migrate quickly once they are released.

If competition for habitat is the concern, the proposed acclimation sites on the South Fork of Gold Creek (Gold) and Beaver Creek (Parmley) are in man-made ponds; Parmley is a farm pond. The nets would partition part of each pond (0.08 acre in each case) for coho acclimation and would not block, either partially or totally, either stream from which the water is diverted (see Appendix 3). In the case of both the proposed Gold and Parmley sites, the nets would be in place for 6 weeks in the spring. These sites likely are accessible to listed fish because the diversions from the streams to the ponds in both cases are unscreened. As stated in Sections 2.2.2.3 and 3.7.5.2 of the Draft EIS, on any stream with listed fish where nets are proposed to be placed in the stream, the nets used to enclose coho for acclimation would not completely block the stream but would allow passage for other fish. Section 3.7.5.2 also states that the nets would be installed in such a way that any listed fish would be excluded from behind the net and ponds that might contain listed fish would be surveyed to ensure no listed fish were trapped within.

There is no literature that suggests that coho have adverse effects on steelhead. Studies, including those done for the feasibility phase of this project, have shown that habitat use is largely different. In just one example, Spaulding, et al. (1994) state:

> "Throughout the study coho salmon and steelhead occupied different space and microhabitat."
>
> "We conclude that introduced coho salmon juveniles in two Wenatchee River side channels did not negatively interact with existing populations of Chinook salmon or steelhead."

However, to ensure that naturally produced coho do not adversely affect listed species, the monitoring and evaluation program includes ongoing monitoring of the status of and changes to non-target species. See Appendix 5.

Comment #11-17: "The draft EIS states that 'Restoration of individual populations may not be possible without restoration of other fish and wildlife populations with which they co-evolved. (NPCC 2004a).' The Department [of Interior] recommends that the final EIS describe how the present day forage base and predators differ from the species 'with which they coevolved' and any plans to restore those species."

Response: The quotation cited in the comment comes from the Northwest Power and Conservation Council's Wenatchee Subbasin Plan (NPCC 2004a.). BPA quoted the plan as part of a discussion to demonstrate how BPA would be providing mid-Columbia coho mitigation in a manner consistent with other regional plans, which seek to improve the ecological balance of natural systems in the subbasins. Comment 11-17 appears to suggest that BPA should undertake primary productivity studies prior to proceeding. BPA notes that the suggestion arrives in the absence of a formal proposal, a recommendation from the Council, ISRP review of a study plan, or a budget. Given that resource managers themselves proceed with similar mitigation efforts without primary productivity studies in hand, BPA believes such information is not necessary for this proposal.

Comment #11-4: The addition of post-spawning coho carcasses at the beginning of winter is likely to improve over-winter survival of all species with the addition of marine-derived nutrients.

Response: We agree, as discussed in Section 3.7.3.2.

Comment #10-41: What is the most sustainable and best environment for the listed species?

Response: That is a question that resource managers struggle with and will continue to try to determine, probably for generations to come. Certainly the answer depends to some degree on the species. However, it is generally accepted that an environment that is healthy for one species, including humans, is healthy for others, listed or not. The sustainability of these environments involves political as well as scientific choices, and the answer depends on entities and processes far beyond the scope of this EIS.

Comment #11-10: "Page ES-10: Table ES-5, row 5 This table indicates that the proposed mitigation measures may 'provide ecological benefits that would aid in listed species recovery;' however, it's not clear what these 'ecological benefits' include. The Department [of Interior] recommends that the final EIS include a description of the ecological benefits that are expected to aid in listed species recovery."

Response: The commenter misread this summary table. The reference to ecological benefits did not refer to mitigation measures. Ecological benefits of coho restoration were discussed in Section 3.7.3.2, and are not expected to benefit only listed species.

White River

Comment #10-8: Is the White River controversy the only area of controversy?

Response: The White River has been controversial for salmon recovery projects developed by other entities. The coho restoration program proposes minimal or no development on three sites in the White River subbasin, which are on the property of willing landowners. Elsewhere, all other development proposed for the program is based on use of property with willing landowners, and includes minimal or no construction development. The public review of the Draft EIS is intended to allow interested parties to express their concerns and questions, and BPA is required to address those concerns. This appendix discloses the concerns that have been raised and how the agency has addressed them.

Comment #10-9: Is White River essential to the program?

Response: The YN might be able to reach its coho restoration goal in the Wenatchee basin without releasing coho in the White River. However, the White River and its small tributaries have good coho habitat potential.

Comment #10-19: White River is not a good area to conduct this experiment. **Comment #10-20:** Why backfill wetlands in the White River to conduct an experiment that has questionable levels of success? **Comment #10-21:** The White River is pristine jewel that should be protected at all costs. **Comment #10-23:** Acclimation sites in the White River watershed are a concern, as is backfilling wetlands.

Response to Comments 10-19, 10-20, 10-21, and 10-23: No wetlands will be filled at any project sites, including at those in the White River watershed. Three project sites would be in the White River watershed: Tall Timber, White River Springs, and Dirty Face (an adult plant site). Only Tall Timber requires any construction activity; the effect on the wetland, if any, would be to increase the amount of water in the existing side channel, but wetlands would not be filled with soil. Water quality modeling showed no measurable change to water quality from the two acclimation sites. Adults are not fed, so there would be no nutrients entering White River from the Dirty Face site. Please see Sections 3.5 (Water Quality) and 3.9 (Wetlands). At this point, now that feasibility studies have been completed, the program is no longer considered an experiment, but monitoring would continue to ensure that the program is not significantly affecting the environment.

Comment #10-18: There are no control sites to study the effects of the project. **Comment #10-22:** Consider using the watersheds above Wenatchee Lake [as controls]. Would the White River and Little Wenatchee River be good controls for the overall coho reintroduction program?

Response to Comments 10-18 and 10-22: The feasibility studies that were undertaken beginning in 1996 did not identify any significant environmental impacts from either constructing and operating the acclimation facilities or from releasing coho into these basins. As stated in the previous response, monitoring is ongoing and would continue to ensure that the program is not significantly affecting resources in the White River or in any other subbasin.

Other Sensitive Species

Comment #7-4: "Table 3-31, Documented state listed Priority Habitats and Species – While footnote 'a' of Table 3-31 notes that '*The WDFW [Washington Dept. of Fish and Wildlife] PHS [Priority Habitat and Species] list also includes all federal ESA-listed species (Table 3-30)*', Table 3-30 does not appear to include all threatened and endangered species documented in the Methow Valley where project sites are proposed. This should be double-checked, and if this is the case, the site specific analysis in Table 3-31 should be updated where applicable, and any adverse environmental impacts identified and mitigated where applicable."

Response: The footnote was somewhat unclear and has been revised to state: "The WDFW Priority Habitat and Species (PHS) list also includes all federal ESA-listed species; the non-fish ESA species documented at the project sites are listed in Table 3-34." Table 3-34 is the new number for what was Table 3-31 in the Draft EIS.

Table 3-33, which shows federally listed species at project sites, was revised to include Canada lynx and gray wolf; a discussion of why impacts are not expected has been added to the text. No designated critical habitat for any of the non-fish ESA-listed species is present. Table 3-34 was revised to identify documented occurrences of other state-listed species within 1,000 feet of the project sites. No ESA-listed or PHS plant species were found at any project sites. The definition of "presence" has been added: for this EIS, presence at the site is defined as documented occurrences within 1,000 feet of the site.

Comment #6-2: Sockeye were not mentioned in the EIS. I want to ensure that the proposal takes into account the existence of a viable population of sockeye salmon that spawn in the Little Wenatchee and White River watersheds, both of which are tributaries of Lake Wenatchee. These fish provide an important sport fishery and deserve notice and protection.

Comment #10-14: What about sockeye exclusion/interaction, adult and juvenile? **Comment #10-31:** Will sockeye have access to spawning beds and be impacted by this project (i.e., nets might block their habitat and migration)?

Response to comments 6-2, 10-14, and 10-31: Effects on sockeye salmon were discussed in Sections 3.7.3.2 and 3.7.3.3. Feasibility studies specifically focused on coho predation on sockeye, showing no effect. Table 3-25 (Table 3-28 in the Final EIS) recognizes that impacts on sockeye would be similar to those for spring Chinook, but less; displacement of juvenile sockeye by coho in the White and Little Wenatchee would be less than for spring Chinook because most sockeye rearing probably is in Lake Wenatchee. Adult sockeye would not be excluded from any habitat, nor would sockeye migration either upstream or downstream be prevented, since no stream will be completely blocked by coho acclimation activity.

Wetlands

Comment #13-10:

- We [EPA] recommend that the FEIS update section 3.9 to reflect the results of the 2011 wetland delineation.
- If unavoidable impacts to wetlands are identified and compensation is required, we recommend that the FEIS identify appropriate compensation measures.

Response: Section 3.9 has been updated to reflect the results of the 2011 wetland surveys and revised plans. No wetlands will be filled at proposed sites. At the proposed Newby acclimation site, up to 100 square feet of wetland would be lost to a discharge pipe outfall, which would be below the ordinary high water mark. No compensation is required.

Economic Costs and Benefits

Comment #11-7: "Page ES-3: The draft EIS states that Mullan (1984) estimated that the historical mid-Columbia River adult coho populations for the Wenatchee and Methow basins were 6,000 - 7,000 and 23,000 - 31,000, respectively. According to Table ES-3, peak operating costs (2013) by basin, operating costs are anticipated to be $2,429,982 for the Wenatchee Basin and $1,777,778 for the Methow Basin. The Department [of Interior] recommends that the final

EIS include a discussion of how the resource allocation decisions between the two basins were made."

Response: The difference in operating costs between the two basins primarily reflects the costs of operating the proposed new hatchery in the Wenatchee basin and the larger number of coho initially released there. Two fewer dams for the coho to cross and existing in-basin trapping facilities made the Wenatchee the preferred basin to focus on for the broodstock development efforts. However, when the program transitions to the natural production phases in approximately 2013, the effort in the Methow will increase and the smolt release numbers will increase to one million, comparable to smolt releases in the Wenatchee (see Table 2-5 in Section 2.2.1). This explanation has been added to Section 2.2.4.

Comment #11-16: "Page 2-31 The document states that 'The difference between producing all the fish at one location versus at multiple locations may be in excess of $6,000,000 over a 20-year period…Important factors used to evaluate rearing system options include the ability to produce fish that return to targeted areas at high survival rates. The degree of difference between the various systems' adult survival rates is unknown.'

"Based on the stated purpose of 'develop[ing] a locally adapted, self-sustaining, naturally spawning coho stock that occupies its historical habitat in the Wenatchee and Methow river basins,' it appears that the relevant metric is the cost per fish returned. If no data are available, and costs are high, the Department [of Interior] recommends monitoring to determine the return rate for fish raised under those rearing conditions."

Response: Data for calculating the cost per returning coho adult will be readily available, and Interior may use that data as appropriate. Instead of the cost per fish returned, BPA believes the appropriate metric is smolt-to-adult survival. As described in Appendix 5, Section 5.1.8, smolt-to-adult survivals will be monitored to determine differences in survival based on rearing conditions: "SARs [Smolt-to-adult returns] will also be used to compare the 'quality of smolt' produced by different rearing strategies, acclimation sites, acclimation duration, and time of release. Knowing how smolt-to-adult survival indices correlate with rearing and environmental conditions will allow researchers to adaptively manage the reintroduction effort to maximize survival. The SARs will be used to evaluate rearing strategies and rearing facilities to maximize survival."

Comment #10-15: What is the cost to BPA of the feasibility studies versus the entire program? What is the economic benefit? Has an attempt been made to compare the financial benefits and costs of the project? Shouldn't that be a concern in these financially difficult times?

Response: The cost of the feasibility studies (estimated through 2010) was approximately $24 million. The expected additional cost of the program proposed in this EIS through 2028, including capital costs and operational expenses, is expected to be approximately $59 million. This information has been added to Section 2.2.4.

No attempt has been made to compare the financial benefits and costs. Cost/benefit analyses are not required under NEPA. Section 1502.23 of the Council on Environmental Quality Regulations for implementing NEPA states:

> *For purposes of complying with the Act [NEPA], the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an*

environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision.

Experience has shown that it is extremely difficult to objectively quantify qualitative benefits such as the increase in marine-derived nutrients from coho carcasses, the restoration of a species that once occupied these basins, or the restoration of an important part of the culture of the Columbia River Indian tribes.

If the project decision were based solely on quantifiable costs and benefits, then the costs clearly would outweigh the direct and indirect employment attributable to the project and the financial value of the harvest in the region. That said, costs are one factor in the decision and additional information about them has been added to Section 2.2.4.

Comment #10-38: The cost to every living organism is immense with the loss of a species and it is economically unquantifiable.

Response: Thank you for your comment.

Comment #10-36: Does the Yakama Nation have their own funding? Could the program and project be impacted in the future with funding cutbacks?

Response: The Yakama Nation does not have sufficient funds of its own to implement this program. The 2008 Columbia Basin Fish Accords commit BPA funding for this project at current levels through 2018, but the program could be affected by funding cutbacks of other entities (see Sections 2.2.2 and 2.3).

Comment #10-25: How will people see financial benefit from the proposal? I caught a large number of coho that were inedible. **Comment #10-32**: Where is the positive economic return to central Washington? My goal is for you to make me money.

Response: The economic benefits are discussed in Section 3.12 Socioeconomics. The BPA Fish and Wildlife Program is a mitigation program for impacts to fish and wildlife resulting from the Federal Columbia River Power System and therefore is not designed to make a profit for anyone. A terminal harvest held in fall of 2011 in the Wenatchee and Methow basins resulted in fishing opportunities for sport anglers, with the consequent economic benefits as discussed in Section 3.12. As the program improves the broodstock's adaptation to the migration distances from the ocean to the mid-Columbia basins, the quality of harvested fish is also expected to improve.

Comment #10-33: The economic impact on the Methow (from the fish industry) was 10,000 hours last year (gas, fish licenses, equipment…). **Comment #10-7:** One cannot get a clear understanding of the economic benefit just by looking at dollars spent and the return in dollars; for example, a great deal of money is spent on recreational activities that is not tracked. **Comment #8-3:** "Economic cost v. benefit: The feasibility study costs are also economic benefits—the consultants, BPA and Yakama staff receive payments (income) from the program ('costs') and take them home to buy groceries, pay school taxes, etc. So the benefit is greater than any expenditures of fishermen."

Response: Verifiable data for the value of recreational and other fisheries was limited. While it is clear there would be some economic benefit attributable to an expected coho harvest, we left the analysis general. The likely benefit is small compared to the total cost of the project and is not a deciding factor. We agree that there is also some employment benefit, although that, too, is relatively small. (See Section 3.12.)

Comment #11-5: The Proposed Action may also provide mainstem and terminal harvest which would generate moderate economic benefit.

Response: There probably will be some localized economic benefits, but the level of economic benefit is not possible to predict with any accuracy with currently available data.

Support Project

Comment #2-1: "Salmon restoration is important."

Comment #4-1: "I trust the Yakama Nation to develop a good plan. I support the work of the Yakama Nation. They are good observers and conservers of nature. God bless them and aid them in all their endeavors to right the wrongs of past decades."

Comment #8-2: "The proposed project...appears well developed and financially conservative. Very impressed by the minimal physical impact."

Comment #10-54: Program would work; fish are hardy.

Comment #11-1: "DOI [Dept. of Interior] supports the Yakama Nation's Mid-Columbia Coho Restoration Program and through USFWS [U.S. Fish and Wildlife Service] has worked cooperatively with them through the feasibility phase. . . . We will continue to cooperate with the Yakama Nation and encourage continued support by BPA."

Comment #11-2: "The coho program appears scientifically sound and is consistent with watershed plans and objectives of the spring Chinook and steelhead recovery plan."

Comment #11-3: "We [Dept. of Interior] agree that the feasibility phase results show a reasonable likelihood of success for the full-scale coho reintroduction proposed in the draft EIS."

Comment #13-1: "EPA supports the overarching goal of restoring a locally adapted, self-sustaining, naturally spawning coho stock in the Wenatchee and Methow river basins. Our review found the DEIS to be thorough in many respects, however we did identify a limited number of questions and concerns."

Response: Thank you for your comments.

Oppose Project

Comment #10-18: Opposed to project, especially the acclimation site in the upper reaches of the [Wenatchee] watershed.

Response: Thank you for your comment.

Public Meetings

Comment #6-1: "...I attended a meeting of the public with the BPA and the Yak[a]ma Nation on the subject of a coho salmon re-introduction in the Wenatchee and Methow basins. This meeting, held in Leavenworth, though attended by no more than forty people, was, I feel, very productive. Those questions that I had about the specifics of the program were well answered by the representatives of the proposal."

Comment #8-1: "[Today's event, Leavenworth public meeting, was] well organized, well planned, educationally valuable."

Response: Thank you for your comments.

Other

Comment #11-18: "Page 3-2 and 3-3, Table 3-1, rows 3, 4, and 7. The Department [of Interior] recommends that the final EIS include references for the information regarding 'Effects of water withdrawals on groundwater supply' and 'Effects of surface and groundwater withdrawals on water rights,' as well as the population estimates related to 'Reduced access to migration or rearing habitat for ESA-listed and other fish.'

Response: The commenter refers to a summary table, prepared to give the reader a compact summary of the major conclusions about environmental effects reached as a result of the analyses documented in Chapter 3. It is not necessary or appropriate to supply a list of references for those conclusions in the table. Documentation of conclusions for all the analyses was supplied in each section of Chapter 3. See Section 3.6 for analysis of effects of water withdrawals on groundwater supply and water rights and Section 3.7 for discussions of reduced access to migration or rearing habitat for ESA-listed and other fish.

Comment #10-37: Are you going to analyze why coho have been successful, for lessons learned for other listed species (e.g., hatchery practices, travel to and from the ocean...)? Will the monitoring plan tease it out?

Response: The monitoring and evaluation plan will help answer some of the questions about techniques and practices that contribute to the success of the program. Some of these analyses might be applicable to listed species. The program provides annual reports of monitoring and evaluation results that are publicly available on BPA's website at: http://efw.bpa.gov/IntegratedFWP/technicalreports.aspx

Comment #8-4: "I would like info on Mullan (1984) and the estimated historical mid-Columbia River coho population."

Response: The reference material was sent to the commenter. Mullan estimated, as stated in Section 3.4.1, that historically 120,000-166,500 coho were attributed to the mid- and upper Columbia tributaries (Yakima, Wenatchee, Entiat, Methow, and Spokane rivers). Mullan estimated that the Wenatchee River supported adult returns of approximately 6,000 – 7,000 coho and the Methow River supported 23,000 – 31,000. The full citation is: Mullan, J.W. 1984. Overview of artificial and natural propagation of coho salmon (Onchorhynchus kisutch) on the mid-Columbia River. Fisheries Assistance Office, U.S. Fish and Wildlife Service, Leavenworth, WA. 37 pp.

Public Comment Letters

COHO11 0004

Department of Energy

Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

ENVIRONMENT, FISH AND WILDLIFE

June 21, 2011

In reply refer to: KEC-4

To: Parties Interested in the Confederated Tribes and Bands of the Yakama Nation's (Yakama Nation) Mid-Columbia Coho Restoration Program

You are invited to review and comment on the draft environmental impact statement (EIS) for the Yakama Nation's Mid Columbia-Coho Restoration Program located in Chelan and Okanogan counties, Washington. The Yakama Nation would sponsor the reintroduction program; the Bonneville Power Administration (BPA) would provide the funding if approved. The draft EIS describes the proposed fish production program and hatchery facilities, and analyzes the potential environmental effects from program operations and facility construction. Your comments on the draft EIS will help us refine the environmental analysis and decide whether to fund the program.

The restoration program is an effort to restore coho salmon to the Methow and Wenatchee basins using information and techniques developed as part of the Yakama Nation's Mid-Columbia Coho Reintroduction Feasibility Project. The Yakama Nation has also prepared a Master Plan to guide the development of the reintroduction program.

Project background 4-1 Yes! I trust the Yakama Nation to develop a good plan.

Over the next 20-25 years, the proposed program would develop a locally adapted, self-sustaining population of coho in the Mid-Columbia basin, capable of supporting harvest. Hatcheries and acclimation facilities used in the feasibility studies would continue to be used. In addition, a new small hatchery in the Wenatchee basin is proposed; and a few existing ponds or side channels would be modified and new ones constructed to serve as semi-natural rearing and acclimation areas for juvenile coho salmon.

Public Meetings

You are also invited to attend our open house public meetings on this project. The meetings will be held:

July 13, 2011 5:30 – 8 p.m.
Chelan Fire District 3 Community Center
228 Chumstick Highway
Leavenworth, WA 98826

July 14, 2011 5:30 – 8 p.m.
Methow Valley Community Center
201 South Methow Valley Highway
Twisp, WA. 98856

Meeting Agenda:
5:30-6:00 Open house
6:00-7:00 Presentation
7:00-8:00 Return to open house

Project team members will be available to take your comments on the draft EIS and answer any questions you may have.

4-1 I support the work of the Yakama Nation. They are excellent observers + conservers of nature. God bless them + aid them in all their endeavors to right the wrongs of past decades. Carolyn

How to comment
Comments are encouraged and will be accepted through **August 8, 2011.** Comments may be submitted online at: *www.bpa.gov/comment*, via mail to: Bonneville Power Administration, Public Affairs Office - DKE-7, P.O. Box 14428; or by fax to (503) 230-4019. You also may call us with your comment toll free at 1 (800) 622-4519. Please reference "Mid Columbia-Coho Restoration Program" with your comments. All your comments will be posted in their entirety on BPA's website at *www.bpa.gov/comment.* Comments and responses to them will be made part of the final EIS.

Copies available
If you have received this letter, we are providing the entire draft EIS, including appendices, on CD. If you would like to receive a hard copy of the draft EIS please call BPA's toll-free document request line at 1 (800) 622-4519. Please leave a message naming this project, giving your complete address. The draft EIS and its appendices may also be viewed at the project's website: *www.bpa.gov/go/midcolumbiacoho.*

Next Steps
BPA expects to complete and publish the final EIS in December 2011 and then issue a Record of Decision in spring 2012 that will explain BPA's decision about whether to proceed with the project.

For More Information
If you need more information or have questions, please call me directly at (503) 230-5192 or toll free at 1 (800) 282-3713 or e-mail me at *sfbreeden@bpa.gov*.

Sincerely,

Stephanie Breeden

Please view my comments at the bottom of page 1.

Stephanie Breeden
Environmental Protection Specialist

Enclosure:
Draft EIS (CD)

Bonneville Power Admin.
Public Affairs Office-DKE-7
P.O. Box 14428
Portland, Oregon 97208

COHO11 0006

Bonneville Power Authority
Public Affairs Office DKE-7
PO Box 14428
Portland, OR 97293 4428

July 14th, 2011

Dear BPA,

Last night I attended a meeting of the public with the BPA and the Yakima Nation on the subject of a COHO salmon re-introduction in the Wenatchee and Methow basins. This meeting, held in
6-1 Leavenworth, though attended by no more than forty people, was, I feel, very productive.Those questions that I had about the specifics of the program were well answered by the representatives of the proposal.

For the record, I would like to submit the statement below.

A very important fish species has not been mentioned in the environmental impact statement and while the BPA and YN are aware of this, I want to ensure that the proposal takes into account that the existence of a viable population of sockeye salmon spawn in the Little Wenatchee and White
6-2 river watersheds, both of which are tributaries of Lake Wenatchee. These fish provide an important sport fishery to our area and deserve just notice and protection.

Please be aware of this population and give them due protection if this coho re-introduction is allowed to progress.

Please keep me informed as to the status of this program.

Sincerely,

Paul E. Poirier
[redacted]

Paul E. Poirier

Methow Conservancy

COHO11 0007

Stephanie Breeden
Environmental Protection Specialist
Bonneville Power Administration
PO Box 3621, KEC-4
Portland, OR 97208-3621

August 5, 2011

Re: Mid-Columbia Coho Restoration Program Draft Environmental Impact Statement

Dear Ms. Breeden,

Thank you for the opportunity to review and provide comments on the Draft Environmental Impact Statement for the Mid-Columbia Coho Restoration Program (June 2011).

The Methow Conservancy serves as the Methow Valley's community-based land trust. Our mission is to ***inspire people to care for and conserve the land of the Methow Valley, ensuring it will remain a place where future generations can enjoy the rural character and natural beauty we cherish today***. The Methow Conservancy currently partners with over 100 families in holding conservation easements on private properties located within the Methow watershed. These conservation easements conserve 7,100 acres including over 25 miles of river shoreline and riparian habitat along the Methow River and its tributaries.

On those lands where the Methow Conservancy enjoys this relationship with private landowners in the Methow Valley, our organization has a perpetual legal responsibility to ensure that the terms of the conservation easement are respected. This is accomplished through regular property inspections, or monitoring visits, as well as through our review of landowner proposed actions on their conserved properties.

Please find the following comments intended to help inform the Draft EIS, as well as the decision-making processes that will involve our organization in the future, as projects are advanced:

7-1

Comment #1: Methow Conservancy-held Conservation Easements - The Draft EIS notes on pages 3-8 that the Methow Conservancy holds a conservation easement on the "Lincoln" site located on the upper Twisp River, but does not identify the other potential acclimation sites where the Methow Conservancy currently holds a conservation easement interest.

Based upon our review of the Draft EIS document, it appears that the projects identified as being located on the **Goat Wall**, **Hancock**, **Heath**, and **Mason** sites are also situated on properties where the Methow Conservancy currently holds a conservation easement interest.

The Methow Conservancy is regularly working confidentially with private landowners to create conservation easements for their properties. Please note that it is possible that confidential conservation easement development may be underway on additional properties identified as target acclimation facility sites within the Draft EIS. Prior to undertaking any site-specific activity over the coming implementation of this project, we encourage BPA and the Yakama Nation to make contact with us to determine whether a conservation easement has been recorded.

Prior to commencing any activity on known conservation easement sites, the Bonneville Power Administration and/or the Yakama Nation will need to coordinate review by the Methow Conservancy for consistency with the individual conservation easements to ensure that the conservation values protected by the easement are not adversely affected. Please contact Heide Andersen, Stewardship Director, for additional information regarding this review process @ (509) 996-2870, or to obtain copies of the recorded conservation easements for these properties.

7-2 **Comment #2: Third-Party Funding Entities** – Many of the Methow Conservancy's riparian conservation easements, including those noted as potential acclimation sites, were secured with funding provided by one or more third-party entities including the Washington State Salmon Recovery Funding Board, the Chelan & Douglas PUD Tributary Committee, Bonneville Power Administration or other public funding sources. In most cases, these funding entities have developed policy guidance regarding the range of permissible uses and activities on conserved properties. This policy guidance has largely been directed towards projects related to the enhancement of habitat benefitting the listed threatened or endangered fish, but not towards projects addressing native coho re-establishment or the establishment of acclimation facilities.

As part of the Methow Conservancy's project-level review process for proposed acclimation sites, review and approval from these third-party funding entities will likely be required. To the degree that BPA and the Yakama Nation can work with these funding entities to develop proactive policy guidance, the project-level review and implementation process may be expedited.

7-3 **Comment #3: NEPA Process for "Lincoln" Site** – Footnote "b" to Table 2-6 (Page 2-15) indicates that the environmental review under NEPA for the "Lincoln" site is *"...done under a different program; impacts are evaluated in other NEPA processes."*

It is not clear whether this alternate environmental review has been completed, or will be completed at some time in the future. Additionally, it is not clear why this Draft EIS does not include an analysis of the environmental impacts of the proposal at this site given the purpose of NEPA as a tool for identifying and mitigating cumulative environmental impacts.

We recommend that BPA either incorporate any conclusions from previous environmental review completed for the "Lincoln" site by reference in this document ***OR*** include the "Lincoln" site as part of this comprehensive EIS process. This would also serve to streamline the associated SEPA review process at the local level, and avoid a potential independent review and/or additional EIS work.

7-4 **Comment #4: Table 3-31, Documented state listed Priority Habitats and Species** – While footnote "a" of Table 3-31 notes that '*The WDFW PHS list also includes all federal ESA-listed species (Table 3-30)*", Table 3-30 does not appear to include all threatened and endangered species documented in the Methow Valley where project sites are proposed. This should be double-checked, and if this is the case, the site specific analysis in Table 3-31 should be updated where applicable, and any adverse environmental impacts identified and mitigated where applicable.

Thank you again for this opportunity to provide comments and information regarding the Mid-Columbia Coho Restoration Program Draft Environmental Impact Statement. If you have any questions regarding this input, please feel free to contact us at (509) 996-2870.

Sincerely,

Heide Andersen
Stewardship Director

Jason Paulsen
Executive Director

7/13/11
Levenworth

COHO11 0008

BONNEVILLE POWER ADMINISTRATION

Mid-Columbia Coho Restoration Program
Draft Environmental Impact Statement
Leavenworth and Twisp WA,
July 13 – 14, 2011
"I'd like to tell you . . ."

1. Here's what I think about today's event:

8-1 WELL ORGANIZED, WELL PLANNED
EDUCATIONALLY VALUABLE

8-2 The project proposed requires relatively minimal development of facilities. It appears well developed and financially conservative.

2. I would like more information about:

I would like info on Mullan (1984) and the estimated historical mid-Columbia River coho pop. 8-4

VERY IMPRESSED BY THE MINIMAL PHYSICAL IMPACT & ECONOMIC COST V. BENEFIT

3. I have other comments:

8-3 The feasibility study costs are also economic benefits — the consultants, BPA and Yakama staff receive payments (income) from the program ("costs") and take them home to buy groceries, pay school taxes, etc. So the benefit is greater than only the expenditures of fishermen

4. Please contact me:

Phone number

☒ Please put me on your project mailing list. (You are already on the mailing list if you have received mailed notices.)

Please e- mail your comments to: http://www.bpa.gov/applications/publiccomments/OpenCommentListing.aspx

or mail your comments to:
BPA, P.O. Box 14428, Portland, OR 97293-4428

Please mention **Mid-Columbia Coho Restoration Program** in your correspondence

You may also call BPA at (800) 340-9323

COHO11 0009

7/19/11
TwsP

9-1

Phase coho reintroduction w/ habitat restoration consider not releasing as many coho if habitat not in place

Keely Recorded
from Michael Liu

Public Meeting Comments, Mid-Columbia Coho Restoration Draft EIS Public Meetings, Leavenworth and Twisp, WA

July 13 and 14, 2011

7/13/11 Leavenworth, WA

1 Are coho returning now?
2 Are coho capable of returning for spawning and rearing--are they “smart” fish?
3 What happens when you do not meet your goals?
4 Why was the Entiat excluded?
5 Are coho in the Chiwawa? When do they emerge from redds?
6 Could egg containers be used?
7 One cannot get a clear understanding of the economic benefit just looking at dollars spent and the return in dollars; for example, a great deal of money is spent on recreational activities that is not tracked.
8 Is the White River controversy the only area of controversy?
9 Is White River essential to the program?
10 How did you identify acclimation sites?
11 Does the DEIS include other river sites as alternatives?
12 What ecological indicators drive production/timing?
13 Has Ecology determined where P is coming from in upper basin? Disappointed if ponds/program didn’t occur because of human influence upriver.
14 What about sockeye exclusion/interaction, adult and juvenile.
15 What is the cost to BPA of feasibility studies versus the full program – what is the economic benefit? Has an attempt been made to compare the financial benefits and costs of the project? Shouldn’t that be a concern in these financially difficult times?
16 Would egg transportation still occur?
17 Opposed to the project, especially the acclimation site in the upper reaches of the watershed.
18 There are no control sites to study the effects of the project.
19 White River is not a good area to conduct this experiment.
20 Why backfill wetlands in the White River to conduct an experiment that has questionable levels of success?
21 The White River is a pristine jewel that should be protected at all costs.
22 Consider using the watersheds above Wenatchee Lake [as controls]. Would the White River and Little Wenatchee River be good controls for the overall coho reintroduction program?
23 Acclimation sites in the White River watershed are a concern, as is backfilling wetlands.
24 Coho releases should be limited until studies determine what adverse impacts to other fish would be. Concerned that it is too late to consider alternatives to the proposal and that everything has been decided already.
25 How will people see financial benefit from the proposal? A fisherman reported catching a large number of coho that were inedible.

26 If adaptive management is used, then will the 24 ponds and 2 adult sites change (as more data/information is known)?

27 Will the proposed project ramp up all at once?

28 Does the Draft EIS include an alternative that improves habitat for all T&E species?

29 Are the higher phosphorus levels from manmade or natural causes?

30 Table ES-6 indicates that fish other than coho will be excluded from passing upstream -- is that true?

31 Will sockeye have access to spawning beds and be impacted by this project (i.e., nets might block their habitat and migration)?

32 Where is the positive economic return to central WA? My goal is for you to make me money.

33 The economic impact on the Methow (from the fish industry) was 10,000 hours last year (gas, fish licenses, equipment…).

34 When do the eggs and young fish imprint?

35 Will they be self-sustaining sometime in the future? How savvy/smart are they -- do they have adaptive management instincts?

36 Does the Yakama Nation have their own funding? Could the program and project be impacted in the future with funding cutbacks?

37 Are you going to analyze why coho have been successful for lessons learned for other listed species (e.g., hatchery practices, travel to and from the ocean…)? Will the monitoring plan tease it out?

38 The cost to every living organism is immense with the loss of a species, and it is economically unquantifiable.

39 One stream not mentioned that would be impacted by the proposed project is the [Peshastin] in the lower Wenatchee.

40 There are coho showing up in traps in the Upper Wenatchee.

41 What is the most sustainable and best environment for the listed species?

42 Why were coho extirpated in the Methow but steelhead and Chinook are still present?

43 Is there any location on the west coast where coho are now, or are coho in the oceans now that will eventually come back up river?

44 Where else are they listed?

45 Do fish in ponds require supplemental feeding? Is there any concern about the feed entering the water system, i.e. extra nutrients?

46 Are you adding to the Chinook acclimation pond in Twisp? Would coho be there at the same time and released at the same time?

47 Did you look at density effects of coho on juvenile Chinook?

48 What about loss of rearing habitat for Chinook? Other salmon?

49 Are there plans to keep ponds open or drained?

50 What about the ponds' contribution to increased water temperatures?

51 Were coho released as part of the feasibility study, and are there any concerns about current coho in system? Are they going to compete with other species' habitat?

52 Concerned that there is limited off-channel habitat, especially below Winthrop and Twisp. Concerned that the addition of coho to this area will increase competition with other fish for the limited off-channel habitat. The project should look at the amount of off-channel habitat available and link coho release numbers to the amount of available habitat.

53 Any plans for species/program monitoring?

54 The program would work--coho are a hardy species.

55 How long will acclimations sites be used? Would you move to plant coho directly in off-channel habitat?

56 What is the habitat work going on now?

57 Will we have a natural population?

58 Will there by monitoring of competition effects in the Methow? What numbers of coho would be required to begin the monitoring studies on competition?

59 The monitoring report for the Methow will be available for all species for 2012. Coho are increasing in numbers. Will this be included in the EIS?

60 DNA data confirms that there are coho/summer Chinook hybrids. Would this create a problem for the coho program in maintaining the integrity of the coho stock?

COHO11 0011

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
620 SW Main Street, Suite 201
Portland, Oregon 97205-3026

9043.1
IN REPLY REFER TO:
ER11/546

August 22, 2011

Stephanie Breeden
Environmental Coordinator
Bonneville Power Administration – KEC – 4
P.O. Box 3621
Portland, Oregon 97208

Dear Ms. Breeden:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement (Draft EIS) for the Mid-Columbia Coho Restoration Program to Mitigate Anadromous Fish, Chelan and Okanogan Counties, Washington. The Department offers the following comments on for consideration in the development of the Final EIS.

GENERAL COMMENTS

11-1 The Department supports the Yakama Nation's Mid-Columbia Coho Restoration Program (Coho Program). The Department, through our component Bureau the U.S. Fish and Wildlife Service (Service), has worked cooperatively with the Yakama Nation throughout the feasibility phase of the Coho Program and agree that the goal to develop a localized broodstock has been achieved. Not only has the use of broodstock from the lower Columbia River ended, but adult returns from locally produced natural and hatchery smolts have at times been significant (over 1000 coho redds in Icicle Creek in 2007). The return of these fish to historical habitats in the mid-Columbia River basin is very encouraging and a step forward to restoring ecosystem function throughout the region.

11-2 The Coho Program appears to be scientifically sound, as evidenced by the approval of the Northwest Power and Conservation Council's Independent Science Review Panel. We are also encouraged that the Coho Program contains a robust monitoring and evaluation component. Further, the goals of the Coho Program are consistent with the Methow and Wenatchee basin watershed plans and with objectives of the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan.

11-3 Given the results from the feasibility phase, we concur there is a reasonable likelihood of success for full-scale coho salmon reintroduction as described in the Yakama Nation's Master Plan and as documented in the draft EIS. The Proposed Action is likely to re-establish locally adapted, self-sustaining, naturally spawning coho stocks which would have tremendous ecological benefits for many aquatic and terrestrial species. The addition of post-spawning coho carcasses at

11-4

the beginning of winter is likely to improve over-winter survival for all species as the carcasses provide marine-derived nutrients at an especially nutrient deficient time of year. The Proposed Action may also provide mainstem and terminal harvest opportunities which would generate moderate economic benefit. We will continue to cooperate with the Yakama Nation and their Coho Program, and encourage continued support by the Bonneville Power Administration. 11-5

However, we do have concerns regarding water quality, particularly in Icicle Creek. Our Leavenworth National Fish Hatchery (LNFH) discharges effluent into Icicle Creek, a tributary of the Wenatchee River. Icicle Creek is also a current and proposed acclimation site for coho salmon. The dissolved oxygen and pH Total Maximum Daily Load (TMDL) for Icicle Creek established a phosphorus discharge limit for Leavenworth NFH. We have been collecting phosphorus discharge data from Leavenworth NFH for several years, and the data suggest phosphorus discharge from Leavenworth NFH may exceed the TMDL requirements. If we cannot meet the water quality standards for Icicle Creek by 2019 (the TMDL compliance timeline), we may reconsider supporting the current and proposed level of coho salmon production from LNFH. Because the fish food is the primary source of phosphorus, the only option for reducing phosphorus discharge to the level of the TMDL is to reduce production and/or the amount of food fed to the fish. The Service and the Environmental Protection Agency are seeking clarification from the Washington Department of Ecology on the interpretation of the TMDL requirements. 11-6a

11-6b Therefore, the Department recommends that the final EIS include an analyzis of the existing water quality data from LNFH to determine what impact the proposed action will have on the existing Wenatchee River water quality requirements, particularly in regards to phosphorus, pH, and dissolved oxygen in Icicle Creek.

SPECIFIC COMMENTS

Page ES-3

11-7 The draft EIS states that Mullan (1984) estimated that the historical mid-Columbia River adult coho populations for the Wenatchee and Methow basins were 6,000 - 7,000 and 23,000 - 31,000, respectively. According to Table ES-3, peak operating costs (2013) by basin, operating costs are anticipated to be $2,429,982 for the Wenatchee Basin and $1,777,778 for the Methow Basin. The Department recommends that the final EIS include a discussion of how the resource allocation decisions between the two basins were made.

Page ES-6

The document states that “The coho restoration program is designed to end when a self-sustaining naturally reproducing population that supports harvest is established. This goal would be met when there is a natural-origin return escapement of more than 1,500 coho to each basin, with a terminal and mainstem harvest in most years; it is expected to be achieved by approximately 2028.” Studies to date suggest minimal negative interaction of coho with listed species of spring Chinook, steelhead, and bull trout; however, these studies appear to have been conducted with densities far less than historical levels of coho in the Wenatchee and Methow basins. Although the goals for natural origin return are lower than the estimated historical levels, there is the potential for this effort to be more successful than planned and that potential

interaction with listed species could be higher than expected. The Department recommends that 11-8
the final EIS include a discussion of when and if it may be appropriate to implement control measures to limit coho expansion as well as indentify potential options. If harvest is expected to be a primary tool, the final EIS should describe the likelihood that listed fish will be included in this harvest as by-catch.

Based on the information provided in the draft EIS, it appears that the reintroduction project and the project's projected impacts on other fish species is predicated on an assumption that target watersheds are currently below carrying capacity with respect to food and space, and that additional food and space are available to sustain the recovery of coho salmon populations. Although evidence is provided to suggest that coho populations were historically substantial (Mullen 1984, Mullen et al. 1992), these estimates are based on available habitat, and may not be sufficient to address carrying capacity under current conditions. In addition, reductions in marine derived nutrients may have reduced carrying capacity to below historic conditions, even in systems where habitat remains largely intact. Assumptions about carrying capacity could have important consequences on the fate of threatened and endangered species, particularly those individuals displaced from coho acclimation sites. The Department recommends that the final
EIS contain a more thorough analysis of the carrying capacity of the areas where coho will be 11-9
introduced and the relationship between the number of stocked fish and that capacity.

Page ES-10: Table ES-5, row 5

This table indicates that the proposed mitigation measures may "provide ecological benefits that would aid in listed species recovery;" however, it's not clear what these "ecological benefits"
11-10 include. The Department recommends that the final EIS include a description of the ecological benefits that are expected to aid in listed species recovery.

Page ES-11: Table ES-6, row 7; Page 3-71, Sections 3.7.5.1, 3.7.5.2, and 3.7.5.3 bulleted lists

The draft EIS states that listed fish will be blocked off from potentially limited habitat (i.e., off-channel habitat for juvenile spring Chinook) in the preferred alternative. The Department recommends that the final EIS include a description of avoidance measures to minimize impacts
11-11 to listed fish from construction activities. Also, the Department recommends that the final EIS describe mitigation measures to be taken for loss of habitat, how the numbers of each species that would be excluded were derived, and any control measures that may be implemented, including thresholds that invoke them.

The Bureau of Reclamation has plans, along with the Yakama Nation, to restore floodplain connectivity in a large swath of the mainstem Methow River. An assessment of the numbers of fish that use these existing and potential off-channel habitats is a major objective of ongoing studies funded by the Bureau of Reclamation in the Methow basin, with the U.S. Geological Survey (USGS) conducting the fisheries studies. Research at the USGS Western Fishery Research Center indicates that these off-channel habitats appear to be limiting habitats for listed
salmonids, especially in certain areas of the Methow basin. The Department proposes that the 11-12
Yakama Nation biologists and managers meet with USGS in an effort to identify potential areas of collaboration and information sharing among these efforts.

Page 1-3, Section 1.3.1

11-13 The draft EIS describes the construction and operation of Columbia dams as a reason for declines in mid-Columbia coho salmon populations. The Department recommends that the final EIS mention that the mainstem dam that was removed in the Methow was the major reason for decline of the coho in the Methow River. The final EIS should discuss how the removal of this dam this affected populations, including the rational for adding fish.

Page 1-6, Table 1-1 row 2

Based on the information provided in the draft EIS, competition for food and space was assessed by tracking habitat use and fish condition in a single tributary by supplementation of hatchery coho. Potential problems with this approach include:

1. The use of hatchery instead of naturally spawned fish.
2. Study looks at habitat overlap, not overlap in food resources.
3. Results show no differences in fish condition and growth, but does not address survival, abundance, and emigration.
4. Food web interactions were not evaluated.
5. Over-winter habitat use and potential competition were not assessed.

Depending on the degree of dietary overlap for particular food resources, and the availability of those prey items in the environment, even small increases in coho populations could have negative consequences. In addition, negative consequences could occur via changes in emigration and survival, not just fish growth and condition. However, coho populations could also have unexpected positive impacts on other target species. The long term impact of coho populations on the aquatic food webs is likely to be unpredictable. More holistic food web studies may be needed to help understand the trophic complexities of these systems, and model the potential impacts of coho. 11-14 The Department recommends that the final EIS address the potential limitations to this approach and how that may affect inferences about competition with other species.

Pages 2-8 and 2-9

11-15 The draft EIS states that "Broodstock compositions would be managed to increase the proportion of natural influence (PNI) in the population, with the goal of having a PNI value greater than 0.5; that is, the natural environment must have a greater influence on the population than the hatchery environment." However, it is not clear how "natural influence" is measured or defined. The Department recommends that the final EIS define "natural influence" as well as describe the tests the fish will undergo to determine whether definition is met.

Page 2-31

The document states that "The difference between producing all the fish at one location versus at multiple locations may be in excess of $6,000,000 over a 20-year period…Important factors used to evaluate rearing system options include the ability to produce fish that return to targeted areas at high survival rates. The degree of difference between the various systems' adult survival rates is unknown."

Based on the stated purpose of "develop[ing] a locally adapted, self-sustaining, naturally spawning coho stock that occupies its historical habitat in the Wenatchee and Methow river
11-16 basins," it appears that the relevant metric is the cost per fish returned. If no data are available, and costs are high, the Department recommends monitoring to determine the return rate for fish raised under those rearing conditions.

<u>Page 2-33</u>

The draft EIS states that "Restoration of individual populations may not be possible without restoration of other fish and wildlife populations with which they co-evolved. (NPCC 204a)."
11-17 The Department recommends that the final EIS describe how the present day forage base and predators differ from the species "with which they coevolved" and any plans to restore those species.

<u>Page 3-2 and 3-3, Table 3-1, rows 3, 4, and 7.</u>

The Department recommends that the final EIS include references for the information regarding
11-18 "Effects of water withdrawals on groundwater supply" and "Effects of surface and groundwater withdrawals on water rights," as well as the population estimates related to "Reduced access to migration or rearing habitat for ESA-listed and other fish."

<u>Page 3-3, Table 3-1, row 2</u>

11-19 The table states that "Listed species would be monitored to determine if adverse effects occur with increasing densities." The Department recommends that the monitoring program be described in the final EIS.

<u>Page 3-35</u>

The draft EIS indicates that lack of water quality data prevented a detailed evaluation of localized impact associated with smaller streams, such as, Beaver (Balky Hill and Parmley), Gold, and Wolf (Biddle) creeks. These small steams are known producers of listed steelhead,
11-20 bull trout, and Chinook. The Department recommends that the final EIS include model predictions for the impact of the addition of 50,000 coho.

<u>Page 3-55, Section 3.7.3</u>

The South Fork of Gold Creek is one of the biggest producers of steelhead in Gold Creek and blocking the stream may impact a large portion of Gold Creek steelhead. In addition, steelhead are likely to be affected if coho are introduced into Beaver Creek in the Methow River watershed. Also, significant work has been undertaken to open up fish passage in Beaver Creek, specifically for ESA-listed steelhead. The addition of 50,000 hatchery coho may impact
11-21 recovering steelhead populations; therefore, the Department recommends that the final EIS

describe measures that will be taken to eliminate the risk to ESA-listed steelhead.

Page 3-62

11-22 The number of juvenile Chinook and steelhead potentially displaced from proposed acclimation sites was calculated to be low and assumed to be relatively insignificant. The calculations themselves may or may not be fine, and it is true that the potential number of fish displaced would likely be low compared to total populations. However, off-channel aquatic habitats, such as side channels and wetlands, may be disproportionately important rearing habitats for sensitive species. These habitats likely provide differential growth conditions for species such as Chinook and steelhead, which may be important for sustaining life-history diversity and long-term population productivity. For example, at a larger spatial scale, Hilborn et al. (2003) found that the overall portfolio of habitats was essential for sockeye salmon productivity in the Bristol Bay region. The Department recommends that the final EIS describe the effects of losing these rearing habitats for sensitive species if the habitats are at carrying capacity.

Page 3-62, Table 3-22

11-23 The Department recommends that the table provide more specific information for those streams that are more important to listed fish rather than a basin-wide approach.

Appendix 2, page 40, 1st paragraph, 3rd sentence

> "…Smolts are released from the raceways and then passed through the hatchery ladder into Icicle Creek."

11-24 It would be more accurate to state: " Coho smolts have been directly pumped from the raceways into the main current of Icicle Creek during the past two years." The Department recommends that this language be included in the final EIS.

Appendix 7, page 38, Table 6, row 9 and column 8

11-25 Based in the information provided in the draft EIS, this was estimated based on actual data collection. The Department recommends that the final EIS provide information on how many data points were used, the time of the year that the data was collected, and whether the data collection was conducted over multiple years. It may also be helpful to include a column with TP load limits identified in the Wenatchee basin total maximum daily loads study. In addition, the final EIS should include a note that the coho program reared at LNFH is part of the its NPDES permit.

Appendix 7, page 40, Section 4.2.6

The draft EIS states the following regarding LNFH:

> "Facilities at the LNFH are being used for acclimation as part of this project. Discharges from this facility flow through the main hatchery outfall that dominates the Icicle Creek

flow during low-flow season. Data at Icicle Creek were not collected as part of this project. The LNFH is required to provide a discharge report as part of the National Pollution Discharge Elimination System (NPDES). However, a review of recent discharge reports did not yield any nutrient data. Thus, TP load specified at the Icicle Creek mouth in the WDOE TMDL (Carroll et al. 2006) was used as a basis for comparison."

"The proposed coho acclimation project was estimated to contribute about 2% of the TP loads used in the WDOE TMDL for summer 7Q10 conditions. Recognizing that acclimation activity is proposed overwinter and during spring, the load comparison here is illustrative. Nonetheless, because a large portion of the load enters during spring high flow, it will likely be rapidly flushed from the system and is unlikely to have a direct impact on the water quality of the lower Wenatchee River and Icicle Creek."

Water flowing though the coho rearing raceways is discharged into Icicle Creek at two locations. During raceway cleaning water is directed into the hatchery's pollution abatement ponds, as required by the hatchery's NPDES permit. For the remaining period water is discharged into Icicle Creek at the base of the fish ladder. The LNFH's current NPDES permit does not require collection of nutrient data (e.g. phosphorus and nitrogen compounds). However, for several years the hatchery has been collecting total phosphorus (TP) and other nutrient data at several key locations near the hatchery. This information is available upon request.

Coho salmon being reared at the hatchery by the Yakama Nation are considered part of the hatchery's production program by EPA and is described in its NPDES permit. The hatchery's new draft NPDES permit also describes the coho program as being part of its fish rearing program. The draft permit will impose limits on the levels of phosphorus in the hatchery's discharge water during the spring (March, April, and May) and summer (July, August, and September). The TP limits will be difficult to achieve, especially during the spring months. The TP data collected thus far indicates the hatchery would greatly exceed the spring TP limits required in the Draft permit. The on-station coho rearing program is contributing to the TP load discharged from the hatchery. The proposed reduction of coho being reared at the hatchery from the current 500,000 to 100,000 will continue to contribute phosphorus to the hatchery discharge water. A continued coho program at the hatchery will have an effect on the total number of fish being reared should the draft permit be implemented as is.

11-26 The Department recommends that the final EIS analyze the LNFH coho rearing program and available water quality data and not use the Nason Creek rearing program as a substitute. The Nason Creek program more resembles extensive fish culture while the LNFH coho program is considered intensive. Differences exist in water quality, temperature, feeding methods, fish health, pond/raceway cleaning, fish cover (from the sun and predators), and can influence water quality at the point of discharge in different ways.

11-27 Water quality requirements described in the Draft NPDES permit are measured at the points of discharge, therefore, flows in Icicle Creek and the Wenatchee River cannot be considered as a means of reducing their impacts to the environment.

Appendix 7, page 43, 4.2.9, Paragraph 5, sentence 5.

11-28 The draft EIS indicates that "…The effluent from the hatchery is expected to undergo treatment…", however, it is not clear what type of treatment is being discussed. This point should be more thoroughly described in the final EIS.

Appendix 7, page 45, Table 8

11-29 The estimates for effluent phosphorus loads for proposed hatchery at Dryden appear to be low. The LNFH has more accurate numbers that may benefit the analysis. Please contact Mr. Al Jensen, Hatchery Manager, at (503) 548-2917 for additional information.

Thank you for the opportunity to review and comment on the DEIS. If you have any questions concerning our comments, please do not hesitate to contact me at (503) 326-2489.

Sincerely,

Allison O'Brien

Allison O'Brien
Regional Environmental Officer

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

COHO11 0013

OFFICE OF
ECOSYSTEMS, TRIBAL AND
PUBLIC AFFAIRS

August 22, 2011

Stephanie Breeden
Bonneville Power Administration
P.O. Box 3621, KEC-4
Portland, Oregon 97208-3621

Re: U.S. Environmental Protection Agency (EPA) Comments on the Mid-Columbia Coho Restoration Program Draft Environmental Impact Statement (DEIS) (EPA Project Number: 09-043-DOE).

Dear Ms. Breeden:

This review was conducted in accordance with EPA's responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. Section 309 specifically directs EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Under our Section 309 authority, our review of the DEIS considers the expected environmental impacts, and the adequacy of the EIS in meeting procedural and public disclosure requirements of NEPA.

The proposed action in the DEIS is to implement the remaining phases of the Mid-Columbia Coho Restoration Master Plan. This would involve building a new in-basin adult holding/spawning, incubation and rearing facility on the Wenatchee River at one of two potential sites; and constructing and improving several sites in both the Wenatchee and Methow river basins for acclimating coho in key habitats in the upper portions of the basins.

13-1a EPA supports the overarching goal of restoring a locally adapted, self-sustaining, naturally spawning coho stock in the Wenatchee and Methow river basins. Our review found the DEIS to be thorough in many respects, however we did identify a limited number of questions and concerns that we believe should be addressed as the Final EIS is developed. Of principal concern is the status of the Leavenworth National Fish Hatchery (LNFH) and its role within the Mid-Columbia Coho Restoration Plan (MCRP). We recognize that the activities associated with the LNFH would occur during high spring flow, but we are concerned that these activities may be subject to constraints pursuant to the 2009 Wenatchee River Total Maximum Daily Load for Dissolved Oxygen and pH that have not been accounted for in the DEIS. We also question whether the current and future status of the Mitchell Act hatcheries included in the proposed action has been fully considered. Finally, we raise questions around the construction of the "No Action" alternative and the decision to limit the range of alternatives to one action alternative. Each of these concerns is detailed in the attached comments. Based on our analysis, we have rated this DEIS as EC-2 (Environmental Concerns – Insufficient Information). An explanation of this rating is also enclosed.

13-1b

Thank you for this opportunity to comment and if you have any questions or concerns please contact me at (206) 553-1601or by electronic mail at reichgott.christine@epa.gov or Teresa Kubo of my staff at (503) 326-2859 or by electronic mail at kubo.teresa@epa.gov .

Sincerely,

for

Christine B. Reichgott, Manager
Environmental Review and Sediment Management Unit

Enclosures:
EPA Detailed Comments on the Mid-Columbia Coho Restoration Program DEIS
EPA Rating System for Draft Environmental Impact Statements

EPA Region 10 Detailed Comments
Mid-Columbia Coho Restoration Program DEIS

Leavenworth National Fish Hatchery (LNFH)
The 2009 Wenatchee River TMDL for pH and Dissolved Oxygen allocates to LNFH 5.7 µg/L
13-2 (maximum daily concentration) and 0.52 kg/day of total phosphorus during the critical periods of March through May and July through October. This wasteload allocation (WLA) represents a 60% reduction from 2002 levels. Because nutrient data were not included in the DEIS for the LNFH[1], it is not clear whether those nutrient reduction goals are being met. If phosphorous levels cannot be maintained at levels at or below the WLA, the TMDL provides zero further allocation for growth in lower Icicle Creek.

In Table 3-3, the DEIS estimates that under the proposed action, 100,000 fish would be acclimated at LNFH, and that this would result in a total phosphorous load of .032 kg/d. That represents 6% of the wasteload allocation. In phase two of the program (the natural production phase), the numbers of smolts
13-3 released program-wide would increase from 1.5 million to 2.16 million for three years (page ES-5). It is not clear whether LNFH would see an increase in the number of fish released during this phase. We recommend that the FEIS clarify whether the LNFH would acclimate and release additional fish during the natural production phase, and whether the LNFH could meet its WLA targets through all phases of the proposed project.

Finally, we note that in discussing water quality impacts, the DEIS repeatedly notes that impacts from phosphorous in effluent would be undetectable downstream in the sections of the river that are water quality limited[2]. We do not question the accuracy of this statement, but we do note that in the case of
13-4 LNFH, the draft 401 Certification issued by the Washington Department of Ecology did not authorize mixing zones for any parameters. Therefore, the FEIS should discuss pollution concentrations at the source rather than downstream.

Recommendations:

- 13-5 We recommend that the FEIS clarify whether the LNFH would acclimate and release additional fish during the natural production phase.
- 13-6 The existing NPDES permit for the LNFH expired in 1979. We recommend that the FEIS discuss the current status of NPDES permitting, CWA 401 certification and TMDL implementation. This should include an assessment of the ability of the LNFH to meet its WLA targets through all phases of the proposed project.
- 13-7 We note that while existing NPDES discharge reports do not contain nutrient data, nutrient data have been collected in association efforts to issue a new NPDES permit for the LNFH. We recommend that BPA work with LNFH operators to incorporate that data into the FEIS.
- 13-8 The FEIS should recognize that the State of Washington has not authorized a mixing zone for LNFH. The analysis should therefore demonstrate that all WLAs can be met at the point of discharge rather than downstream.

---

[1] MCRP DEIS page 3-13
[2] MCRP DEIS Pages ES-11, 3-2, 3-18

Mitchell Act Hatcheries

Two of the hatcheries proposed for incubation/rearing (the Cascade and the Willard hatcheries) are funded through the Mitchell Act. In July of 2010, the National Marine Fisheries Service (NMFS) released a Draft EIS to inform Columbia River basin hatchery operations and the funding of Mitchell Act Hatchery Programs[3]. One of the alternatives explored in that EIS would eliminate all Mitchell Act hatchery funding and close all Mitchell Act-funded hatchery programs. Because NMFS has not yet issued a Final EIS and Record of Decision, the policy direction that NMFS will pursue cannot be known. It is not clear from the Mid-Columbia Coho Restoration Program (MCRP) EIS whether this issue has been explored with NMFS. The MCRP DEIS also makes reference to sharing the rearing costs of the current program with NMFS, and states that if the proposed action is implemented, cost sharing is expected to continue (page 2-27). It is not clear, however, whether that cost share is funded through the Mitchell Act.

Recommendations:

13-9

- We recommend that the FEIS clarify the extent to which BPA has coordinated with NMFS with regard to the status of Mitchell Act Funded Hatcheries and Programs.
- If uncertainty exists around the future of Mitchell Act funding, we recommend that that be disclosed in the document and any impacts to the proposed action be accounted for.

Wetlands

The DEIS indicates that a limited amount of wetlands would be permanently impacted (3,179 square feet at the primary sites). The DEIS also states, however, a wetland delineation would be performed in 2011 that could identify other wetland habitats within proposed areas of construction.

Recommendations:

13-10

- We recommend that the FEIS update section 3.9 to reflect the results of the 2011 wetland delineation.
- If unavoidable impacts to wetlands are identified and compensation is required, we recommend that the FEIS identify appropriate compensation measures.

No Action Alternative

Per 40 CFR 1502.14(c), an Environmental Impact Statement must include an evaluation of the no-action alternative. When the proposed action involves updating or expanding an existing management plan or program, the "no action" alternative is generally the continuation of the current management plan or program. The inclusion of the "no action" alternative in the EIS is required by NEPA as a basis for comparison. In the current DEIS, the "no action" alternative is essentially a "no funding alternative" where BPA would discontinue funding of the MCRP. This would result in reductions in all aspects of the current program. Because defunding the program would result in changes to the program, this alternative is not a "no action" alternative in the traditional sense. That said, we agree that it is important to the decision making process to understand the effect that defunding would have on the overall coho restoration program.

Recommendation:

13-11

- We recommend that the FEIS clarify whether any funding would be available through BPA for the MCRP in the absence of the proposed action. If zero funding would be available, that should

[3] http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/MA-EIS.cfm

be disclosed as the basis for your rationale to not include a true "no action" alternative in the DEIS.

Range of Alternatives

Per the CEQ NEPA Regulations (40 CFR 1502.14), the alternatives section of a Draft EIS is required to rigorously explore and objectively evaluate all reasonable alternatives, including reasonable alternatives not within the lead agency's jurisdiction or congressional mandate. The Regulations go on to say that substantial treatment should be devoted to each alternative so that reviewers may evaluate their comparative merits. The current DEIS analyzes only one "action alternative". As such, the DEIS does not provide a clear basis for choice by decision makers and the public. We recognize that there are alternative elements incorporated within the proposed action, such as backup hatchery sites, but we encourage BPA to include a clear rationale within the FEIS as to why no additional alternatives were analyzed within the DEIS. 13-12

U.S. Environmental Protection Agency Rating System for
Draft Environmental Impact Statements
Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections
The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns
EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections
EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory
EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

Appendix 13 Icicle Creek Water Quality Evaluation

400 Montgomery Street, Suite 650
San Francisco, California 94104
Phone 415.230.0862
Fax 415.230.0864
www.anchorqea.com

MEMORANDUM

To:	Nancy Weintraub, Bonneville Power Administration	**Date:**	October 14, 2011
From:	Pradeep Mugunthan, Anchor QEA, LLC and Greg Ferguson, Sea Springs	**Project:**	1105950-01.01
Re:	Detailed Evaluations of Water Quality Impacts of Discharges in Icicle Creek		

As part of the Mid-Columbia Coho Restoration Program (MCCRP) acclimation of up to 100,000 Coho is proposed at the Leavenworth National Fish Hatchery (LNFH). An assessment of these impacts was provided in the Water Quality Impacts of Discharges Appendix of the MCCRP Draft Environmental Impact Statement (EIS) released for public review in June 2011 (BPA 2011). In the Draft EIS, a qualitative assessment of the impacts of acclimation activity at LNFH was provided for Icicle Creek. Subsequently a detailed evaluation of impacts on Icicle Creek was undertaken. This memorandum presents the additional evaluations performed subsequent to the Draft EIS.

A total maximum daily allocation (TMDL) for total phosphorus (TP) was developed for Icicle Creek by Washington State Department of Ecology (WDOE) as part of the Wenatchee River TMDL assessment (Carroll and Anderson 2009). The TMDL requires TP load reductions from LNFH to improve water quality in Icicle Creek.

The water quality assessment team, following discussions with the LNFH managers, developed an approach to provide a more detailed assessment of the acclimation impacts. The detailed assessment was made possible by additional data provided by LNFH and Yakama Nation, which were previously not available to the water quality assessment team. A two-level assessment was developed using both site-specific data and mechanistic modeling to determine Icicle Creek impacts. These are discussed below.

CONTRIBUTION OF ACCLIMATION ACTIVITY TO HATCHERY EFFLUENT TP LOADS

TP concentration and flow data were provided by LNFH at the hatchery intake, at the pollution abatement pond and at the main outfall. In addition, LNFH provided Chinook production data for Lots 9 and 10 (corresponding to fish hatched in 2009 and 2010 respectively), which included information on fish numbers, fish biomass, and fish feed dispensed. Similar fish production information was also obtained for the ongoing over-winter Coho acclimation at the LNFH which is being carried out by the Yakama Nation.

Based on the TP data and net fish biomass production, a mass balance approach was used to develop TP loads discharged per pound of fish biomass raised. The calculations are summarized in Table 1. In these calculations, the biomass increase correspond to two Chinook age classes and one Coho age class consistent with the species raised at the hatchery in April 2011. Over this period, the net contribution of acclimation activity to the effluent TP load was separated out by subtracting the influent TP loads from the sum of the main outfall and abatement pond effluent loads. A net TP contribution of approximately 1 kilogram was calculated for every 0.66 Metric Tons of fish biomass increase (over all age classes and species).

Assuming that the proposed Coho acclimation will use feed similar to that used for Chinook (which is presently the case for the ongoing Coho acclimation), and assuming the same biomass growth rate as that calculated from ongoing Coho acclimation (see Table 1), the TP loading per unit fish biomass increase developed above was applied to estimate a TP load contribution of 13.2. grams per day (g/d) in April from the proposed Coho acclimation. This amounted to 7.1 percent of the net TP loads from LNFH in April 2011.

The Icicle Creek TMDL allocation for LNFH is 520 g/d (Carroll and Anderson 2009). The total hatchery effluent TP load in April 2011 was calculated to be 307 g/d, which is approximately 40 percent below the target load limit. When the TP loads at the hatchery intake are removed, the hatchery contributed a net TP load of 238 g/d. Of this, the current acclimation of approximately 500,000 Coho (5 times the number proposed in MCCRP) was estimated to contribute approximately 27 percent. Considering that the estimated increase in the net hatchery effluent TP load from the proposed Coho acclimation is approximately only 7 percent (see Table 1) it is unlikely that the proposed acclimation program will increase hatchery loads enough to result in violations of the permit conditions.

Table 1. Estimation of Total Phosphorus Load Increase from Proposed Acclimation

Parameter	Value	Unit	Source
Fish Production Data			
Number of Age 1 Chinook (April 2011)	1,197,764		LNFH
Number of Age 2 Chinook (April 2011)	1,233,400		LNFH
Number of Coho[1] (April 2011)	487,284		Yakama Nation
Age 1 Chinook Biomass Growth Rate ($F_{ch,1}$)	37.4	kg/d	LNFH
Age 2 Chinook Biomass Growth Rate ($F_{ch,2}$)	77.3	kg/d	LNFH
Coho Biomass Growth Rate[1,2] (F_{co})	42.7	kg/d	Yakama Nation
Total Phosphorus Loads[3]			
TP Load at Intake (L_{in})	0.069	kg/d	LNFH
TP Load at Main Outfall (L_{UBD})	0.207	kg/d	LNFH
TP Load at Abatement Pond Outfall (L_{AP})	0.100	kg/d	LNFH
Hatchery Load Calculations			
Net TP Load Added ($L_{net} = L_{UBD} + L_{AP} - L_{in}$)	0.238	kg/d	
Net TP Load Introduced per Unit Biomass Raised [TPLR = $L_{net}/(F_{ch,1} + F_{ch,2} + F_{co})$]	1.51E-03	kg TP/kg Fish	
Hatchery Effluent Net TP Load Discounted for Ongoing Coho Acclimation ($L_{net,ch} = L_{net} - TPLR*F_{co}$)	0.174	kg/d	
Load Increase from Proposed Acclimation			
Number of Fish Proposed	100,000		
Expected Biomass Growth Rate[4] in April ($F_{co,p}$)	8.8	kg/d	
Expected TP Load from Coho Acclimation ($L_{co} = F_{co,p}*TPLR$)	0.013	kg/d	
Load Increase ($L_{co}/(L_{net,ch}+L_{co})$)	7.1%		

1. Presently Coho acclimation is ongoing and therefore was accounted for in these calculations. In the future when the TMDL is in effect, fewer Coho are proposed for acclimation as part of the MCCRP.
2. As in the ongoing acclimation, only a single age class of Coho will be acclimated. Size at release expected to be approximately similar to the Age 2 Chinook, which also gets released in spring
3. Estimated from average daily flow reported in April 2011 discharge monitoring report and concentration data from LNFH. With data from subsequent years these estimates can be refined
4. Assumes same size as ongoing Coho acclimation

WATER QUALITY IMPACTS ON ICICLE CREEK

Water quality impacts on Icicle Creek were evaluated using a modified version of the QUAL2K model developed by WDOE for the Wenatchee River and Icicle Creek TMDL study (Carroll and Anderson 2009). The approach adopted for the Icicle Creek model was similar to those employed for the Wenatchee River sites discussed in the Draft EIS (BPA 2011). The QUAL2K model used the summer low flow conditions employed in the TMDL study, but used climatic conditions and water temperatures in April to reflect cooler air and water temperatures.

The air and water temperature functions were established from 90th percentile of historical records (i.e. one in ten probability of exceedance) to provide a conservative estimate of critical atmospheric and in-stream conditions. For air temperature, climate data recorded at the city of Leavenworth were used. For water temperature, long-term data were not available from Icicle Creek. So, the headwater temperatures were derived from the 90th percentile of the data collected by WDOE in the Wenatchee River at Leavenworth (Station 45A110) by subtracting out the change in average temperature simulated from upstream to downstream in the summer QUAL2K model. Dissolved oxygen boundary conditions were derived from DO saturation, by assuming the same percent saturation as those employed in the summer QUAL2K model. The air and water temperatures and the DO boundary conditions used are shown in Figure 1.

A natural conditions simulation was performed to establish background conditions in April by setting TP concentration at all point and non-point sources to the background values established in the TMDL study. The simulated water quality for background TP concentrations are shown for April and August conditions in Figure 2. August conditions were used in the WDOE TMDL study to establish load allocations in Icicle Creek. Even under background loading conditions violations in DO occurred in the August simulation. However, stream and atmospheric temperatures used were significantly cooler in April which resulted in substantially higher levels of DO with no violations throughout the stream. Further, the pH range simulated was narrower in April compared to August suggesting lower algal activity in spring. The relatively higher levels of TP simulated in April also supports this interpretation.

The water quality impact on Icicle Creek from the proposed acclimation was evaluated under the condition that LNFH will meet the load allocation without the proposed acclimation. Two QUAL2K simulations were setup: one where the LNFH discharged at the load allocation; and one where the acclimation loads from MCCRP estimated in Table 1 were added to the LNFH effluents. The MCCRP loads were split proportionally between the main and pollution abatement pond effluents based on flows specified in the QUAL2K model. The simulated water quality with and without the MCCRP loads are shown in Figure 3. The MCCRP caused a negligible change in the predicted Icicle Creek water quality and did not result in any water quality violations.

Figure 4 shows the change in pH range and the change in minimum DO relative to the background conditions established for April. It is evident that the additional TP loading expected from MCCRP did not produce a large enough change in minimum DO or pH range to be classified as measurable (the Washington State Standards for measurable change are shown as redlines in each panel).

The excess assimilative capacity in the system was evaluated through a series of QUAL2K model simulations where the TP concentration from the hatchery effluents were progressively increased until a measurable change was simulated for either DO or pH. Results from the simulation at the boundary for pH threshold for measurable change are also shown in Figures 3 and 4. This corresponded to an effluent TP concentration of 7.0 μg/L. These results show that for the critical conditions used, the system still had an approximately 23 percent buffer to assimilate excess phosphorus loads while still meeting the thresholds for measurable change.

SUMMARY

Effluent TP data and fish production data from the acclimation period were used to determine TP loading from the proposed acclimation activity at LNFH. Coho acclimation was estimated to result in an approximately 7 percent increase in the net effluent TP loads. WDOE's QUAL2K model was modified for April conditions to assess water quality impacts in Icicle Creek. 90th percentiles of measured water and air temperatures in April, and summer low flow conditions used in WDOE TMDL study were used to provide conservative simulations of water quality impacts. The model simulations suggested that increases in the LNFH effluent concentrations due to Coho acclimation resulted in only negligible changes in Icicle Creek water quality relative to the case with TMDL load allocation. A sensitivity analysis showed that the system has an approximately 23 percent excess capacity for assimilating phosphorus for the conditions simulated in the April model.

REFERENCE

BPA (Bonneville Power Administration), 2011. *Mid-Columbia Coho Reintroduction Program: Draft Environmental Impact Statement*. Released for public comments on June 6, 2011. Available at: http://efw.bpa.gov/environmental_services/Document_Library/Mid-Columbia_Coho_Restoration_Project/.

Carroll, J. and R. Anderson, 2009. *Wenatchee River Watershed Dissolved Oxygen and pH Total Maximum Daily Load, Water Quality Improvement Report*. Publication No. 08-10-062, Water Quality Program, Central Regional Office, Washington Department of Ecology, Yakima, Washington.

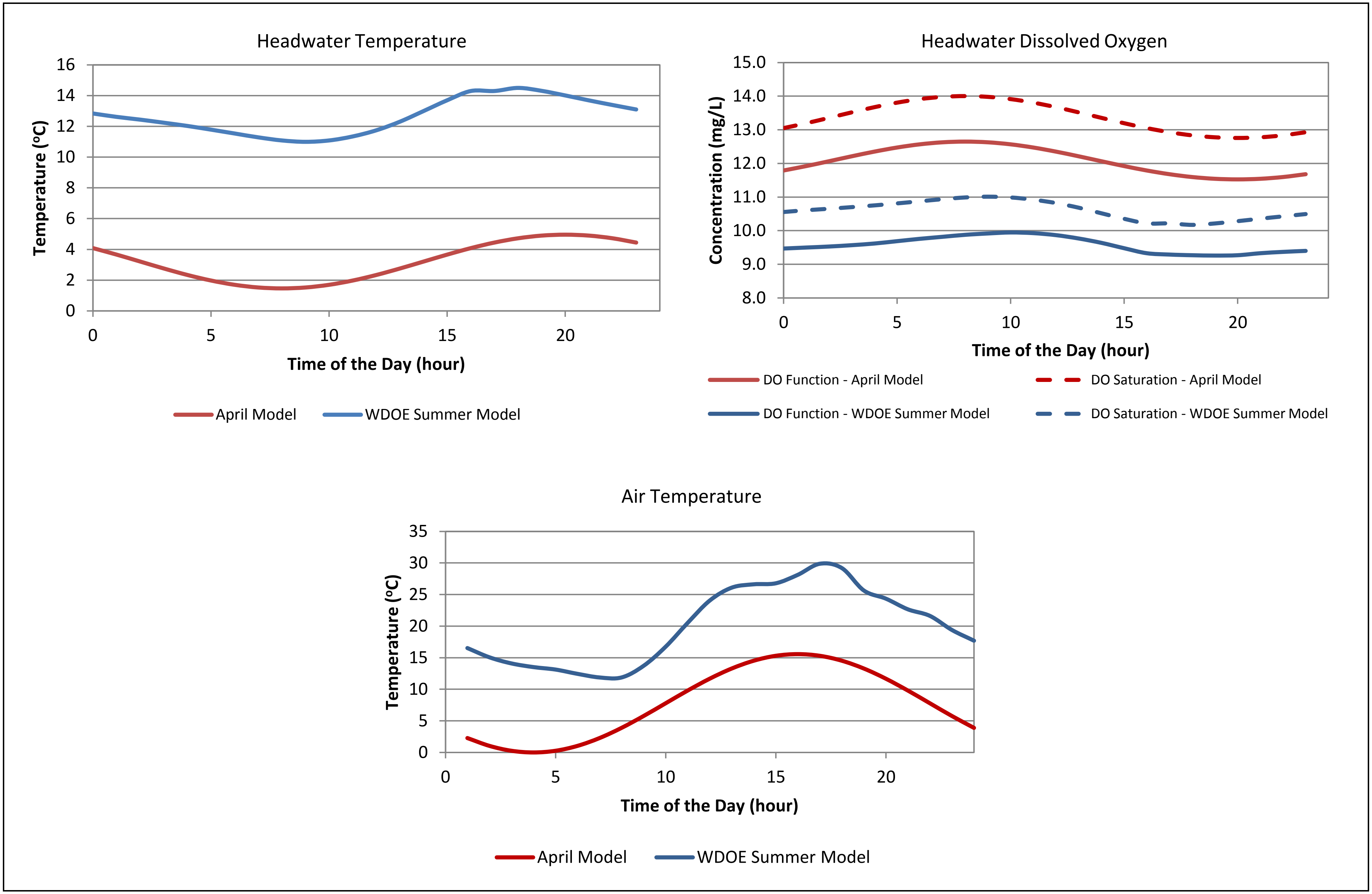


Figure 1
Boundary Conditions Specified in April QUAL2K Model

ANCHOR QEA

Source: \\SF-PMUGUNTHAN\AQ\Jobs\SeaSprings\Yakama_Nation_Coho\Model\Icicle_Creek\Inputs\Inputs_Data_Analysis_v2.xlsx

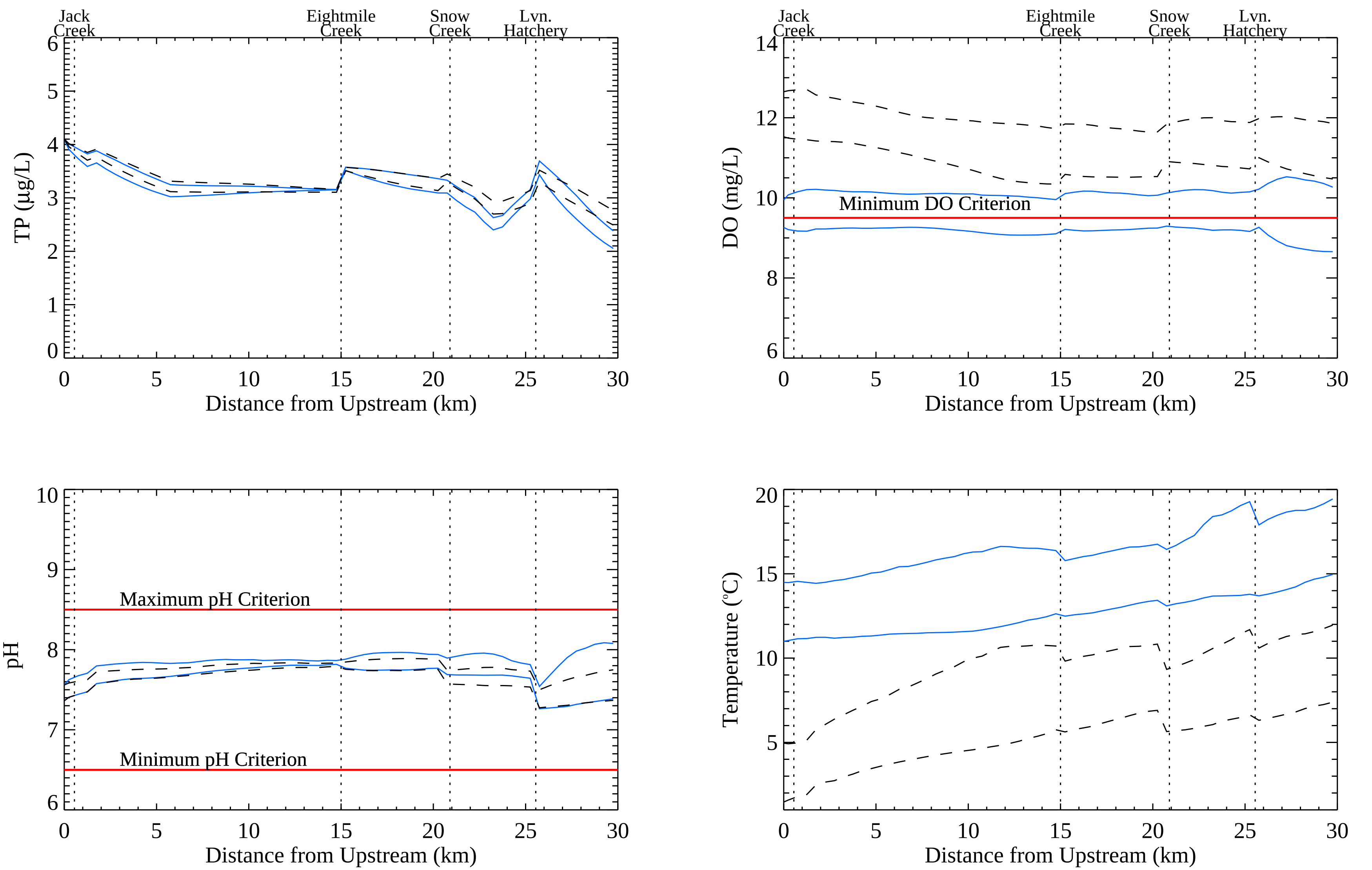


Figure 2

Water Quality Predictions in Icicle Creek under Background Natural Conditions with August and April Climatic Conditions

ANCHOR QEA

Natural Conditions (Apr)
Natural Conditions (Aug)

All sources set to background values used in WDOE natural conditions simulation
Minimum and maximum values simulated by the model are shown

PM/BG - C:\AQ\Jobs\SeaSprings\Yakama_Nation_Coho\Model\Postprocessor\plot_q2k_res_IC_4_panel.pro Wed Oct 12 17:20:29 2011

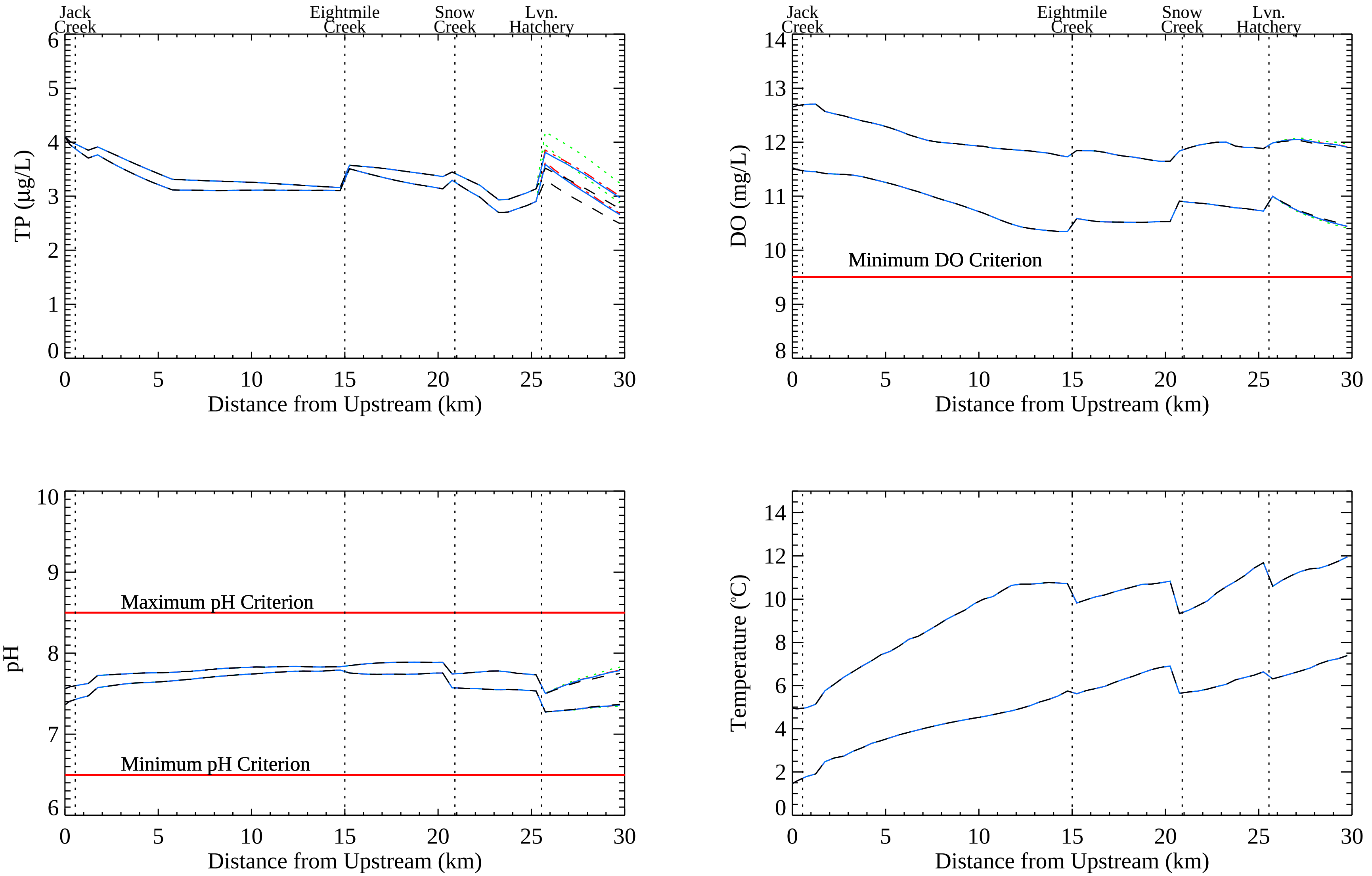


Figure 3

Water Quality Predictions in Icicle Creek for April Conditions with Coho Acclimation at Leavenworth Hatchery

ANCHOR QEA

Natural Conditions (Apr)
LNFH at 5.7 µg/L (Allocation)
LNFH at 5.84 µg/L (Allocation + MCCRP)
LNFH at 7.0 µg/L (Max. w/o Measurable Change)

All other sources set to background values used in WDOE natural conditions simulation
Minimum and maximum values simulated by the model are shown

PM/BG - C:\AQ\Jobs\SeaSprings\Yakama_Nation_Coho\Model\Postprocessor\plot_q2k_res_IC_4_panel.pro Thu Oct 13 17:32:06 2011

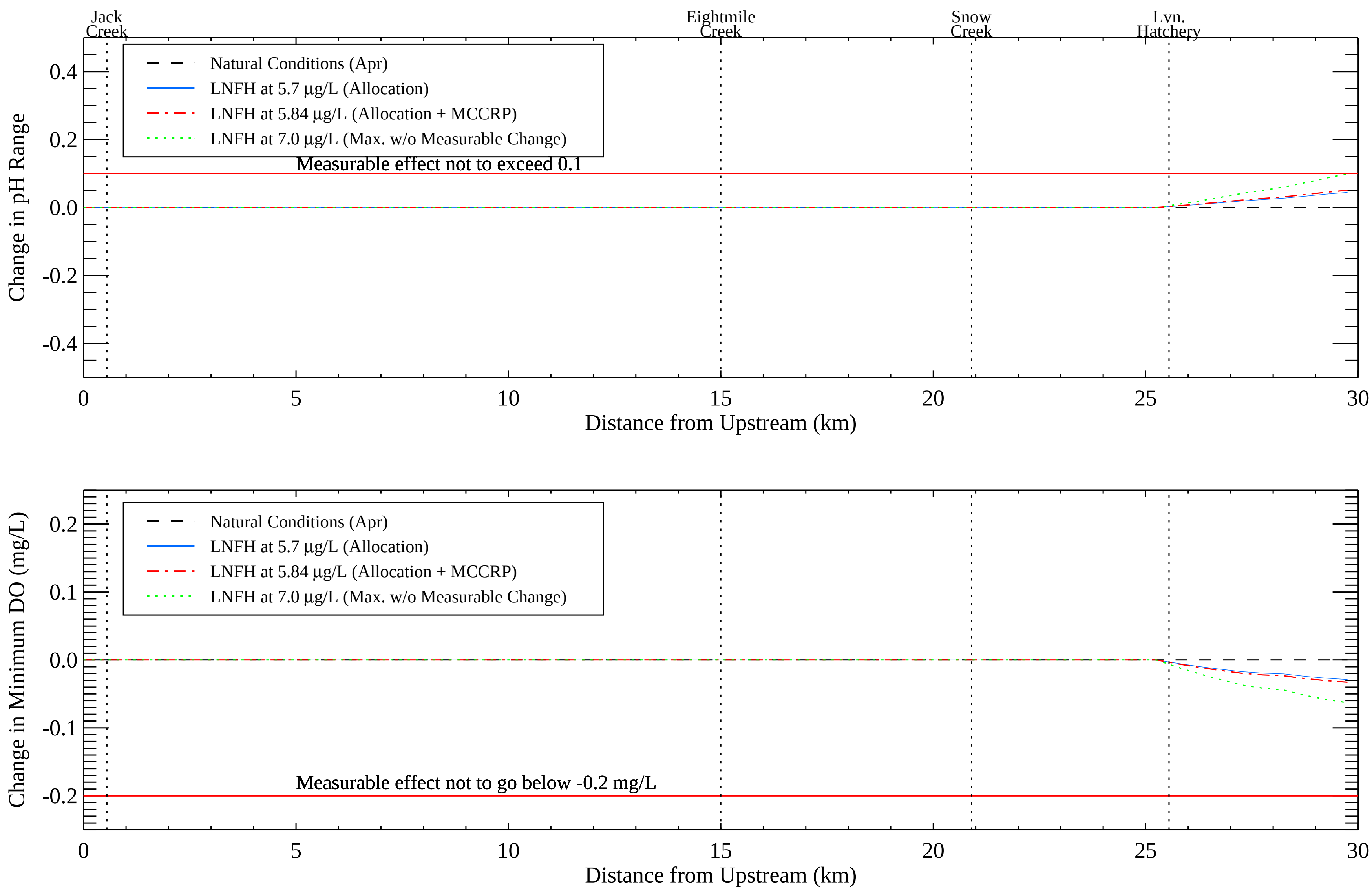


Figure 4

Difference in the range of pH and minimum dissolved oxygen in Icicle Creek relative to maximum natural conditions simulation

All other sources set to background values used in WDOE natural conditions simulation

ANCHOR QEA

BONNEVILLE POWER ADMINISTRATION
DOE/BP-4392 ▪ March 2012