US Army Corps of Engineers ®
Portland District

Revised Draft Environmental Assessment

HATCHERY FACILITIES IMPROVEMENTS FOR THE JOHN DAY MITIGATION PROGRAM

Photos of Ringold Springs State Fish Hatchery in Franklin County, Washington

Revised Draft February 13, 2014

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Abbreviations and Acronyms

°C	degrees Centigrade
°F	degrees Fahrenheit
APE	area of potential effects
BiOp	Biological Opinion
BPA	Bonneville Power Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMZA	Coastal Zone Management Act
CWA	Clean Water Act
DAHP	Department of Archaeology and Historic Preservation
DO	dissolved oxygen
DOC	dissolved organic carbon
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	essential fish habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FCRPS	Federal Columbia River Power System
FONSI	Finding of No Significant Impact
FR	Federal Register
FWCA	Fish and Wildlife Coordination Act
HGMP	Hatchery and Genetic Management Plan
JARPA	Joint Aquatic Resources Permit Application
JDM	John Day Mitigation
mg/L	milligrams per liter
mS/cm	millisiemens per centimeter
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
ODFW	Oregon Department of Fish and Wildlife
PCB	polychlorinated biphenyl(s)
PUD	Public Utility District
RM	river mile
RSH	Ringold Springs Hatchery
TDG	total dissolved gas
µg/L	micrograms per liter
URB	upriver bright (fall Chinook salmon)
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USC	United States Code
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WDOE	Washington Department of Environmental Quality

1. PROJECT DESCRIPTION

1.1. Introduction

This revised draft Environmental Assessment (EA) evaluates a range of potential alternatives aimed at meeting the "in-place and in-kind" goals of the John Day Mitigation (JDM) program for fall Chinook salmon (*Oncorhynchus tshawytscha*) in the Columbia River. This revised draft EA was prepared because of a design change to the proposed action at the Ringold Springs State Hatchery (RSH). At RSH, the river water intake design was changed and eliminates the pump station, and instead locates the pumps in a precast concrete intake structure to be constructed in the Columbia River. The intake structure will have a bridge and a crane. The associated electrical equipment will still be located on-shore with conduit routed along the bridge to the pumps. In addition, this revised draft EA was informed by and revised to reflect and address the agency and public comments received from review of the initial draft EA (dated March 22, 2013), as appropriate.

Unless otherwise noted, introductory information and alternative descriptions used to prepare the revised draft EA were taken from the *Post-Authorization Change Report for the John Day Mitigation Program* (February 2013); *John Day Mitigation Alternatives Study* (October 2012); *John Day Mitigation Design Documentation Report, 60 Percent Submittal, Modification 2* (October 2013); and the *John Day Mitigation Design Documentation Report for I-182 Acclimation Facility, 60 Percent Submittal* (November 2013), all prepared by Tetra Tech, Inc. for the U.S. Army Corps of Engineers (USACE).

1.2. Scope and Nature of Proposed Action

The Flood Control Act of 1950 (Public Law 516, 81st Congress, 2nd Session) authorized construction of John Day Dam and The Dalles Dam, based on plans presented in House Document No. 531, including authorization for mitigation, by artificial propagation, of fish losses sustained by inundation of spawning and rearing areas in the two reservoirs.

The JDM program was authorized to offset mainstem fall Chinook salmon production losses that resulted from construction and operation of The Dalles and John Day dams. The scope of the mitigation was based on historic spawning estimates presented in the project authorization documents and related administrative records. The USACE relied on historic data from U.S. Fish and Wildlife Service (USFWS) and the states of Oregon and Washington to determine the extent of the mitigation. The specified mitigation was to support escapement of 30,000 adult Chinook salmon to compensate for spawning habitat that was inundated. The USACE designed, constructed, and currently operates hatchery facilities to achieve mitigation, which consists of hatchery fall Chinook production. Since implementation of the JDM program in 1978, adjustments to the program have occurred related to the specific stock of Chinook salmon and the production, rearing, and release locations.

1.3. Purpose and Need

1.3.1. Purpose

The purpose of the proposed action is to design facilities for increasing the number of upriver bright (URB) fall Chinook through the Zone 6 Tribal Fishery (Bonneville to McNary Dams), while minimizing effects on Endangered Species Act (ESA) listed Lower Columbia River Chinook. Currently, mitigation is provided by a combination of adult egg take, incubation, and juvenile rearing using a combination of RSH, Priest Rapids Hatchery, Little White Salmon and Spring Creek National Fish Hatchery, Bonneville

State Hatchery, and the Umatilla and Prosser Tribal Hatcheries. Two acclimation sites located in the Umatilla River Basin, Pendleton and Thornhollow, also contribute to the JDM program production. About half of the fall Chinook mitigation fish are URB that are released above or just below McNary Dam. The remaining production is composed of both Tule (the lower-river fall Chinook that return from the ocean to the Columbia River ready to spawn and generally spawn below The Dalles Dam) and URB fall Chinook, which are released in the Bonneville pool and just below Bonneville Dam.

1.3.2. Need

The proposed action is needed because the current JDM program does not fulfill the 30,000 adult escapement and "in-place and in-kind" mitigation objectives and federal Indian Trust responsibilities related to The Dalles and John Day dams. In addition, the current JDM program does not meet provisions of the 2008 Federal Columbia River Power System Biological Opinion (2008 FCRPS BiOp as supplemented by 2014 Final Supplemental FCRPS BiOp) or the 2008 Columbia Basin Fish Accords (Accords) between the FCRPS Action Agencies [Bonneville Power Administration (BPA), USACE, and U.S. Bureau of Reclamation (USBR)] and Columbia Basin Treaty Tribes. The FCRPS BiOp includes specific provisions to evaluate changes to the JDM program to improve production in order to offset losses of upriver bright fall Chinook with "in-place and in-kind" mitigation. The 2008 Accords include the following language: "The U.S. Army Corps of Engineers and U.S. v. Oregon parties are working on proposals regarding mitigation for the losses to anadromous fish caused by the construction of John Day and The Dalles dams, in particular the appropriate balance between upriver and downriver stock production…"

In August 2011, as a part of the Columbia River Fish Mitigation Program, the USACE formally initiated studies to address adjustments in the JDM program that are necessary to achieve "in-place and in-kind" mitigation objectives. This included an assessment of alternatives to increase production of URB fall Chinook. As a result of these studies, it was determined that in order to meet mitigation objectives, hatchery improvements are needed that will accommodate an increase in production of the upriver bright fall Chinook while at the same time minimizing effects on ESA-listed Columbia River salmonids.

During development of the proposed action, input was received from the *U.S. v. Oregon* Production Advisory Committee (a group established in response to a 1968 court decision that upheld treaty fishing rights) on the measurement of JDM program production levels. The *U.S. v. Oregon* parties recommended that the USACE use a method referred to as the total adult production and current smolt-to-adult ratio data to more accurately calculate the production level required to produce the 30,000 adult spawners under the authorized JDM program. After extensive review, in August 2012 the USACE accepted the total adult production and smolt-to-adult ratio as the best available methods with scientific basis to calculate production that is necessary to meet the authorized mitigation level. Based on this methodology, a total adult production of 107,000 fish is required to meet the authorized 30,000 adult escapement. This equates to a production of at least 26 million juvenile fish. Current production associated with the JDM program is approximately 17 million juvenile fish.

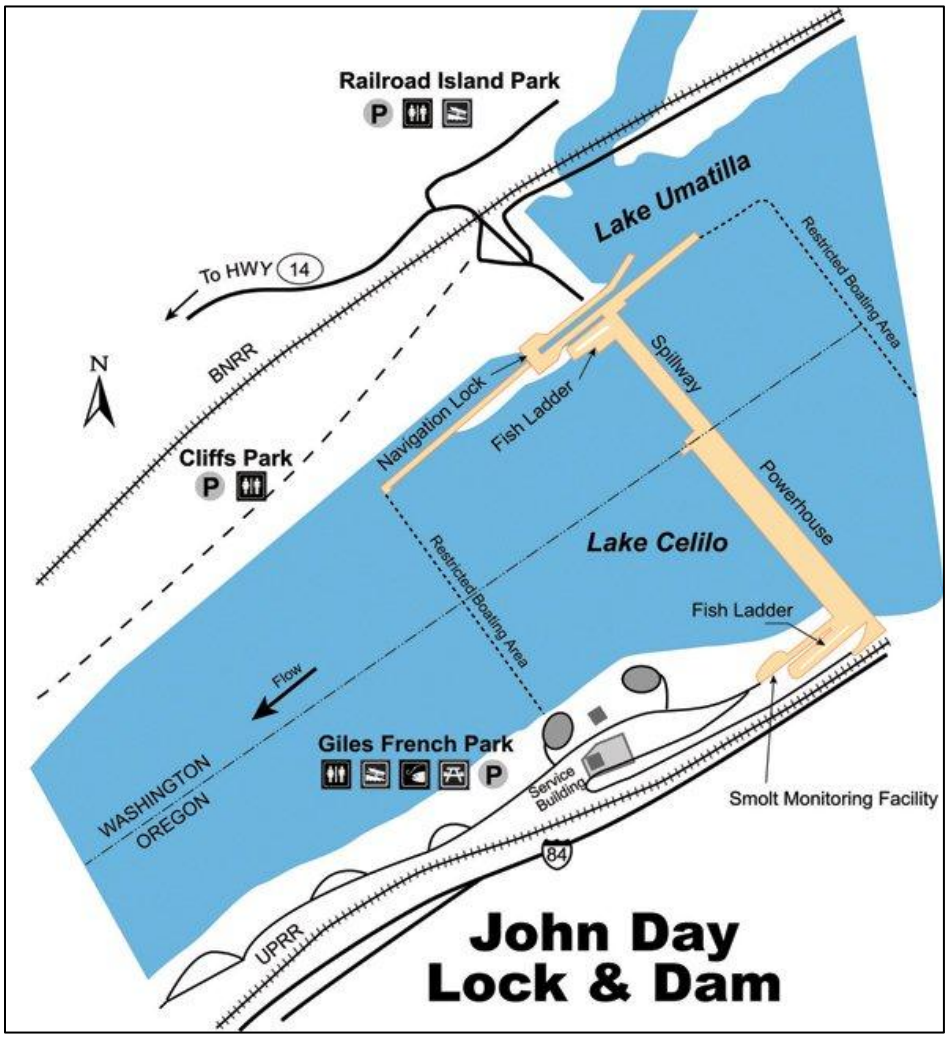
1.4. Vicinity of the Proposed Project

The JDM program addresses mitigation requirements for the John Day and The Dalles projects. The John Day Dam is located on the Columbia River, 215.6 miles upstream from the river's mouth (Figure 1). John Day Dam is approximately 25 miles upstream from The Dalles Dam. The reservoir behind The Dalles Dam, Lake Celilo, extends upstream to the base of John Day Dam. Lake Umatilla extends upstream from John Day Dam to the base of McNary Dam, a length of 77 miles with a water surface area of about 50,000 acres.

Figure 1. Columbia River Basin Dams

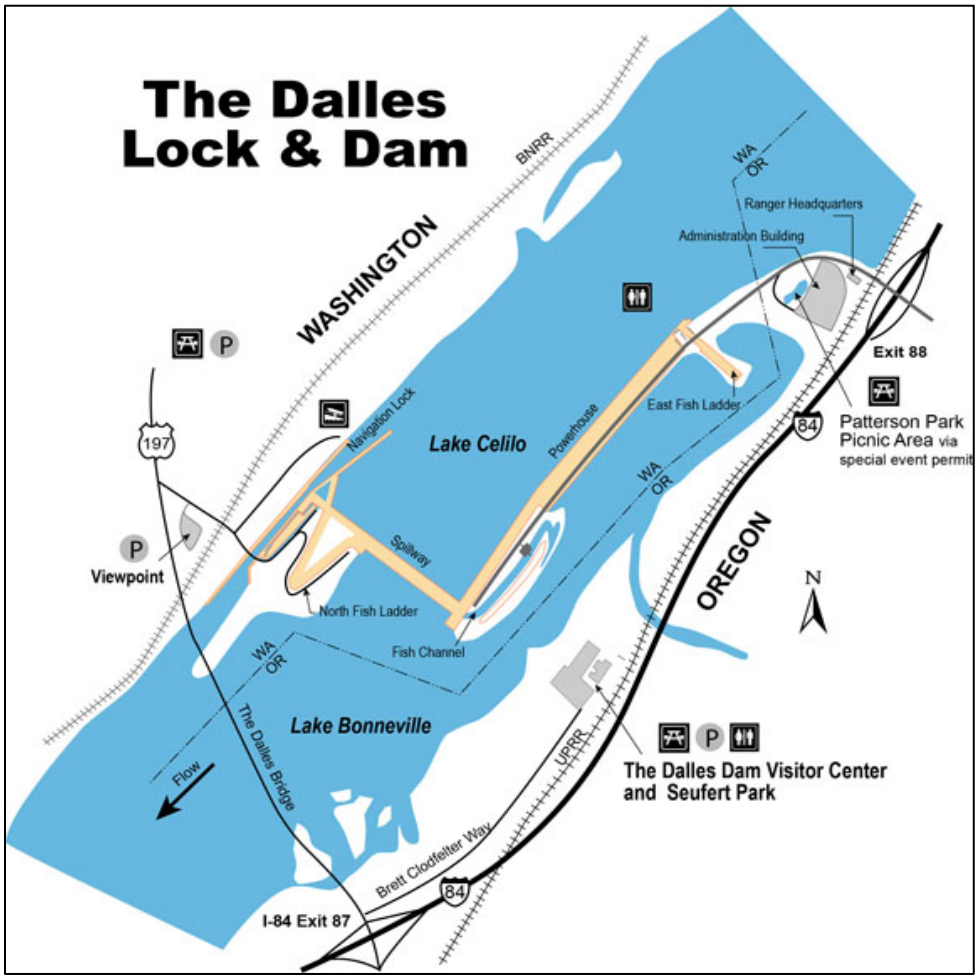
The John Day project consists of a navigation lock, spillway, powerhouse, and fish passage facilities on both shores. The reservoir behind the dam is known as Lake Umatilla. Recreational facilities are also provided along the shores of Lake Umatilla and on the John Day River. The primary project purposes are hydropower generation and navigation. The project also provides 500,000 acre-feet of flood storage for Columbia River system flood regulation and includes fish passage and recreation. Figure 2 shows details of the features at the John Day project.

Figure 2. Details of John Day Lock and Dam



The Dalles project consists of a navigation lock, spillway, powerhouse, and fish passage facilities on both shores. Recreational facilities are also provided along Lake Celilo. The primary project purposes are navigation and hydropower. Figure 3 shows details of the features at The Dalles project.

Figure 3. Details of The Dalles Lock and Dam



The stretch of the Columbia River between McNary Dam and Bonneville Dam is referred to as Zone 6 of the Columbia River Fishery (Figure 4). The reservoirs formed by John Day and The Dalles dams are included in Zone 6. The Columbia River Interstate Compact established fishery zones along the Columbia River, which were approved by Congress in 1918. This agreement between the states of Washington and Oregon allows their respective fish and wildlife departments to set commercial fishing seasons on the Columbia River. The compact divides the river into six zones. Zones 1-5 are located below Bonneville Dam. Zone 6, the 147-mile stretch between Bonneville and McNary dams, is an exclusive treaty Indian commercial fishing area where tribal members are legally entitled to half the harvestable surplus of fish in the river. To meet that requirement, Oregon and Washington must set their commercial fishing limits (season and catch) in Zones 1-5 in order to leave enough fish for harvest in Zone 6. Indian fishing is regulated under the ongoing U.S. District Court litigation known as *U.S. v. Oregon.* The mitigation for John Day and The Dalles in relation to impacts in Zone 6, and above and below this area, is a subject of importance to all parties in the basin.

Figure 4. Columbia River Zone 6

1.5. JDM Program Overview

The JDM program was originally implemented to offset mainstem fall Chinook production losses that resulted from construction and impoundment of water behind John Day and The Dalles. The scope of the mitigation was based on historic spawning estimates presented in the project authorization and supporting documents. The USACE relied on historic data from the USFWS and the states of Oregon and Washington to determine the extent of the mitigation. The USACE then expanded existing hatchery facilities in Oregon and Washington to achieve mitigation goals for fall Chinook production.

The JDM program objective is to produce sufficient juvenile fall Chinook salmon to support an escapement of 30,000 returning adults. The program objective is summarized in Design Memorandum No. 46 for the Spring Creek National Fish Hatchery (USACE 1969):

> *The degree, extent, and location of mitigation facilities required for spawning and rearing area losses due to John Day Reservoir were established after extensive studies conducted in coordination with State and Federal fishery agencies. The studies involved propagation requirements, surveys of potential sites, and water quality. It has been agreed that the hatcheries should be capable of supporting a run of 30,000 adult Chinook salmon. The number of juveniles to be reared for a run of 30,000 adults was set at 17,150,000 sized to 90 fish per pound, based on a 0.175 percent return rate. The studies also concluded that the juvenile rearing requirements should be equally divided between two locations, based on availability of suitable water and established fish runs. The use of existing runs removes the risk involved in creating new runs at other locations. The sites selected were Spring Creek National Hatchery, Underwood, Washington, and Bonneville Oregon State Hatchery, Bonneville, Oregon.*

As noted in Design Memorandum No. 46, the design included expansion of Spring Creek National Fish Hatchery to produce a sufficient number of juvenile salmon to support half of the mitigation requirement. The balance of the mitigation requirement was to be accomplished through build-out at Bonneville State Hatchery (Bonneville). The expansion of Spring Creek and Bonneville was completed between 1976 and 1978. Both of these facilities continue to be used today to help meet the specified program objective of an escapement of 30,000, although the Chinook stocks have been adjusted over time. The facilities used for production, rearing, and acclimation have also been supplemented since the original JDM program was implemented.

Currently, seven facilities are used to meet the mitigation requirement of 30,000 adults, which is based on hatchery return rates. The adjustments and refinements to the original JDM program are based on advancements in fisheries science and management and a better understanding of impacts associated with the original construction of John Day Dam. The JDM program has also been and will continue to be shaped by tribal trust responsibilities, Endangered Species Act requirements, and other legal and management agreements.

Program adjustments in the 1980s and 1990s have resulted in the current JDM production configuration with approximately half of the production as URB fall Chinook salmon that are released from several facilities just below Bonneville Dam to above McNary Dam (in Zone 6), and half of the production as tule that are released in the Bonneville pool or just below Bonneville Dam (Table 1).

Table 1. JDM Program Current Production and Release Locations

Release Locations		URB Fall Chinook			Tule Fall Chinook			Total Juvenile Release (1000s)	Total Adult Return (1000s)	Stock Split $ (based on Adult Return)	
		Juvenile Release (1000s)	Smolt-to-Adult Ratio	Adult Return/ Adult Survival (1000s)	Juvenile Release (1000s)	Smolt-to-Adult Ratio	Adult Return/ Adult Survival (1000s)				
Current Production (measured as total adult return)	Above McNary Dam	5,598	0.00176	9.9	0	0.00176	0.0			%URB	%Tule
	In Zone 6	2,074	0.00176	3.6	6,954	0.00176	12.2			50%	50%
	Below Bonneville Dam	900	0.00176	1.6	1,596	0.00176	2.8				
Total Mitigation		8,572		15.1	8,550		15.0	17,122	30.1		

Source: USACE February 2013

1.6. JDM Program Facilities and Operation

The current JDM program configuration has historically been estimated to return approximately 30,000 adult fall Chinook salmon back to the Columbia River fisheries and the hatchery facilities. Figure 5 shows the locations of existing facilities in the JDM program. Table 2 shows the existing production mix and facilities, and the release locations. As noted in Table 1, the current production mix is approximately 50% tule and 50% URB.

Figure 5. JDM Program Existing Facilities

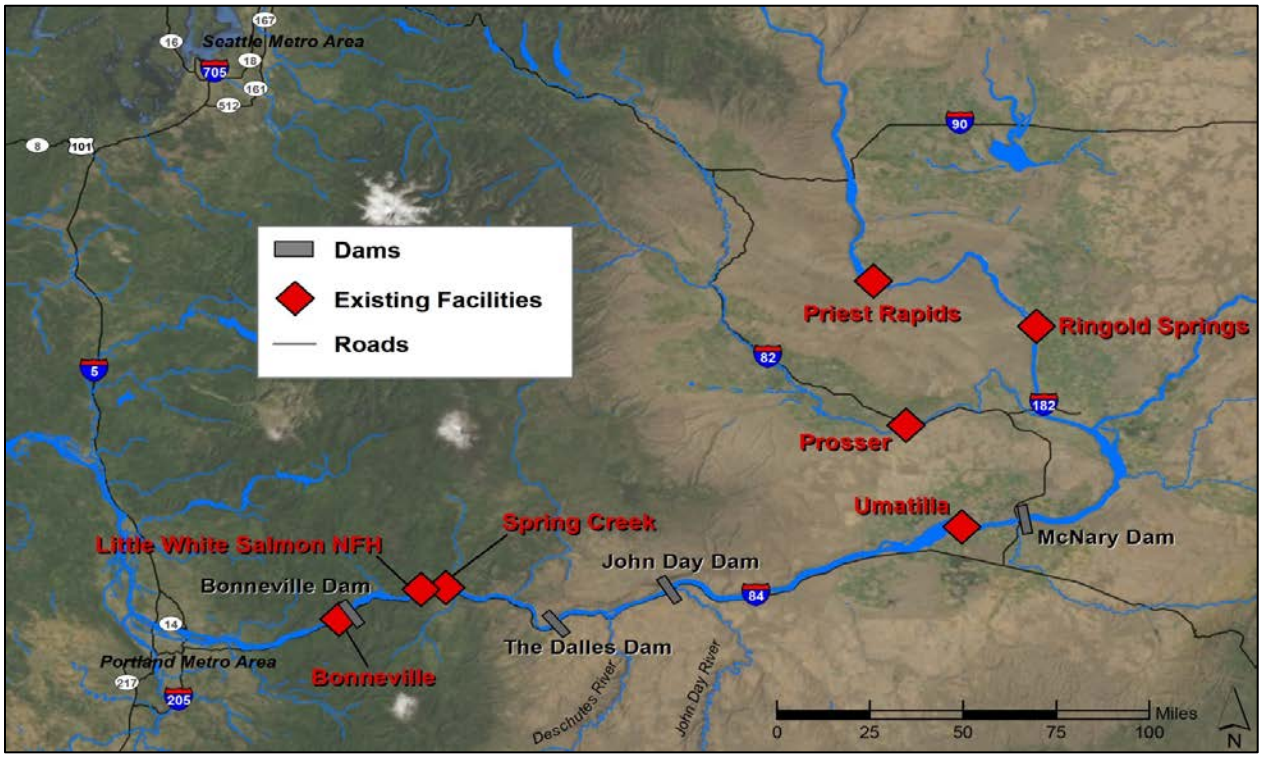


Table 2. JDM Program Existing Facilities and Production (November 2011)

Release Location	Stock	Total No. Released	USACE JDM Component	Spawn/Rear/Release Locations	Mitigation Impact Area (juvenile release location)
Spring Creek	Tule	10,500,000	5,985,000	Spring Creek	Bonneville Pool Zone 6
Little White Salmon	Tule	1,700,000	969,000	Spring Creek/Spring Creek/Little White Salmon	Bonneville Pool -Zone 6
Bonneville	Tule	2,800,000	1,596,000	Spring Creek/Bonneville/ Bonneville	Below Bonneville
Subtotal	**Tule**	**15,000,000**	**8,550,000**		
Little White Salmon	URB	2,500,000	1,125,000	Bonneville/Bonneville/Little White Salmon	Bonneville Pool - Zone 6
Little White Salmon	URB	2,000,000	468,800	See Note	Bonneville Pool -Zone 6
Bonneville	URB	2,000,000	900,000	Bonneville/Bonneville/ Bonneville	Below Bonneville
Umatilla	URB	480,000	480,000	Bonneville/Bonneville/ Umatilla	Zone 6
Ringold Springs	URB	3,500,000	3,500,000	Priest Rapids/Bonneville/ Ringold	Above McNary
Priest Rapids	URB	1,700,000	1,700,000	Priest Rapids/Priest Rapids/ Priest Rapids	Above McNary
Prosser Tribal Hatchery	URB	1,700,000	398,480	See Note	Above McNary
Subtotal	**URB**	**13,880,000**	**8,572,280**		
Total 2011 JDM Production			**17,122,280**		

Note: These numbers represent the fraction of the total stock production supported by JDM feed-only funding.
Source: USACE February 2013

Bonneville Hatchery is on Tanner Creek, which flows into the Columbia River near the base of Bonneville Dam about 145 miles upriver from the ocean. The USACE owns the property and the Oregon Department of Fish and Wildlife (ODFW) operates the hatchery using funds from the National Marine Fisheries Service (NMFS) under the Mitchell Act of 1938 and the JDM program. In 1957, the facility was remodeled and expanded as part of the 1938 Mitchell Act, a program to enhance declining fish runs in the Columbia River Basin. The USACE expanded the hatchery in 1974 to mitigate for fish losses from the construction of the John Day Dam. The hatchery currently receives funding from NMFS (Mitchell Act) and USACE. The hatchery releases 2.8 million tule fall Chinook annually into the Columbia River, of which approximately 1.6 million can be attributed to the JDM program. Bonneville also produces 2 million URB fall Chinook, of which 0.9 million can be attributed to the JDM program.

The Little White Salmon National Fish Hatchery is located on the Little White Salmon River approximately 1 mile upstream from the Columbia River. The USFWS owns the property and operates the hatchery using funds from NMFS under the Mitchell Act of 1938 and the JDM program. This hatchery was a pioneer in the science of salmon propagation when it began rearing salmon in 1896. Currently, more than 9.4 million young salmon are released annually into the river in the Bonneville pool or transferred to other sites for release. Specifically, 1.7 million tule and 2.5 million URB fall Chinook were released in 2011, of which 0.97 million (tule) and 1.13 million (URB) can be attributed directly to the JDM program.

The Spring Creek National Fish Hatchery is located on the Columbia River in Underwood, Washington. The USFWS owns the property and operates the hatchery using funds from NMFS under the Mitchell Act of 1938 and the JDM program. Spring Creek produces tule fall Chinook salmon to mitigate for lost fisheries and habitat. The USACE funded expansion of the hatchery to its current size in 1972 to support the JDM program. The hatchery produces 10.5 million tule fall Chinook annually for release into the Columbia River in the pool above Bonneville Dam, of which approximately 6 million can be attributed to the JDM program. This hatchery plays a key role in maintaining the genetic integrity of this unique stock of fish, a native of the White Salmon River. The Spring Creek tule fall Chinook stock is also an indicator stock for the U.S.-Canada Pacific Salmon Treaty, and an integral component of the *U.S. v. Oregon* agreement, which reaffirms Native American treaty fishing rights under the Treaties of 1855.

The Umatilla Hatchery is located adjacent to the Columbia River, 3.5 miles west of Irrigon, Oregon. The 23-acre site is owned by the USACE and operated by ODFW, which raises fall and spring Chinook and summer steelhead at the hatchery. Hatchery funding is provided by the Bonneville Power Administration and USACE under the JDM program. The Umatilla hatchery began operation in 1991 under the Northwest Power Planning Council's Fish and Wildlife Program to mitigate for fish losses caused by hydroelectric dams on the Columbia River. Umatilla produces 480,000 URB fall Chinook annually for release into the Columbia River, all of which can be attributed to the JDM program.

The Prosser Tribal Fish Hatchery in Prosser, Washington, is owned by Bureau of Reclamation and co-operated by the Yakama Nation. The URB fall Chinook program is funded by the USACE, the JDM program, and Bonneville Power Administration. Prosser produces 1.7 million URB fall Chinook annually for release into the Columbia River above McNary Dam, approximately 400,000 of which can be attributed to the JDM program.

The Ringold Springs State Fish Hatchery (RSH) is located on the Columbia River approximately 17 miles west of Mesa, Washington. The hatchery infrastructure is owned by the Washington Department of Fish and Wildlife (WDFW) and the property is owned by the USBR and leased to WDFW. The hatchery was initially built in 1962 as part of the Columbia River Fisheries Development Program, a program to

mitigate for fishery losses from hydropower development. In 1996, a cooperative agreement was signed by USACE, WDFW, NMFS, and USBR to share the rearing facility at RSH to increase JDM program fall Chinook salmon releases upstream of McNary Dam (above Zone 6). The USACE constructed a test facility at RSH to assess its capacity to produce URB fall Chinook, and it was demonstrated that RSH could successfully acclimate fall Chinook smolts for the JDM program. The acclimation program at RSH continues today at the existing capacity, which ranges from 3.5 million to 5.5 million fall Chinook smolts, depending on fish size. Of the total production, 3.5 million contribute to the JDM program requirement. This was an important change in the mitigation program to better address in-place and in-kind mitigation objectives. The hatchery is owned and operated by WDFW using funds from NMFS under the Mitchell Act of 1938 and the JDM program.

The Priest Rapids Hatchery is located in the Hanford Reach, a 56-mile segment of the Columbia River upstream of the Priest Rapids Dam. The hatchery is owned by the Grant County Public Utility District (PUD) and was originally designed as a mitigation facility for fall Chinook after the Priest Rapids and Wanapum dams were constructed. In operation since 1963, the Priest Rapids hatchery is operated by WDFW and is part of the agency's Priest Rapids Hatchery Complex, which also includes the RSH, Meseberg, Naches, and Columbia Basin hatcheries. The Priest Rapids Hatchery has intermittently provided eggs to the Umatilla, Prosser, and Bonneville hatcheries from 1980 to 2013. In 1992, the WDFW and USACE, in agreement with the Grant County PUD, began rearing and releasing URB fall Chinook salmon at Priest Rapids for the JDM program. Currently, the hatchery produces 1.7 million URB fall Chinook annually for release into the Columbia River above McNary Dam, all of which contribute to the JDM program. Since 2010, Grant County PUD has received funding from the USACE under the JDM program.

2. ALTERNATIVES

2.1. Assumptions

A total adult production of 107,000 fish is required to meet the authorized 30,000 adult escapement for the JDM program. This equates to a production of at least 26 million juvenile fish. Current production associated with the JDM program is approximately 17 million juvenile fish. Increased juvenile production to support approximately 8.878 million additional juvenile fish will require expanded and/or new hatchery facilities. There are no viable non-hatchery methods available that would meet this increased level of juvenile fish production.

The alternatives were formulated to address in-place and in-kind mitigation by increasing the number of returning adults to the area impacted by John Day and The Dalles, and using a production ratio of 75% URB and 25% tule fall Chinook. In addition, alternatives were formulated based on the assumption that production of tule fall Chinook would decrease with the increase in URB fall Chinook.

It was assumed that the Spring Creek Hatchery, with its current tule release in Zone 6, would continue to be used to meet the 25% tule ratio target of total adult production. With Spring Creek tule making up 25% of the returns and a smolt-to-adult ratio of 0.004723, the production goal is the release of 5,664,300 tule juveniles. This accounts for 25% of the total juveniles to be released to meet 25% (26,752) of the total adult production goal of 107,000 adult fall Chinook. Bonneville Hatchery tule releases would be eliminated from the John Day Mitigation program because the location does not meet the in-place and in-kind mitigation goal. The tule fall Chinook production and release location at Spring Creek Hatchery is the same for all alternatives.

It is assumed that Priest Rapids would be not be used to meet any of the long-term JDM program requirements under the 75% URB and 25% tule fall Chinook ratio. The Priest Rapids facility is not large enough to provide all of the needed increase in production. In order to reduce the overall management costs of the mitigation program and to eliminate future facility fees, it was assumed that the egg production and mid-Columbia releases would be moved and consolidated at the RSH.

The target for the remainder of the 107,000 adult production goal is URB fall Chinook. The minimum URB adult production is 80,248. Alternatives were developed using different combinations of build-out at existing and new facilities. Release location was also considered in developing alternatives. The number of URB juveniles released to meet this goal is based on the smolt-to-adult survival ratios for the various hatcheries. These ratios are based on data from 1990 to 2004 and are shown in Table 3. Using these figures, the number of URB juveniles needed to meet the goal was at least 20 million, with the specific number dependent on the smolt-to-adult ratio for the hatchery.

Table 3. Summary of Smolt-to-Adult Survival Ratio by Hatchery

Facility	Smolt-to-Adult Survival Ratio
Spring Creek Tule	0.004723
Little White Salmon URB	0.003196
Ringold URB	0.00384
Umatilla URB	0.013323
Klickitat URB	0.003196
I-182 URB	0.00384

The hatchery facilities were considered for use in three different ways:

1. On-station production–Spawning, incubation, rearing, and release of smolts at the facility.
2. Intermediate rearing–Spawning, incubation, and initial rearing. The fish are then transferred to another facility for final acclimation.
3. Acclimation–Final rearing and release of smolts.

Hatchery facility designs were based on fish being sized at 200 fish per pound when transported and 50 fish per pound when released. The production, rearing, and release figures are limited to smolt, which are part of the JDM components, and not total facility production to meet mitigation or other requirements.

2.2. Alternatives

The alternatives under consideration include five hatchery improvement alternatives and the no action alternative. In the John Day Mitigation Alternatives Study Report (USACE October 2012) there were three alternatives evaluated. Subsequent to that report, Alternative 1, the partial build-out at RSH, was expanded into 3 separate alternatives (1A, 1B, and 1C) with different scenarios for the acclimation and release of fish into the Columbia River Basin. The hatchery improvement alternatives were developed using different combinations of build-out at RSH and at existing and new facilities to meet revised juvenile production levels, and to better address in-place and in-kind mitigation. The alternatives include:

- No Action Alternative
- Alternative 1A – Ringold Hatchery Expansion and URB Acclimation/Release at Klickitat.
- Alternative 1B – Ringold Hatchery Expansion and New Acclimation/Release Facility near I-182.
- Alternative 1C – Ringold Hatchery Expansion and URB Acclimation/Release at Little White Salmon Hatchery Complex.
- Alternative 2 – Additional Production (above the level proposed for Alternative 1) at Ringold Hatchery and URB Acclimation/Release at Little White Salmon Hatchery Complex.
- Alternative 3 – Full Build-out at Ringold Hatchery to allow for on-site rearing and release.

The potential to support increased production at the RSH was recognized with the execution of the 1996 Cooperative Agreement for design and construction of the test facility for rearing and release of URB fall Chinook. The RSH provides rearing and release location above McNary Dam. Ringold is currently used to produce 3.5 million URB fall Chinook. The five hatchery improvement alternatives include expansion at RSH for on-station production. The volume of production and release at RSH varies across the alternatives and ranges from 10.4 million to 20.9 million fish. These five alternatives also include a range of other facilities to meet the target juvenile release figure to support the mitigation goal and align with the *U.S. v. Oregon* Management Agreement. The primary distinguishing characteristic of the alternatives is the release location in the system. Each of the alternative locations also has ESA implications and feasibility differences.

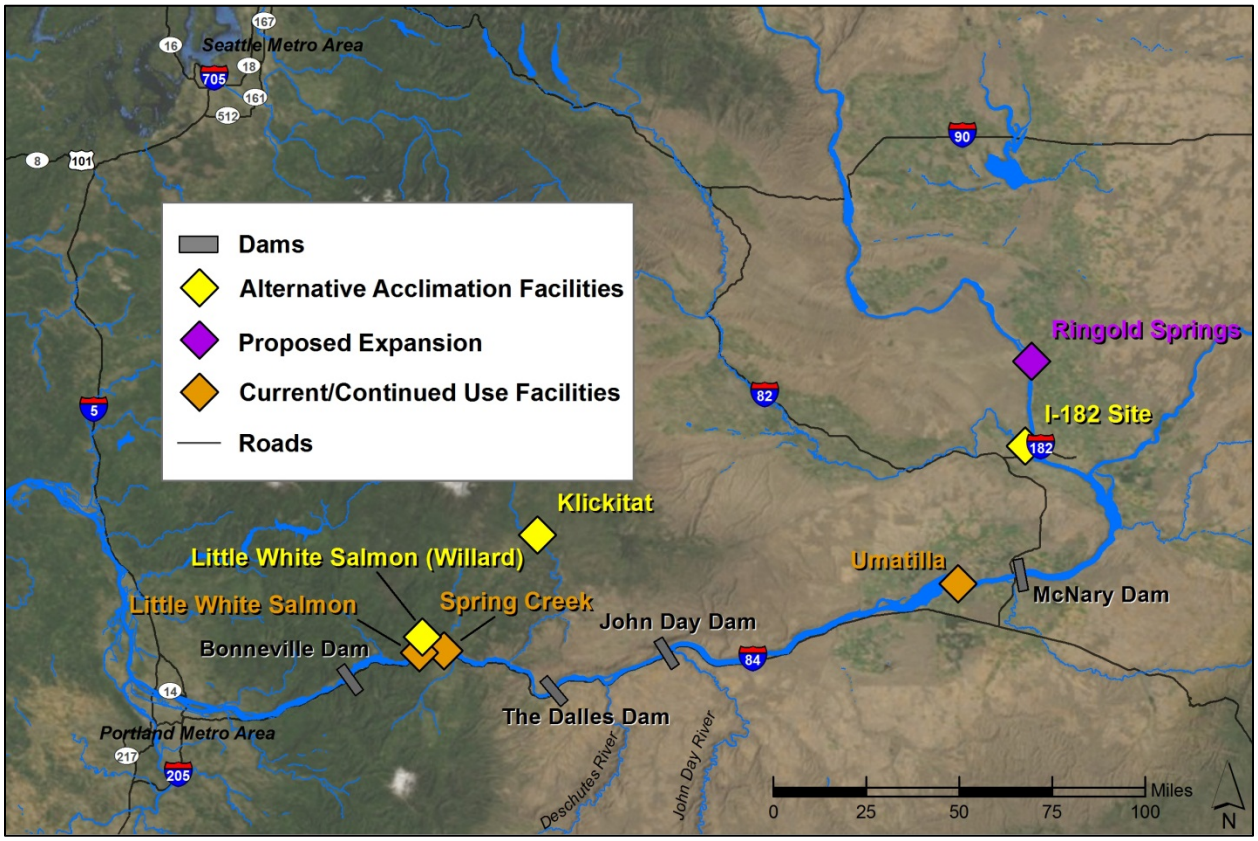
Table 4 summarizes the production at each facility by alternative. Figure 6 shows the locations of the facilities included in the alternatives. The five alternatives are described in the following subsections.

Table 4. Summary of Production at Each Facility by Alternative

Location	Smolt-to-Adult Survival	No Action Alternative		Alternative 1A		Alternative 1B		Alternative 1C		Alternative 2		Alternative 3	
		Juveniles	Adults	Juveniles	Adults	Juveniles	Adults	Juveniles	Adults	Juveniles	Adults	Juveniles	Adults
Bonneville SFH	0.001226 T 0.003128 URB	1,596,000 T 2,000,000 URB	1,957 T 6,256 URB										
Spring Creek Tule	0.004723	5,985,000	28,267	5,664,300	26,752	5,664,300	26,751	5,664,300	26,752	5,664,300	26,752	5,664,300	26,752
Little White Salmon (Willard or LWS On-Station)	0.003196	969,000 T 2,700,000 URB	4,577 T 8,629 URB	4,065,000	12,992	4,500,000	14,382	4,065,000	12,992	500,000	1,598	0	0
Ringold URB	0.00384	3,500,000	6,965	10,439,500	40,088	10,439,500	40,088	10,439,500	40,088	16,735,500	64,264	20,900,000	80,256
Umatilla	0.013323	480,000 y		480,000	6,395	600,000 y 2,531,086 sy	12,094	480,000	6,395	480,000	6,395		0
Klickitat	0.003196	0		4,000,000	12,784		0		0		0		0
I-182	0.00384	0			0	3,750,000 sy 500,000 y	14,124,000	0	0		0		0
Priest Rapids	0.00384	1,700,000	6,528										
Prosser		170,000	338										
Total Tule		8,550,000	34,800	5,664,300	26,752	5,664,300	26,751	5,664,300	26,752	5,664,300	26,752	5,664,300	26,752
Total URB		10,550,000	35,112	21,484,500	80,248	22,320,586	80,688	21,484,500	80,248	20,215,500	80,247	20,900,000	80,256
Total		19,100,000	69,912	27,147,800	107,001	27,984,586	107,439	27,148,800	107,001	25,879,800	107,000	26,564,300	107,008
Goal		19,000,000 JUV			107,000		107,000		107,000		107,000		107,000
Ratio		55%			75.00%		75.00%		75.00%		75.00%		75.00%

T = Tule, URB = Up-river Bright, y = yearling, sy = subyearling, JUV = Juvenile

Figure 6. Alternatives for the JDM Facilities Improvements



2.2.1. No Action Alternative

For the no action alternative, existing hatchery operations would continue with insufficient in-place/in-kind production to meet the mitigation terms of the JDM program. The JDM program has been and will continue to be shaped by tribal trust responsibilities, ESA requirements, and other legal and management agreements. Taking no action would not meet the requirement of Reasonable and Prudent Action #40 in the FCRPS BiOp, which was developed to ensure that the JDM program does not impede recovery for Lower Columbia Chinook salmon. In addition, taking no action would not address the balance between upriver and downriver stock production as required in the 2008 Columbia Basin Fish Accords, and would not meet requirements of the *U.S. v. Oregon* Management Agreement.

2.2.2. Alternative 1A – Ringold Expansion and URB Acclimation/Release at Klickitat

Alternative 1A was formulated to support increased on-station production at RSH and development of an acclimation facility at the Klickitat Hatchery. It would also use fish produced from the Little White Salmon and Umatilla hatcheries to meet the targeted mitigation goal. The Klickitat hatchery is an existing facility located on lands owned by the state of Washington and operated by the Yakama Nation, located 7 miles east of Glenwood, Washington, at river mile (RM) 42 of the Klickitat River.

Alternative 1A provides for the on-station production of 10.4 million URB fall Chinook at an expanded RSH (current URB production at RSH is 3.5 million). In addition, RSH would be modified to support

production of approximately 4 million fish for intermediate rearing. Under Alternative 1A, 4 million smolts would be acclimated at an expanded facility at Klickitat. Thus, the capacity of RSH for incubation and intermediate rearing would be approximately 14.5 million for this alternative.

Alternative 1A also includes on-station production of 6.565 million fish at the Little White Salmon hatchery. This portion of the production would not affect the design of RSH. Of these fish, 2.5 million would be acclimated at the Willard facility, which is part of the Little White Salmon complex. These fish would be released in the Bonneville pool. Adult long-term holding facilities would not be required for this alternative since the existing adult return pond is adequate. Alternative 1A also includes the on-station production of 480,000 (approximately 0.5 million) fish at the Umatilla hatchery. This production is separate from any production at RSH.

Under Alternative 1A, acclimation and release of 4 million juveniles would occur at the Klickitat Hatchery. One of the disadvantages of this location is that the juveniles released in the Klickitat River would enter the Columbia River below The Dalles Dam in the Bonneville pool. This site is the greatest distance from RSH.

2.2.3. Alternative 1B – Ringold Expansion and New Acclimation/Release Facility

Alternative 1B would include the same expansion of RSH as Alternative 1A and would include a new off-site acclimation/release facility located in the lower Yakima River. Alternative 1B also uses the Little White Salmon National Fish Hatchery and Umatilla Hatchery to meet the targeted mitigation goal.

Four off-site acclimation/release sites were evaluated for use: I-182, Horn Rapids County Park, Barker Ranch, and Priest Rapids Hatchery. The site information was taken from McMillen, LLC (2012) and USACE (October 2012).

The I-182 site is located on the southerly portion of an 87-acre parcel in Richland, WA, on the right bank of the Yakima River (RM 3) about 2.5 miles from its confluence with the Columbia River. The 5-acre site proposed for development is located about 27 miles south of RSH. The property is owned by the USACE and is mostly undeveloped and operated as a wildlife management area. The portion of the site identified for potential use is a fairly level grass and sagebrush field. The river frontage is a heavily vegetated riparian zone. The USACE has a water right for irrigation of 5 acres at the site. An irrigation canal is located along the west side of the parcel and may be able to provide some additional water.

The Horn Rapids site is located on the west bank of the Yakima River about 7 miles north of Benton City, Washington. The site is located on a small portion of a 295-acre parcel owned by Benton County and operated as a multi-use county park. At the project frontage, there is no riparian vegetation along the river bank. A gravel road provides access to the river bank. Most of the site consists of relatively barren uplands vegetated with cheat grass and occasional sage brush. The site does not have utilities or existing water rights.

The Barker Ranch site is located on the east bank of the Yakima River (RM 9) in Benton County, Washington, about 6 miles northwest of Richland. The site would utilize several acres on the 1,040 acre parcel, forming the northern half of the total ranch area. Since 1994, the ranch has been owned by a hunting and conservation group that manages the land for wildlife habitat. Vehicular access to the proposed site is controlled by a locked gate on a 3/4 mile dirt road. The ranch property is fenced and is closed to the general public. The portion of the site identified for potential use is a fairly level grass field bordered by Russian olive, alders, and willow trees. The river frontage is a heavily vegetated riparian

zone. The site has a pre-existing 17 cubic feet per second (cfs) water right that would be available for only part of the year. During fall, the water is needed to attract waterfowl for hunting.

At Priest Rapids, services would be leased from the owner of the hatchery, Grant County PUD, for juvenile rearing and release, and for adult holding/collection. Remodeling of the Priest Rapids hatchery is underway with some facilities ready for use in brood year 2013 and full completion in 2014. Currently, 1.7 million of URB fall Chinook produced at Priest Rapids are released as part of JDM production goals. Whether this program is to be continued will depend largely on the need to meet JDM goals and economic factors relating to operation and maintenance costs in the future.

Each of the four possible acclimation/release sites was evaluated using the following criteria. The evaluation used a scoring procedure in which a score of score of +1 was assigned when a site was positively rated for the evaluation criteria, a score of 0 when a site was neutral for the evaluation criteria, and a score of -1 when a site was negatively rated for the evaluation criteria.

- Water Availability
  - Is there an existing water right?
  - Can the water right be expanded?
  - What are the existing water sources?
- Water Quality and Temperature
  - Are there any known water quality issues at the site?
- Site Size
  - Is the site large enough to accommodate rearing and/or holding facilities?
- Site Access
  - Has site access already been developed?
- Power Availability
  - Does the site already have on-site electrical service?
- Site Security
  - Have any security issues been identified?
- Site Acquisition/Ownership
  - Who owns the site?
  - Could the site be purchased or leased? How difficult would this be?
- Permitting Difficulty
- Location
  - Does the site location help spread fish through the watershed?
  - What is its proximity to other facilities and dams?
  - Would fish need to be transported long distances?
- Dual Use/Flexibility
  - Does the site have potential for both juvenile rearing and adult holding/collection?
- Cost
  - What is the cost of developing this site relative to the cost of the other acclimation sites?

I-182 Site

- **Water Availability – Score 0**. Some water is available from a well on site. Additional water rights and possibility of using surface water from Yakima River are being explored.
- **Water Quality and Temperature – Score 0.** Unknown at this time.
- **Site Size – Score +1.** Sufficient size to accommodate some rearing and adult holding ponds.
- **Site Access – Score +1**. Access to the site is developed off of I-182.

- **Power Availability – Score +1**. The site has electrical service.
- **Site Security – Score 0**. No security issues identified.
- **Site Acquisition/Ownership – Score +1**. Owned by the Federal Government (USACE).
- **Permitting Difficulty – Score 0**. Since the property is owned by USACE, permitting would be simplified. However, there are apparent wetlands on the site.
- **Location – Score +1**. On the Yakima River and easily accessible.
- **Dual Use/Flexibility – Score +1**. The site could potentially be used for both adult holding and juvenile acclimation.
- **Cost Relative to Other Acclimation Sites – Score +1**. Since USACE already owns the land, the relative cost is lower than the other acclimation sites.

Horn Rapids Site

- **Water Availability – Score -1**. There is no existing water right.
- **Water Quality and Temperature – Score 0.** Unknown at this time.
- **Site Size – Score +1.** Sufficient size to accommodate some rearing and adult holding ponds.
- **Site Access – Score 0**. Site access is not developed.
- **Power Availability – Score -1**. No power to site.
- **Site Security – Score 0**. No security issues identified.
- **Site Acquisition/Ownership – Score -1**. Is owned by Benton County and would either need to be purchased or leased from the county.
- **Permitting Difficulty – Score 0**. Site is on public land so permitting would be easier than on private property, but less simple than land already owned by USACE. No apparent wetlands on the site.
- **Location – Score +1**. On the Yakima River, further upstream than I-182 site.
- **Dual Use/Flexibility – Score +1**. The site could potentially be used for both adult holding and juvenile acclimation.
- **Cost Relative to Other Acclimation Sites – Score -1**. Lack of existing utilities, development, and land ownership.

Barker Ranch Site

- **Water Availability – Score +1**. Existing 17 cfs water right.
- **Water Quality and Temperature – Score 0**. Surface water from Yakima River. Temperature data unknown.
- **Site Size – Score +1.** Sufficient size to accommodate some rearing and adult holding ponds.
- **Site Access – Score +1**. Site access has been developed.
- **Power Availability – Score +1**. On-site electrical service available.
- **Site Security – Score 0**. No security issues identified.
- **Site Acquisition/Ownership – Score -1**. Located on private property and would either need to be purchased or leased.
- **Permitting Difficulty – Score -1**. Permitting difficult because property is privately owned. Also, most of property is flooded for waterfowl refuge, which may be considered wetland habitat.
- **Location – Score +1**. On the Yakima River.
- **Dual Use/Flexibility – Score -1**. The site could not potentially be used for both adult holding and juvenile acclimation because there is no water right during the adult run.
- **Cost Relative to Other Acclimation Sites – Score 0**. Similar to I-182 site.

Priest Rapids Site

- **Water Availability – Score +1**. Capacity exists, but more research needed to determine exact amount.
- **Water Quality and Temperature – Score +1**. Sufficient.
- **Site Size – Score 0.** Sufficient size to accommodate rearing of 1.7 million subyearlings and adult holding ponds.
- **Site Access – Score +1**. Site access has been developed.
- **Power Availability – Score +1**. On-site electrical service available.
- **Site Security – Score +1**. No security issues identified; site is fenced with gated keyed entry.
- **Site Acquisition/Ownership – Score -1**. Grant County PUD ownership; compensation required.
- **Permitting Difficulty – Score +1**. Adding acclimation to existing hatchery.
- **Location – Score -1**. Upstream on Columbia River. Using Priest Rapids for production without also using an acclimation site on the Yakima River would not add in-place, in-kind URB production to the Yakima.
- **Dual Use/Flexibility – Score +1**. The site could be used for both adults and juveniles.
- **Cost Relative to Other Acclimation Sites – Score -1**. While using capacity at Priest Rapids is unlikely to come with a large initial capital investment for improvements by the USACE, the ongoing compensation for capacity and operation/maintenance costs for the life of the program make this alternative less predictable from an economic perspective.

Table 5 provides a summary comparing the evaluation of the four possible acclimation/release sites.

Table 5. Summary Comparison of Possible Acclimation/Release Sites

Evaluation Criteria	I-182	Horn Rapids	Barker Ranch	Priest Rapids
Water Source				
Water availability	0	-1	+1	+1
Water quality/temperature	0	0	0	+1
Site Characteristics				
Site size	+1	+1	+1	0
Site access	+1	0	+1	+1
Available power	+1	-1	+1	+1
Site security	0	0	0	+1
Site acquisition/ownership	+1	-1	-1	-1
Permitting Difficulty	0	0	-1	+1
Location			+1	
Relative to Yakima River fishery	+1	+1	+1	-1
Future Flexibility				
Possible adult collection? Dual use?	+1	+1	-1	+1
Cost relative to other site alternatives	+1	-1	0	-1
Total Score	**+7**	**-1**	**+3**	**+4**

Scoring Key:
+1 = positive rating for the evaluation criteria.
0 = neutral rating for the evaluation criteria.
-1 = negative rating for the evaluation criteria.

Based on the evaluation, the I-182 site would be the most feasible new acclimation/release site. In addition, its location on the Yakima River supports spreading some of the URB fall Chinook production and collection throughout the Zone 6 Fishery and into the Yakima River (adding in-place, in-kind URB production).

Alternative 1B would provide for on-station production and release of 10.4 million juvenile URB fall Chinook. In addition to an increase in on-station production at RSH, the facility would also be modified to support production of an additional 3.75 million subyearlings for intermediate rearing before transporting to the I-182 site for acclimation. The site would allow for juvenile release above McNary Dam. The I-182 site is expected to have a higher smolt-to-adult ratio than Klickitat and Little White Salmon, so the smolt production figure and capacity at the acclimation facility can be reduced to obtain a release of 3.75 million subyearlings and 0.5 million yearlings. Similar to Alternative 1A, on-station production at the Little White Salmon (4.065 million) and Umatilla (480,000) hatcheries would continue. An additional 2.5 million eggs from Little White Salmon would be transported to and acclimated for release at the Willard facility as described under Alternative 1A.

2.2.4. Alternative 1C – Ringold Expansion and URB Acclimation/Release at Little White Salmon Hatchery Complex

Alternative 1C would provide for production in the same manner as described for Alternatives 1A and 1B, including the expansion of RSH and the use of Little White Salmon and Umatilla hatcheries. However, this alternative would include new acclimation facilities at the Little White Salmon Hatchery. Alternative 1C would utilize the Little White Salmon Hatchery complex (including Willard) for acclimation and release. The alternative would increase the number of fish released at Little White Salmon by 4 million. The facilities at Willard would also be used to provide space for production of these additional fish. Little White Salmon is located farthest downstream of the three acclimation and release sites proposed in Alternatives 1A, 1B, and 1C. Alternative 1C would return fish to the Bonneville pool.

2.2.5. Alternative 2 – Additional Production at Ringold and URB Acclimation/Release at Little White Salmon Hatchery Complex

Alternative 2 proposes that production be more focused at an expanded RSH and supplemented by the Little White Salmon complex (including Willard) and the Umatilla hatchery. In Alternative 2, the total on-station production at RSH would be 16,735,500 fish. Under this alternative, the total program production at Little White Salmon would decrease from 6.565 million fish (Alternatives 1A and 1B) to 3 million fish. The details of how this production would be split between Little White Salmon and Willard would be determined in the future. No additional facilities would be required for this reduced number of fish. The production at Umatilla would remain the same at 480,000 fish. This alternative provides a release location above McNary Dam, but there is concern that the high juvenile release level at RSH may not be environmentally sound and that a mix of sites may be preferable.

2.2.6. Alternative 3 – Full Build-out at Ringold

Alternative 3 would represent a full build-out at RSH. This alternative would eliminate URB production from other sites and rely completely on RSH for on-station production. The greatly expanded RSH would provide for the release of 20.9 million juvenile URB fall Chinook. All acclimation and release would occur at RSH; no transportation would be required. As with Alternative 2, there is concern that using only one site for acclimation and release may not be the most environmentally sound approach, and that a mix of release sites is preferable.

2.3. Comparison of Alternatives

The following criteria were used to compare the alternatives. These criteria are listed below and alternatives compared in Table 6.

- Ability to meet in-place and in-kind objectives (FCRPS BiOp and 2008 Accords).
- Transportation costs based on distance from production site to acclimation/release site (low, medium, or high).
- Potential for adverse ESA impacts, policy, and/or authorization concerns.

In addition, the alternatives were compared with the goal of meeting JDM objectives. These objectives are listed and alternatives compared in Table 7.

Table 6. Comparison of Alternatives

Alt.	Meets in-place and in-kind objectives	Transportation Cost			Potential for Adverse ESA Impacts, Policy, and/or Authorization Concerns
		Low	Medium	High	
1A	Partial			X	USACE does not own the land; approval and implementation could be complicated and delayed.
1B	**Optimal**		**X**		**None**
1C	Partial			X	None
2	High	X			Potential for adverse ESA impacts by having juvenile release at one location.
3	High	X			Potential for adverse ESA impacts by having juvenile release at one location.
No Action	Partial	X			Potential to further delay or impede recovery of Lower Columbia Chinook salmon; does not meet requirements of the FCRPS BiOp and 2008 Accords.

Table 7. JDM Objectives Comparison

JDM Objective	No Action	Alt 1A	Alt 1B	Alt 1C	Alt 2	Alt 3
Meets existing JDM mitigation objective of an escapement of 30,000 Chinook based on using the total adult production method and specific smolt-to-adult ratio.	No	Yes	**Yes**	Yes	Yes	Yes
Meets in-kind production ratio of 75% URB and 25% tule fall Chinook salmon.	No	Yes	**Yes**	Yes	Yes	Yes
Meets in-place mitigation objective by increasing release of juvenile salmon in Zone 6 and above McNary Dam.	No	No	**Yes**	No	Yes	Yes
Provides a mitigation program that is economically efficient.	Yes	No	**Yes**	No	No	No
Provides a mitigation program that is ecologically sound.	Yes	Yes	**Yes**	Yes	No	No

Based on the above comparisons, Alternative 1B would best meet the evaluation criteria and JDM objectives listed in Tables 6 and 7, respectively.

Further evaluation of the preliminary alternatives was provided by the *U.S. v. Oregon* Production Advisory Committee in March 2012. Concerns were raised by the committee as related to Alternatives 2 and 3 that proposed siting all (or nearly all) of the URB mitigation at RSH, as summarized below:

- A 20.9 million production-level facility would not be acceptable ecologically with this number of hatchery fish released directly into the Hanford Reach natural spawning areas. This approach does not implement best management practices for new hatchery production programs.
- A 20.9 million production program would require new water rights and substantially more water than is currently available, which may be difficult and/or not timely to achieve. There is also uncertainty about water quality/quantity availability for such a large program.
- Consolidating all of the production of URB leaves vulnerability to catastrophic failure (disease, facility failure, etc). Reliance on a single brood stock collection and rearing site also presents vulnerabilities.
- A 20.9 million production program does not adequately address logistics for an integrated hatchery approach under best management practices.
- Federally funded mitigation programs require 100% mass marking and a 20.9 million production program would be unprecedented and logistically impossible given short marking windows.

Alternative 3 would rear and release all of the required URB production for meeting the 75% split, totaling 20.9 million. Based on the Production Advisory Committee comments, this production has several issues that would not comply with the objective of being ecologically sound. Alternative 2, with a proposed production at RSH of 16.7 million URB, faced similar concerns as Alternative 3. The Production Advisory Committee generally agreed that a mix of facilities should be used and the RSH build-out should be limited to a production range of 8 to 12 million. Based on these reasons, Alternatives 2 and 3 were not recommended for further consideration.

Using a mix of sites for acclimation, as described under Alternatives 1A, 1B, and 1C, was assessed to be the preferred approach and was deemed to be more ecologically sound and aligned with best management practices for hatchery programs.

> **Alternative 1A:** Alternative 1A better meets the in-place and in-kind objectives when compared to existing conditions. However, given the Klickitat Hatchery location, the release of 4 million juvenile URB fall Chinook would be below the John Day Dam in the Bonneville pool. The location is closer to the Bonneville Dam than to the John Day Dam.

Alternative 1A would result in higher operation costs due primarily to the distance and time involved with transfer of fish from RSH to the Klickitat Hatchery. The time that fish would be in the transport trucks may also affect their health, resulting in lower adult returns due to potential increased mortality. Since the USACE does not own the land, acquisition and leasing arrangements would incur additional costs. Approval and implementation could be complicated and delayed given the lack of USACE ownership.

> **Alternative 1B:** Alternative 1B best meets the in-place and in-kind objectives due to its release location above McNary Dam on the Yakima River, very close to the Columbia River.

Alternative 1B would result in comparatively lower operation costs because of the close distance and time involved with transfer of fish from Ringold to the I-182 site. The short period of time that fish would be in the transport trucks would minimize stress and decrease health issues associated with the transport. The site is on property owned by the USACE and would not be subject to land acquisition costs, leasing arrangements, and associated time delays.

Alternative 1C: Alternative 1C meets the in-place and in-kind objectives when compared to existing conditions. However, the use of the Little White Salmon Hatchery, which is the farthest down river, would return fish to the Bonneville pool, which is outside of the area impacted by construction of John Day and The Dalles dams.

The existing facilities at Little White Salmon are well maintained and maintenance costs would likely be equal to or slightly higher than the Alternative 1B site, which requires all new facilities. Alternative 1C would have less of a direct environmental impact than Alternative 1B since new land would not be disturbed and in-water work would not be needed for intake construction. At Little White Salmon, there is the possibility that hazardous materials handling could be an issue with the demolition of 60-year old lab buildings needed in order to use the site.

2.4. Selection of the Preferred Alternative

Alternative 1B was selected as the preferred alternative. Alternative 1B best meets the criteria and objectives of the JDM program. Alternative 1B meets 107,000 adult returns for an escapement of 30,000 Chinook salmon, and meets a production ratio of 75% URB and 25% tule fall Chinook salmon. This alternative also provides for in-place and in-kind mitigation of lost spawning areas above John Day Dam, and would be economically efficient and ecologically sound in meeting the higher production capacity while minimizing potential adverse effects on wild fish populations and ESA-listed fish species.

2.5. Preferred Alternative

The preferred alternative is a combination of actions, which include an expansion of facilities at RSH to allow for the production and release of 10.4 million juvenile URB fall Chinook. In addition to an increase in on-station production, the RSH facility would be modified to support production of approximately 4 million for intermediate rearing and release at another site. This would bring the total production at RSH for incubation and intermediate rearing to approximately 14.5 million. The preferred alternative also includes construction of acclimation facilities at the I-182 site, which would be used for acclimation and release of 3.75 million subyearlings produced at the expanded RSH and 0.5 million yearlings from the Bonneville State Fish Hatchery. The existing facilities at the Bonneville State Fish Hatchery, Little White Salmon National Fish Hatchery, and Umatilla fish facilities would continue to be used for URB fall Chinook production, rearing, acclimation, and release. The Spring Creek National Fish Hatchery would continue to be used to produce tule fall Chinook; however, overall production of tule would be reduced such that the total production of both stocks would total approximately 26 million, meeting the 107,000 Total Adult Production goals. This production and ratio would best meet in-place and in-kind mitigation goals.

2.5.1. Ringold Hatchery Expansion

The RSH site is approximately 242 acres in size. The hatchery infrastructure is owned by WDFW and the property is owned by WDFW and the U.S. Bureau of Reclamation. The USBR-owned land is approximately 188 acres of the total site and leased to WDFW. The existing RSH site has the following components: 9-acre rearing pond, 5-acre rearing pond, 14 vinyl raceways, and adult trap and holding pond. Water for the facilities is supplied by an existing water right of 70 cfs, which provides year-round water. Figure 7 shows an aerial view of RSH.

Figure 7. Aerial View of Ringold Hatchery

An overview of the facility improvements at RSH is provided below and shown on Figures 8 and 9.

- Replace the existing fishways with structures meeting current NMFS design criteria. The lower fish ladder will be a series of 18 precast concrete weirs, each 12 inches thick, to replace the existing ecology blocks in the Ringold Creek channel and will extend into a sufficiently deep section of the Columbia River. A holding pool will be excavated between each weir and will have a 3:1 side slope, a depth 6 inches below the lower weir elevation, and be covered with crushed rock to prevent erosion within the channel. The upper fish ladder will be a weir and orifice design (also known as a half Ice Harbor fish ladder) using a 6-foot-wide concrete channel with 12-foot-high side walls. The upper fish ladder will contain 14 ladder pools and pass returning adult fish 14 vertical feet from the lower fish ladder to the pre-sort holding. The upper fish channel will be a 6-foot-wide concrete channel with 12-foot-high walls provided from the upper fish ladder to both the pre-sort holding pond and the dual use ponds.

- Construct a river intake structure in the Columbia River to supply additional river water to RSH. The proposed river water intake will be located approximately 2,000 feet south of the existing river intake and placed in a deeper portion of the Columbia River to provide a more reliable water supply. The intake will be a precast concrete structure supported on two drilled shafts, each 8 feet in diameter. Large floating equipment will be needed to install the intake structure. Precast pile caps and support beams will be set between the two shafts. The intake structure will have a bridge approximately 480 feet in length and a crane. A stairway will extend from the bridge to the intake structure. The pump system will consist of three identical vertical shaft turbine pumps to provide 40 cfs to 90 cfs of river water. The intake screen system will consist of three vertical

screens in slots located at the opening of the pump chamber. The screens will be oriented parallel to river flow to prevent debris accumulation and will also be equipped with an air-burst screen cleaning system. Screen bar spacing is 0.069 inches and will provide sufficient surface area to limit velocities to below 0.4 feet per second per NMFS requirements for intake screens. Two in-water work periods will likely be required to install the intake structure.

- Provide an adult return flume to return fish species not destined for spawning at RSH back into the Columbia River. The flume will be a high-density polyethylene pipe, 18 inches in diameter, and will run from the sorting facility to the shore end of the intake structure bridge. Most of the flume will be an elevated pipe supported by steel supports suspended from the bottom of the intake bridge structure; the remainder will be supported on pipe supports. The flume is designed to operate within a range of Columbia River water surface elevations (350.4 to 357.4 feet).

- The lower fish ladder, river water intake, and adult return flume all require some element of in-water work. The entrance to the lower fish ladder extends into the Columbia River. In-water work includes excavation, installing support pipe piles, installing precast concrete weirs (9 weirs), and placing riprap. This work would likely be accomplished using a barge-mounted crane. The river water intake requires barge-mounted equipment to install the drilled shafts and the precast concrete structure. The adult return flume will be installed under the intake structure bridge and will require work from a barge during the in-water work period. This in-water work will occur during the in-water work period, as designated by WDFW, from 16 July to 30 September.

- Construct a pre-sort holding pond to provide temporary holding and resting space for adult fish after exiting the upper fish ladder prior to sorting. This rectangular concrete pond is approximately 113 feet in length and 20 feet in width, with pond walls 13 feet high and 8 feet of water depth. A v-trap will prevent adult fish from passing back into the upper fish ladder.

- Construct six dual-use ponds, each 200 feet in length, 20 feet in width and 8 feet in depth, in the southern end of the existing 9-acre pond to be used for rearing and adult holding. Thirty rearing ponds will be constructed north of the dual use ponds. The rearing ponds will be rectangular concrete structures, each 100 feet in length, 10 feet in width and 5 feet in depth. The ponds will be covered with a metal roof for shade. Tensioned bird netting will completely surround the ponds to provide protection from avian predation.

- Replace the existing above-grade corrugated metal supply line from the main (spring) intake. The new supply line will be a high-density polyethylene pipe, 42 inches in diameter, that will be covered by an earthen berm to reduce the effect of solar heating; it will be connected to the existing 42-inch supply line from the lower (spring) intake.

- Install pre-engineered metal buildings to be used as a sorting facility, spawning shelter, and hatchery building (incubation room, office, restrooms/lockers).

- Provide a new domestic well for potable water.

- Grading will be required for facility installation. The proposed earthwork at the site requires approximately 12,000 cubic yards of net fill.

- New paving and building impervious surfaces will create stormwater runoff that will be captured in four bio-infiltration swales sized to store the first 6 inches of runoff. These will serve as temporary silt removal ponds during construction.

- Construct a road 24 feet in width to provide access to the rearing ponds. All paved areas will be covered with a 3-inch-thick asphalt surface, underlain by an 8-inch-thick crushed base course.
- Construct a reinforced concrete pollution control pond (120 by 160 feet) to be used to decant the uneaten food and fish feces vacuumed from the bottom of the rearing ponds. The decanted fluid outflow from the pollution abatement pond will be discharged through the process water discharge system. At the end of the rearing season, the pond will be drained and the solid matter allowed to dry. Once dry, it can be removed and disposed of in an approved disposal facility.
- Install onsite septic system to treat sewage from the bathrooms in the incubation building.

2.5.1.1. Geotechnical Considerations

Ten test pits were dug in April 2012 to determine existing soil and groundwater characteristics at the RSH site. Subsurface conditions consist of predominately loose sand/silt deposits overlying dense coarse gravels. The top levels of loose sand/silt will likely be difficult to compact, and over-excavation of grades and import of structural fill may be required in some locations. Native sand/silt soils are acceptable for retaining wall backfill. During April testing, groundwater was found a few feet below the surface west of the pond with high rates of horizontal groundwater flow within the test pits. The RSH site has a high level of horizontal ground water flow. Groundwater flow on the site is typically from the east edge of the site towards the creek on the southwest of the site and west towards the Columbia River.

A pumping test was conducted to evaluate the amount of ground water that would be available at the site. A drilling program identified two aquifers below the site. The upper aquifer was about 20 feet deep and was separated from a lower aquifer by a leaky aquitard. Initial tests of the water in the upper aquifer indicated that its temperature was lower than that of the lower aquifer. On that basis, and the expectation that the upper aquifer would provide an adequate flow of water, the pump test was run on the upper aquifer. The test indicated that the anticipated groundwater gallery system would not be able to provide adequate flows, with the projected flow rate of only 0.5 to 1 cfs. A larger collection gallery would not be cost effective.

As a result of the initial tests, the basis for the proposed design is a well field consisting of 10 wells approximately 150 feet deep. During the final design phase, testing of the lower aquifer will be done to verify the capacity of the aquifer. The wells drilled for that testing program would be used for production wells.

Temporary dewatering during construction may be necessary to prevent the loose sands from becoming quick and making excavation below grade challenging. Below-grade structures will be constructed during late winter and early spring and not during timeframes when the rearing pond is being used. Due to high lateral groundwater flow, it is anticipated that high capacity sumps and pumps along with dewatering ditches will be needed for construction of below-grade structures. It is unknown at this time the requirements for permanent dewatering systems and the seasonal variations of groundwater levels. It may be necessary to install gravity cutoff trenches and ditches on the uphill (eastern) side of the facilities to provide long-term drainage depending on seasonal groundwater levels.

Figure 8. Ringold Site Plan

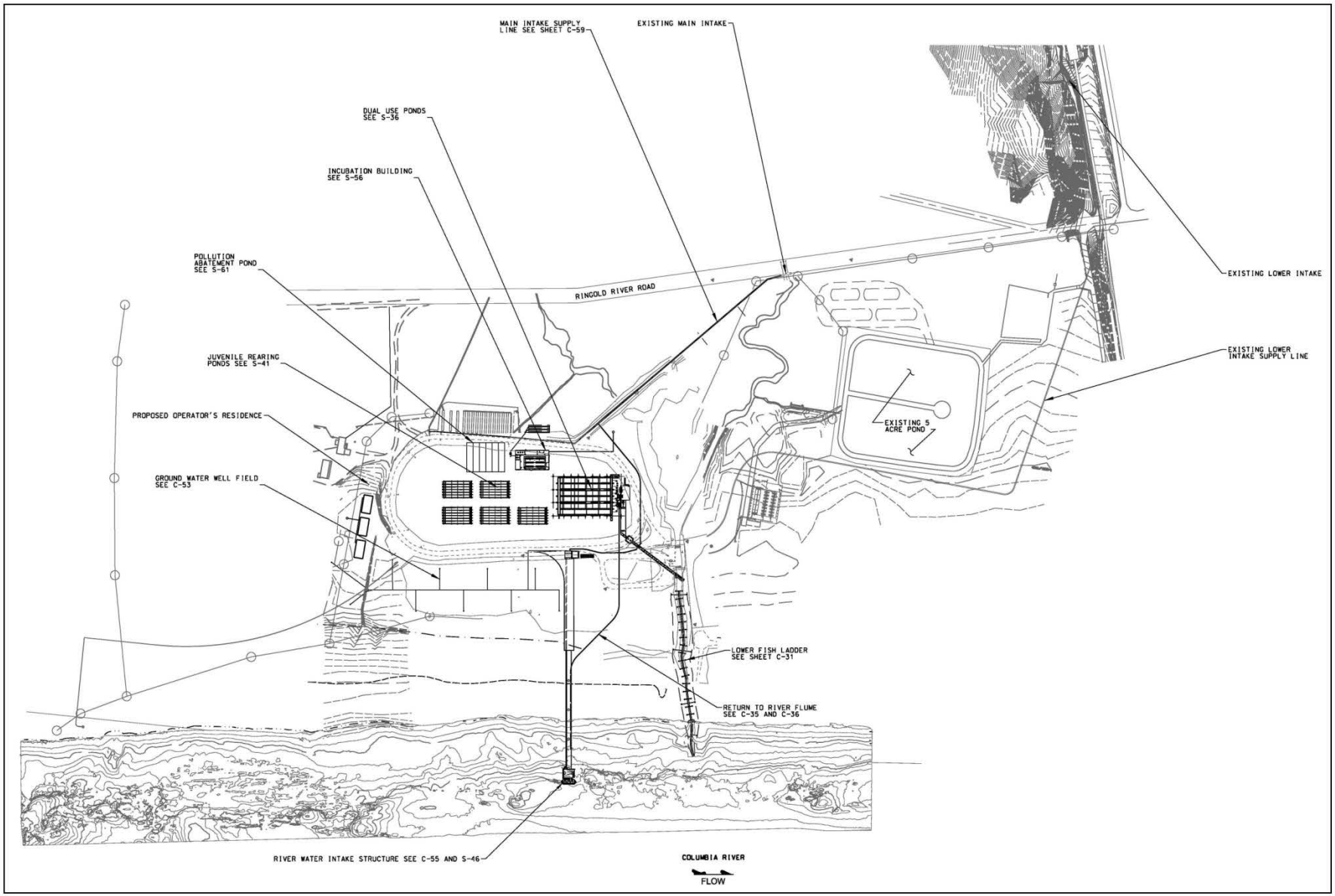
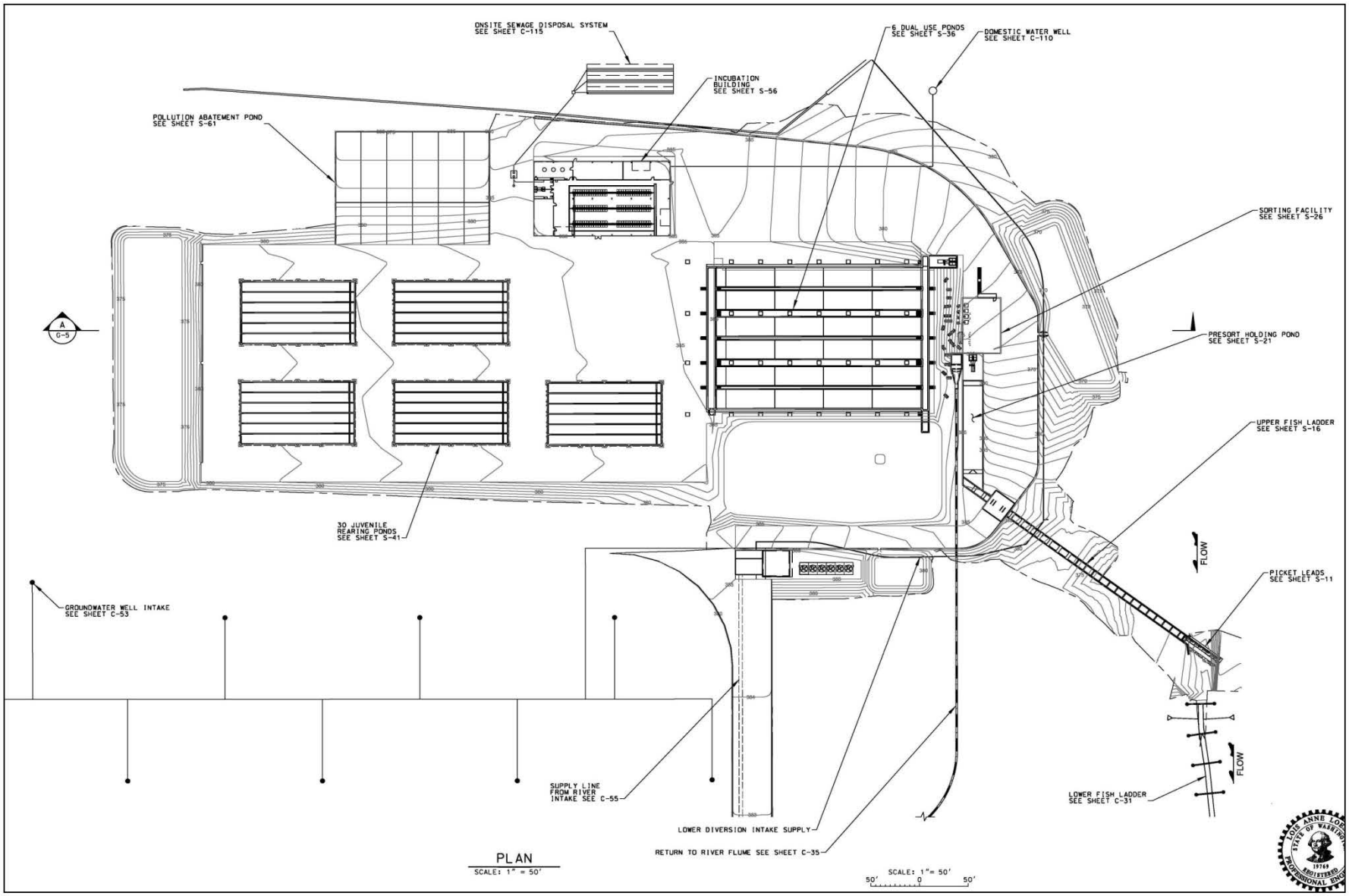


Figure 9. Ringold General Arrangement



2.5.1.2. Site Design

The current water supply does not meet the demand for the expanded RSH facilities and fish production. Fish facility water demands vary throughout the year, up to a maximum of 90 cfs of river and spring water, plus an additional 5 cfs of groundwater, which is used for incubation. The amount of water available from the existing springs is limited by the amount of water available and the capacity of the water supply lines to convey it to the distribution tower. In March, only 5.6 cfs of spring water is available from the existing springs, and the remainder will be drawn from the proposed river water intake. A non-consumptive water right will be obtained for the expanded uses.

A groundwater well field will be installed to collect groundwater and pump it to the distribution tower. This water will be aerated to increase oxygen content making it suitable to be used for incubation. Because the groundwater temperature will be too high for incubation, a cooling process will be performed by a closed-loop cooling tower. The cooling tower will be constructed out of fiberglass and will contain two or more heat exchangers. The cooling tower will be located adjacent to the water distribution tower.

The distribution tower will provide a steady water pressure to each of the facilities, regardless of which source is being used to supply it. Its design consists of three sets of supply pipelines, which allow water from the spring water, river water, and groundwater to be routed to the facilities and mixed separately. When there is more water available from any of the supplies than is required, such as when the river intake pumps are started, the excess water will discharge through a high-density polyethylene overflow pipe into Ringold Springs Creek, at a point chosen to provide an attraction flow to the lower fish ladder.

A single high-density polyethylene pipe will discharge the process water from all the facilities into Ringold Springs Creek, near the location of the existing fish trap, where it will also serve as attraction flow into the lower fish ladder. At the end of the rearing season, this discharge pipe will also serve as the juvenile salmon release, transporting them into Ringold Springs Creek.

The pollution abatement pond is a reinforced concrete pond with six treatment cells used to settle pollutants and treat discharge water before leaving the site and being discharged to Ringold Springs Creek.

A new potable water supply well will be provided to supply the residence, shop, and bathrooms. Sewage treatment from facility bathrooms will be provided by a conventional onsite septic system. Stormwater will be collected and treated in bio-infiltration swales with overflows discharging to the Columbia River and Ringold Springs Creek.

2.5.1.3. Facility Design

Hatchery facilities were designed based on biological criteria to meet production goals and as established by regulatory agencies. The adult holding and sorting facilities were sized based on an adult rack return run of 14,093 fish each year.

The pre-sort pond is a concrete rectangular pond located at the top of the fish ladder. The pre-sort pond provides the capacity to hold 3,000 returning adult fish. The pre-sort pond includes a V-trap at the downstream end to prevent adults from escaping back down the ladder, and includes a mechanical fish crowder, false weir, and vertical brail net to route and move fish into the electro-anesthesia baskets. At the end of the pre-sort pond is the sorting facility. The sorting facility is a 30-foot by 40-foot single-story pre-engineered metal building containing an electro-anesthesia assembly, sorting table, fish sorting

flumes, fish totes, and a coded wire tag detector. Adult fish pass from the pre-sort pond into the electro-anesthesia assembly, then to the sorting table. Fish are sorted for delivery to several destinations, which include the adult holding ponds, the surplus totes, or the recovery tank. The recovery tank is located adjacent to the pre-sort pond, and functions as a temporary holding pond for anesthetized fish recovery before returning to the river.

The six dual-use ponds have an average water depth of 8 feet and can hold a maximum of 3,200 returning adults each, or 1.3 million juvenile fish at 50 fish per pound in each pond. A crowding channel is aligned perpendicular to the end of the six adult holding ponds allowing fish to be crowded to the fish lift, which will move fish to the spawning area.

The spawning area is an enclosed 50-foot by 40-foot concrete slab located between the dual-use ponds and the hatchery building. The spawning area is 4,000 square feet and houses a spawning table, two stunners, and a fertilization station. Fish are lifted out of the dual-use ponds and onto a small sorting table in the spawning area. Fish are spawned, and then the eggs delivered directly to the hatchery building into the incubation stacks. In addition to the incubation area, the hatchery building also includes a meeting room, break room, restrooms, and offices.

Initial rearing will occur in 10-foot by 100-foot concrete raceways. There will be six banks of five raceways, for a total of 30 raceways. The raceways have the capacity to hold 14.4 million juveniles at 200 fish per pound. Fish are marked at that size, and then approximately 4 million will be transferred to an off-site acclimation facility; 10.4 million are to be held on site in the raceways and the dual-use ponds. The on-site total holding capacity for the raceways is approximately 2.7 million fish at the 50 fish per pound release size, and the dual-use pond is approximately 7.7 million fish at 50 fish per pound. Each bank will be covered by a roof to provide shade and control water temperatures, and bird netting will be attached to the roof, enclosing the ponds to prevent avian predation. Each bank of raceways and the dual-use ponds will have a pond vacuum system for cleaning fish waste and uneaten food from the bottom of the pond. The wastewater will be routed to the pollution abatement pond. All of the pond structures will have a screened inlet and outlet structure and will include a stoplog structure for water surface control.

2.5.2. I-182 Site

For additional URB rearing and acclimation, a new acclimation facility would be developed at the I-182 site (Figure 10). There are currently no fisheries facilities at this site, which is owned by the USACE. It is planned that 3.75 million subyearlings and 0.5 million yearlings will be acclimated and released from the I-182 site. Adult long-term holding facilities are not required since returning adults will be surplused, and the adult return pond is adequate for that purpose. An overview of the I-182 facility is provided below and shown on Figure 11.

- From two to five dual-use ponds will be constructed. The dual-use ponds will be rectangular reinforced concrete structures, providing up to 64,000 cubic feet of volume when filled to 8 feet deep for adult holding. The design will allow for up to 88,000 cubic feet of volume (up to 11 feet deep) for juvenile rearing. Though the number of ponds to be constructed has not yet been determined, the square footage to meet the production goals is estimated to be 8,000 square feet of dual-use ponds. If the 5-pond design is used, each pond would be 50-feet wide by 20-feet long. If the 2-pond design is used, each pond would be 20-feet wide by 200-feet long.
- A submerged cone screen river intake will be constructed in the Yakima River. This in-water work will occur during the in-water work period for the Yakima River from 1 June to 15 September. The associated pump station will be located on shore.

- A new concrete fish ladder will be constructed connecting the ponds to the Yakima River.
- For pollution abatement, a two-cell settling pond designed to the latest technology standards will be used to meet the water quality standards.
- The existing dirt road would be improved with gravel surfacing near the entrance to the facility.
- Trailer pad for office trailer and temporary housing (security) for use during operation of the facility.

Figure 10. I-182 Acclimation Facility Vicinity Map

Generally, the I-182 facility would be operated 8 months during the year, 5 months for acclimation and release (February – June), and 3 months in the fall (September – November) for adult collection.

2.5.2.1. Fish Transportation

Transport of fish from RSH to the I-182 site will take approximately 45 minutes one way, and the total round-trip time will be approximately 3 hours included loading, unloading, and breaks. Based on the use of one 1,800-gallon fish truck, it will take 5 days to transport approximately 4 million fish from RSH.

2.5.2.2. Water Supply

The water supply for the acclimation facility includes an intake screen and pump station drawing flow from the Yakima River. River temperatures will most likely follow Columbia River trends, and be favorable for rearing in March through May when fish would be in the ponds onsite. Returning adults will not be held in the long term, and will most likely be surplused; thus, the higher river water temperatures in the fall would not be an issue. The intake will consist of a submerged cone screen and pump station designed to meet NMFS guidelines and criteria, sized to supply a maximum flow of 30 cfs. A new, non-consumptive water right will be required.

The pump system consists of three identical vertical shaft turbine pumps located at the pump intake structure. The intake screen system consists of two cone screens mounted to a precast base set in the river bottom. The cone shape would provide a large screen area at shallow depths. The intake screen provides adequate surface area to limit intake velocity to below 0.4 feet/second and with a screen bar maximum spacing of 0.069 inches per NMFS requirements for active screens. Although the primary means of screen cleaning will be passive sweeping flow of the river current, the screens will be equipped with an active cleaning system.

2.5.2.3. Rearing Facilities

Yearling fish, possibly from the Bonneville Hatchery, would be transported to the facility for about 1 month of acclimation. They would be followed by subyearling fish moved from RSH at 200 fish per pound after they are marked, and released at 50 fish per pound. The dual-use ponds at the I-182 site will be similar to those proposed at RSH. The dual-use ponds will be designed to function as holding ponds for adult fish and rearing ponds for juvenile fish. There will be two to five rectangular concrete ponds (totaling approximately 8,000 square feet) located on the site oriented in an east/west direction and aligned perpendicular to the Yakima River. The components of the dual use ponds are pond crowders, the end channel crowder, the upwell supply system, and the drain channel/water level control system. Walkways will be provided on both sides of each pond for access. The ponds will sit high relative to the surrounding ground surface so that the wall heights will be higher than the 100-year flood elevation. Fish may be released volitionally from the ponds directly into the Yakima River, or forced to egress to the river through release pipes. The ponds will be covered with a roof structure to provide shade. Net panels will hang from the roof along the sides of the ponds for exclusion of birds and other predators. A pond vacuum system will be provided within each pond for periodic cleaning of uneaten food and fish waste from the bottom of the ponds.

2.5.2.4. Fish Ladder

A fish ladder will be constructed on the right bank of the Yakima River. A fish ladder will lead from the entrance channel to the water surface operating level of the dual-use holding ponds. The fish ladder will be a vertical slot design, using a concrete channel that is 8 feet wide with side walls 13 feet high. Concrete baffle walls will be placed at a 10-foot, 6-inch horizontal spacing along the channel. The channel bottom, weirs, and orifices will be placed 12 inches above each other to provide a 12 inch drop in each pool, or a 10.5:1 overall ladder slope. The concrete baffles provide holding pools in the fishway, which will be 9.5 feet long, 8 feet wide and 8 feet deep.

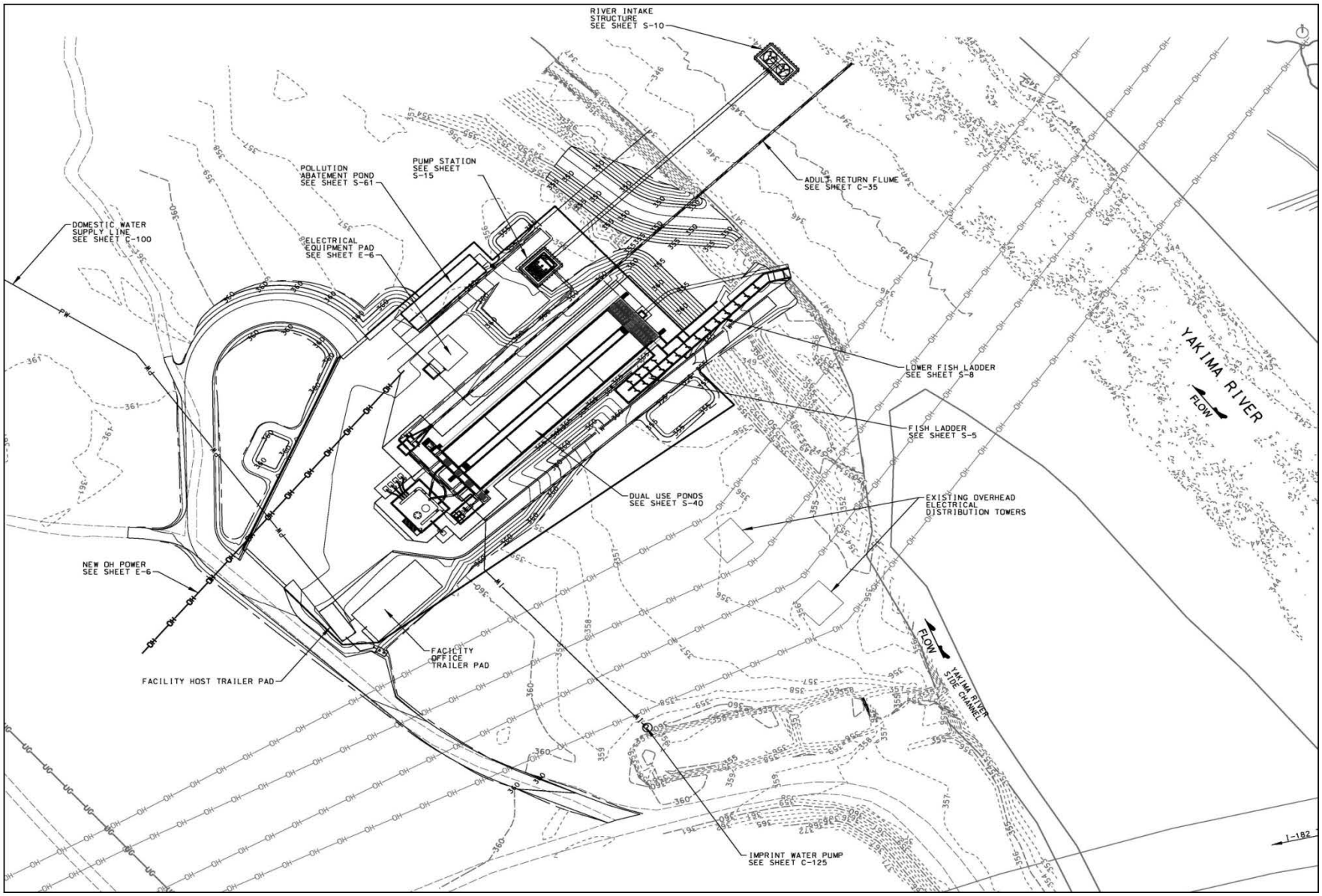
2.5.2.5. Adult Return Flume

An adult return flume will provide a means of returning fish not selected as broodstock to the Yakima River. The flume will be a continuous, minimum 18-inch inside diameter pipe aligned on a straight path from the recovery tank to the flume exit, which would provide the shortest route back to the Yakima River. The majority of the flume will be an elevated pipe, suspended on pipe supports which are up to 10 feet in height. The flume has been designed to operate during the period when the returning adults are expected to arrive at the site, from September through November.

2.5.2.6. Pollution Abatement Facilities

Pollution abatement facilities would be required at the I-182 site to meet National Pollutant Discharge Elimination System (NPDES) requirements for drain water released to the Yakima River. A two-cell settling pond designed to the latest technology standards would be constructed as part of the facility to meet the water quality standards.

Figure 11. I-182 Site Plan



3. AFFECTED ENVIRONMENT

3.1. Physical Characteristics

3.1.1. Geology and Soils

At RSH, the majority of the project site sits on somewhat of a gentle sloping terrace and does not appear to have been flooded in recent historical times. Some 12,000 ± 3,000 years ago, repeated catastrophic flooding around the end of the Pleistocene Epoch scoured a channel that essentially cut and formed the relatively steep slope that borders the eastern edge of the site. This scour uniformly exposed a relatively permeable confined aquifer, thus forming a remarkably linear spring system along the side slope that produces substantial volumes of water; the volume increases substantially (on the order of a factor of three) with the annual agricultural irrigation cycle, which peaks in early fall.

At RSH, the near surface aquifer is called the Ringold formation (Newcomb 1958) and generally consists of coarse alluvium, with the lower portions of the unit containing several sequences of blue-grey clay that form intermediate aquatards (material of low permeability that slows groundwater movement). The result is a highly porous, confined system. Observation of the spring volume produced along the short, relatively steep slope overlooking the RSH site leads to the conclusion that gravel and cobble zones exist within the formation. In the vicinity of the hatchery, the Ringold formation is present at depth, if not directly beneath the surface sand deposit, and a characteristic clay deposit was noted on a well log at a depth of 85 feet. It is expected that the older coarse alluvium underlying the RSH site is hydraulically well-connected to the Ringold formation aquifer, if not the same formation. During periods of high flow in the Columbia River, some river-sourced water may intermingle with the spring-sourced groundwater along the western edge of the site for short periods of time.

At the I-182 site, the near surface soils are alluvial and consist of unconsolidated sand with varying amounts of cobble and gravel. Shallow groundwater conditions may be encountered at the site especially when Yakima River levels are high (McMillen 2012).

3.1.2. Hydrology

3.1.2.1. Columbia River

No existing hydrologic model of the span of the Columbia River near RSH was found to exist; however, Grant County Public Utility District was able to provide flow and water surface elevation data at certain points along the Columbia River between Priest Rapids Dam and McNary Dam, including a point at RM 354.27, located near the RSH site. A regression analysis of this data was performed to establish a backwater curve at the site. The backwater curve is shown in Figure 12.

The Columbia River average daily flow rate was determined based on measurements of the average daily flow from USGS gage 12472800, which is located directly below the Priest Rapids Dam. Gage data for a 10-year period was used (3/26/1992 to 4/24/2012). The minimum, average, and maximum daily flow rate for each month were calculated. The minimum, average, and maximum water surface elevation values were then determined using the backwater curve shown in Figure 12. The resulting range of Columbia River water surface elevations is shown in Figure 13. The results shown represent an approximate range of the Columbia River water surface elevations at the RSH site. It is intended to cover the flow range expected when the site is in operation and does not include unusual or extreme (flood) events.

Figure 12. Columbia River Backwater Curve at Ringold Hatchery

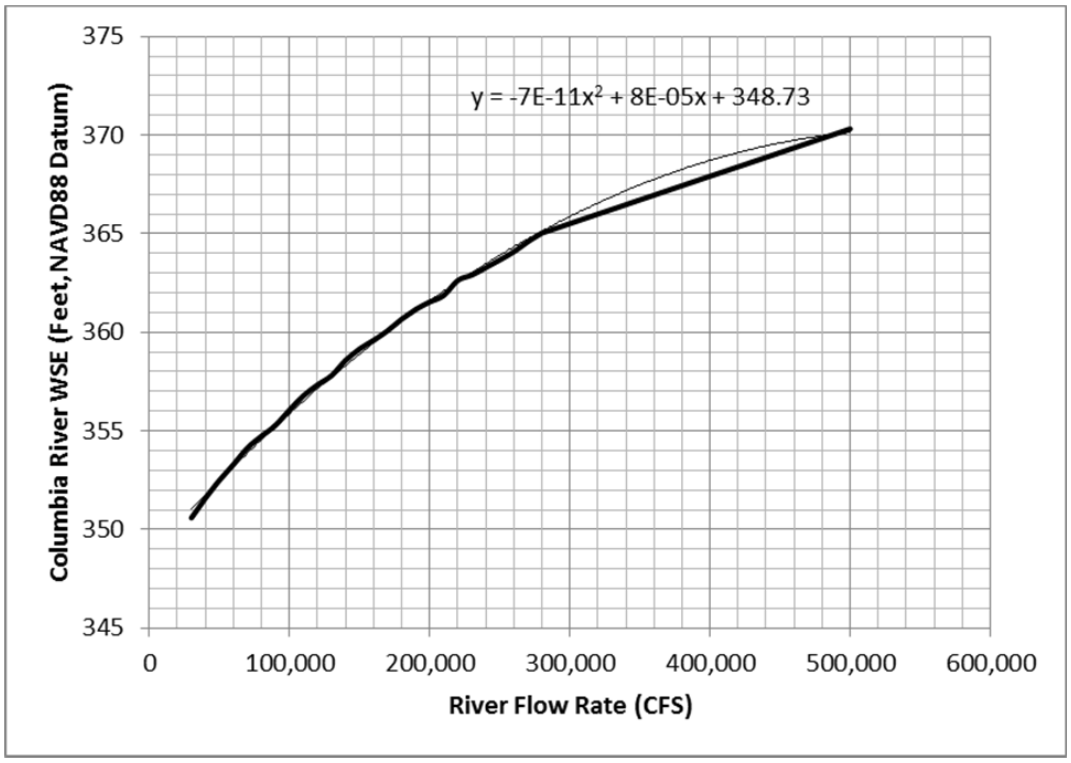
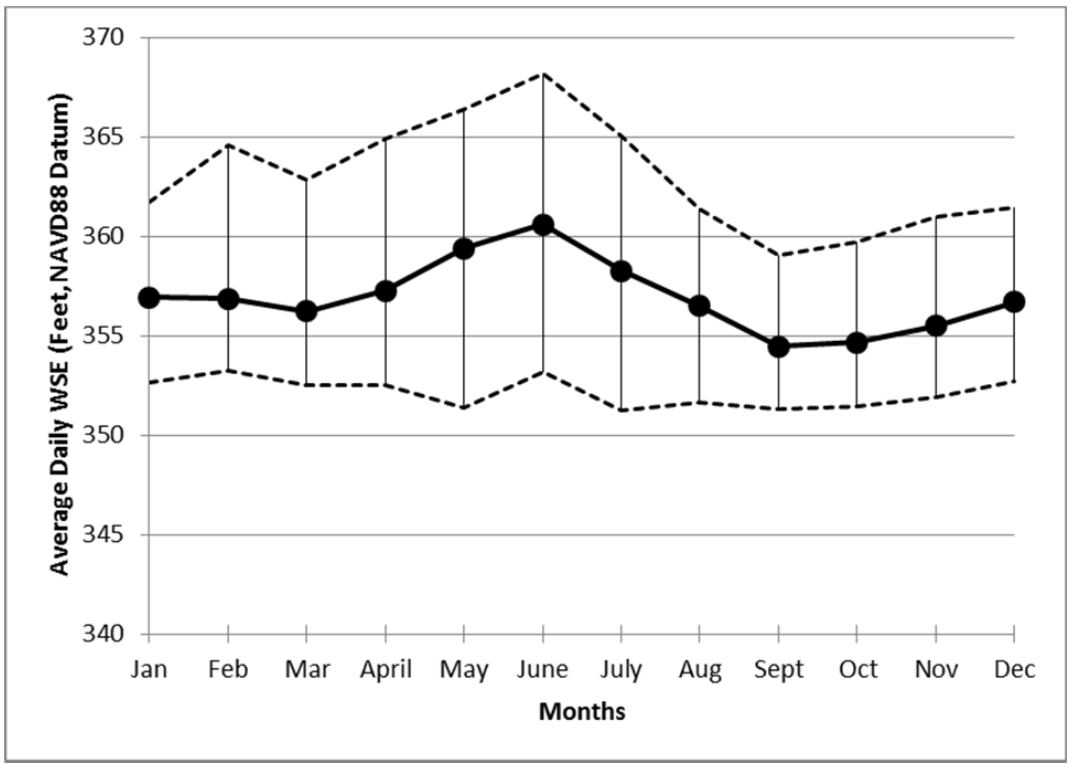


Figure 13. Range of Columbia River Water Surface Elevations



3.1.2.2. Yakima River

The Yakima River originates at Keechelus Lake in the Cascade Mountains and joins the Columbia River at Richland, Washington. The river is highly regulated, providing irrigation water to the Yakima Basin. The closest Yakima River gage to the I-182 site is U.S. Geological Survey gage #12510500, located in Kiona, Washington. Records for this gage are shown below:

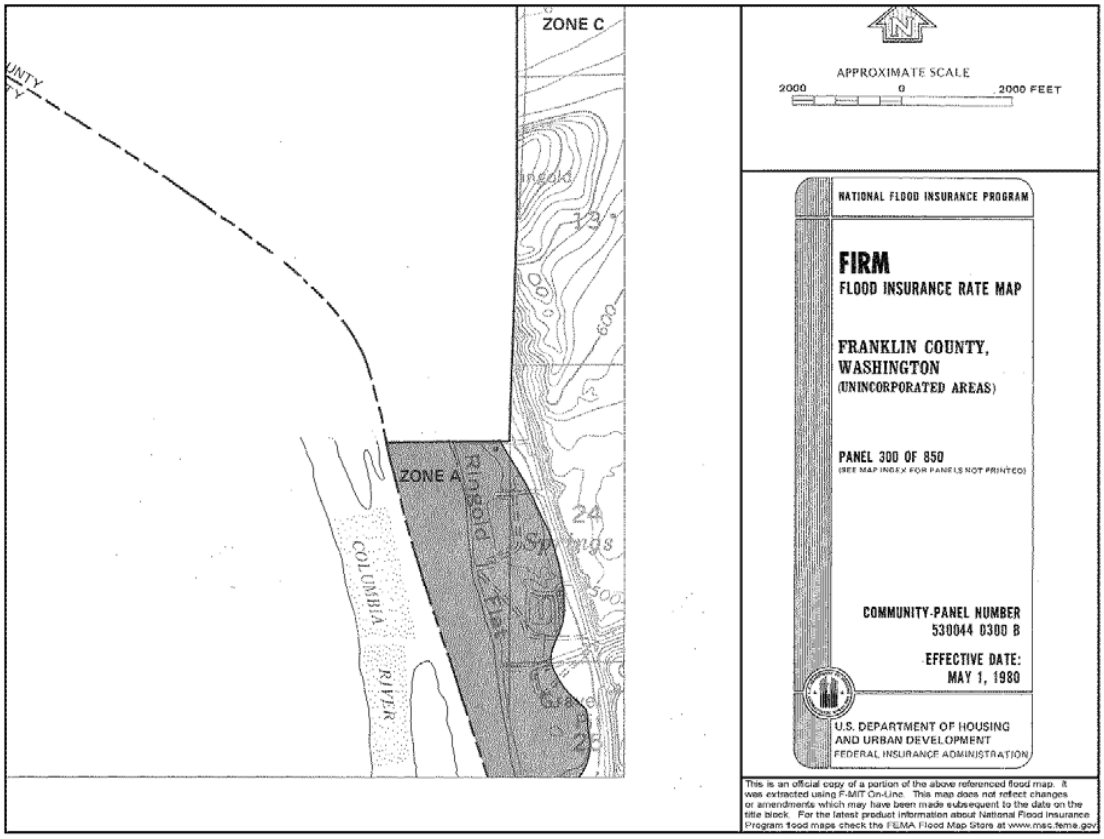
- Average Discharge: 3,508 cfs (1934-2012)
- Maximum Discharge: 67,000 cfs (1933)
- Minimum Discharge: 105 cfs (observed 1906)
- Drainage Area: 5,615 square miles

The Columbia Canal is located west of the I-182 site. This earth-lined canal is operated by Columbia Irrigation District, and is used to distribute screened water diverted from the Yakima River at Wanawish (Horn Rapids) Dam.

3.1.3. Floodplains

The RSH is located in Franklin County shown on Flood Insurance Rate Map panel number 530044 0300 B, dated May 1, 1980 (Figure 14). This map identifies a portion of the site as being in flood Zone A, described as, "Areas of 100-year flood; base flood elevations and flood hazard factors not determined."

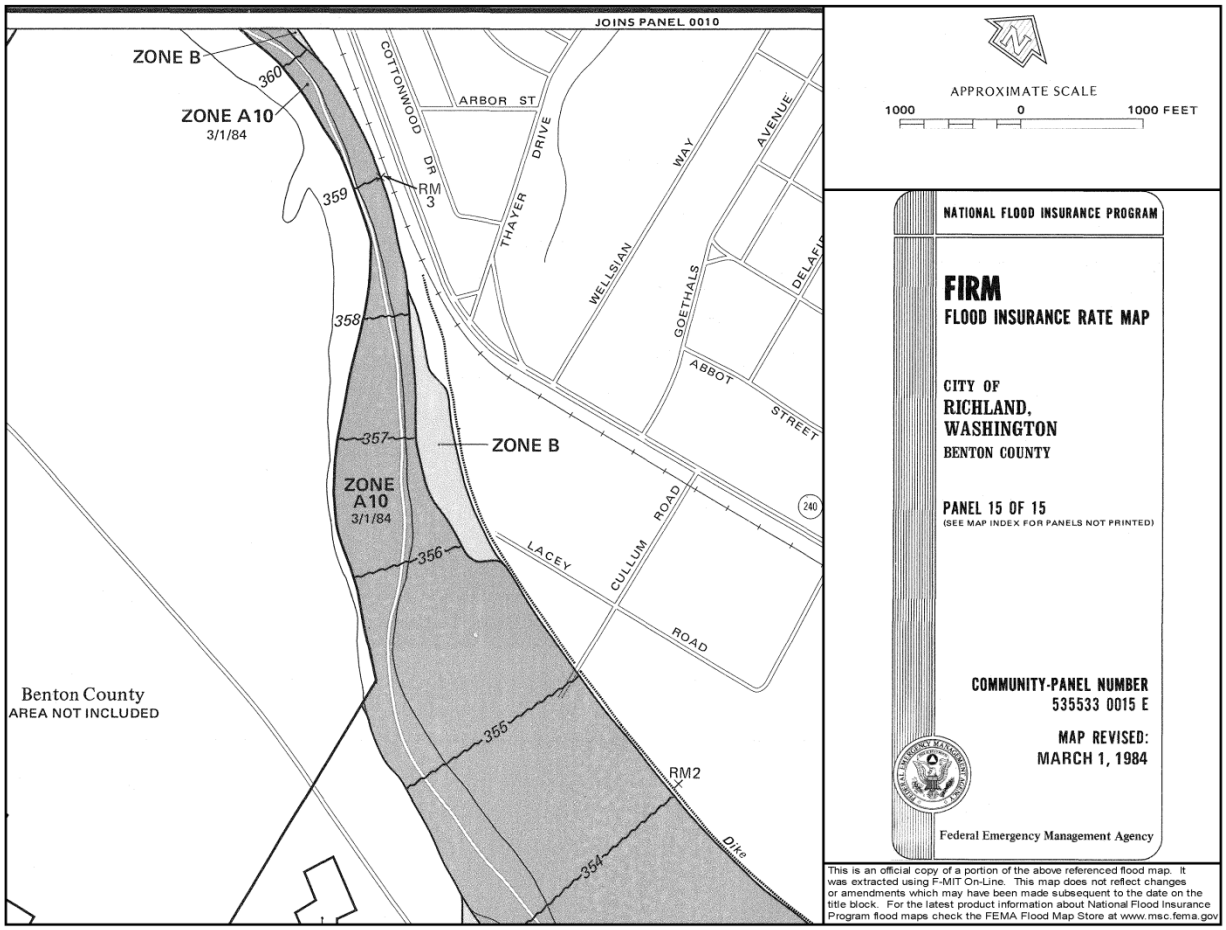
Figure 14. Flood Insurance Rate Map for Ringold Hatchery



Source: https://msc.fema.gov

The I-182 site is located in the city of Richland shown on Flood Insurance Rate Map panel number 535533 0015 E, dated March 1, 1984 (Figure 15). This map identifies the base flood elevation at RM 3 as elevation 359 feet (1929 datum), with the correction for NAVD 88 at elevation 362.4 feet.

Figure 15. Flood Insurance Rate Map for I-182 Site



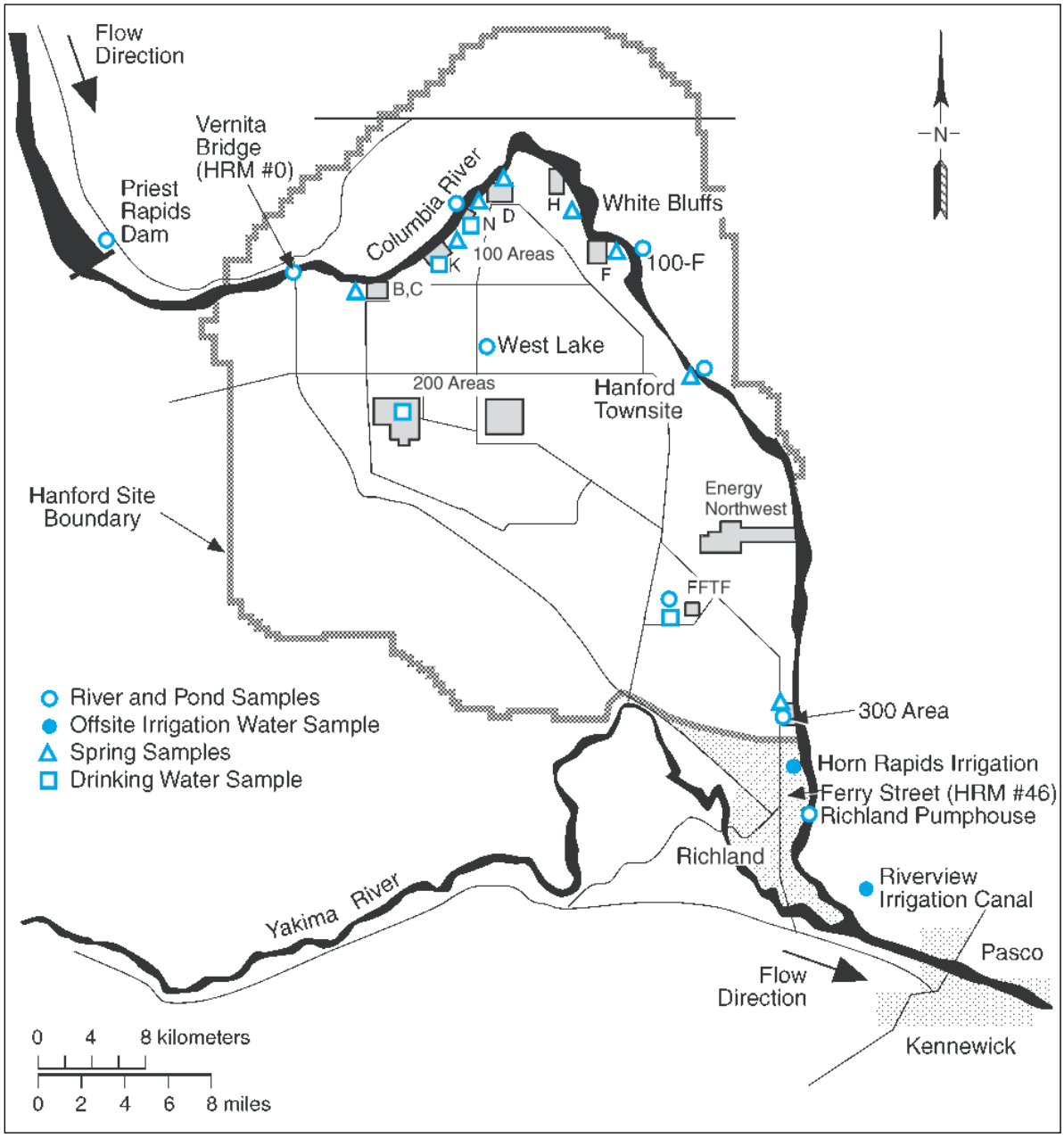
Source: https://msc.fema.gov

3.1.4. Water Quality

3.1.4.1. Columbia River

According to the USFWS (2008a), Washington has designated the water quality of the Columbia River from Grand Coulee Dam to the Washington-Oregon border, which includes the Hanford Reach, as Class A, Excellent. Class A waters are suitable for essentially all uses, including raw drinking water, primary-contact recreation, and wildlife habitat. During 2002, the U.S. Geological Survey measured several water quality parameters at Vernita Bridge (State Route 24) upstream of the Hanford Reach National Monument and at the Richland Pumphouse downstream of the National Monument (Figure 16). Total dissolved solids, dissolved nitrogen, and dissolved oxygen measured near the Monument during 2002 were well within U.S. Environmental Protection Agency (EPA) and Washington state standards. There was no statistical difference between upstream and downstream samples for these parameters (Poston et al. 2005 in USFWS 2008a).

Figure 16. Water Sampling Sites in Hanford Reach of Columbia River



Source: Peterson and Patton 2009

The Pacific Northwest National Laboratory measured radiological and non-radiological constituents in Columbia River water in 2002 as part of a continuing monitoring program (Poston et al. 2003 in USFWS 2008a). Cumulative water samples are collected at Priest Rapids Dam and at Richland Pumphouse. Additional samples were taken at river transects and at near-shore locations at Vernita Bridge, 100-F Area, 100-N Area, Hanford Town sites, and 300 Area (Figure 16). These water samples were collected at frequencies varying from quarterly to annually. The data show a statistical increase in tritium, nitrate, uranium and iodine-129 along the Hanford Reach. All these constituents are known to be entering the river from contaminated groundwater beneath the Hanford Site. Measurements of strontium-90 at the

Richland Pumphouse were not statistically higher than those at the Vernita Bridge, even though strontium-90 is known to enter the river through groundwater inflow at 100-N Area. Measurements of tritium along transects showed higher concentrations near the shoreline relative to mid-river for samples from the 100-N Area, Hanford Town sites, 300 Area, and Richland Pumphouse (USFWS 2008a).

Other sources of pollutants entering the Columbia River are irrigation return flows and groundwater seepage associated with irrigated agriculture (USFWS 2008a). The U.S. Geological Survey (1995) documented nitrate groundwater contamination in Franklin County, which also seeps into the river along the Hanford Reach. Dilution in the river results in contaminant concentrations that are below drinking water standards (Poston et al. 2003 in USFWS 2008a).

3.1.4.2. Yakima River

As required by the Clean Water Act (CWA), the state of Washington has an EPA-approved list of impaired water bodies (based on a specific number of exceedance measurements of state water quality criteria in a specific segment of a water body). The freshwater 303(d) list from 2008 (approved January 2009) lists the lower Yakima River as impaired for temperature, pH, dissolved oxygen (DO), dieldrin, bacteria, and the pesticides DDT, 4,4'-DDE and 4,4'-DDD. Lake Umatilla (above McNary Dam) on the Columbia River is listed as impaired for water temperature. For many water quality parameters, the quality of irrigation return flows largely determines the quality of water in the lower Yakima River. Agricultural drains in the mid and lower valleys have been found to be a substantial source of nutrients, suspended sediment, fecal coliform bacteria, and pesticides. The highest detection frequencies and concentrations of pesticides generally occur during irrigation season. Pesticides that persist in soil, such as DDT, continue to be transported in streams and drains throughout the year, especially during storm runoff or snowmelt (WDOE 2010).

3.1.4.3. Ringold Springs Hatchery

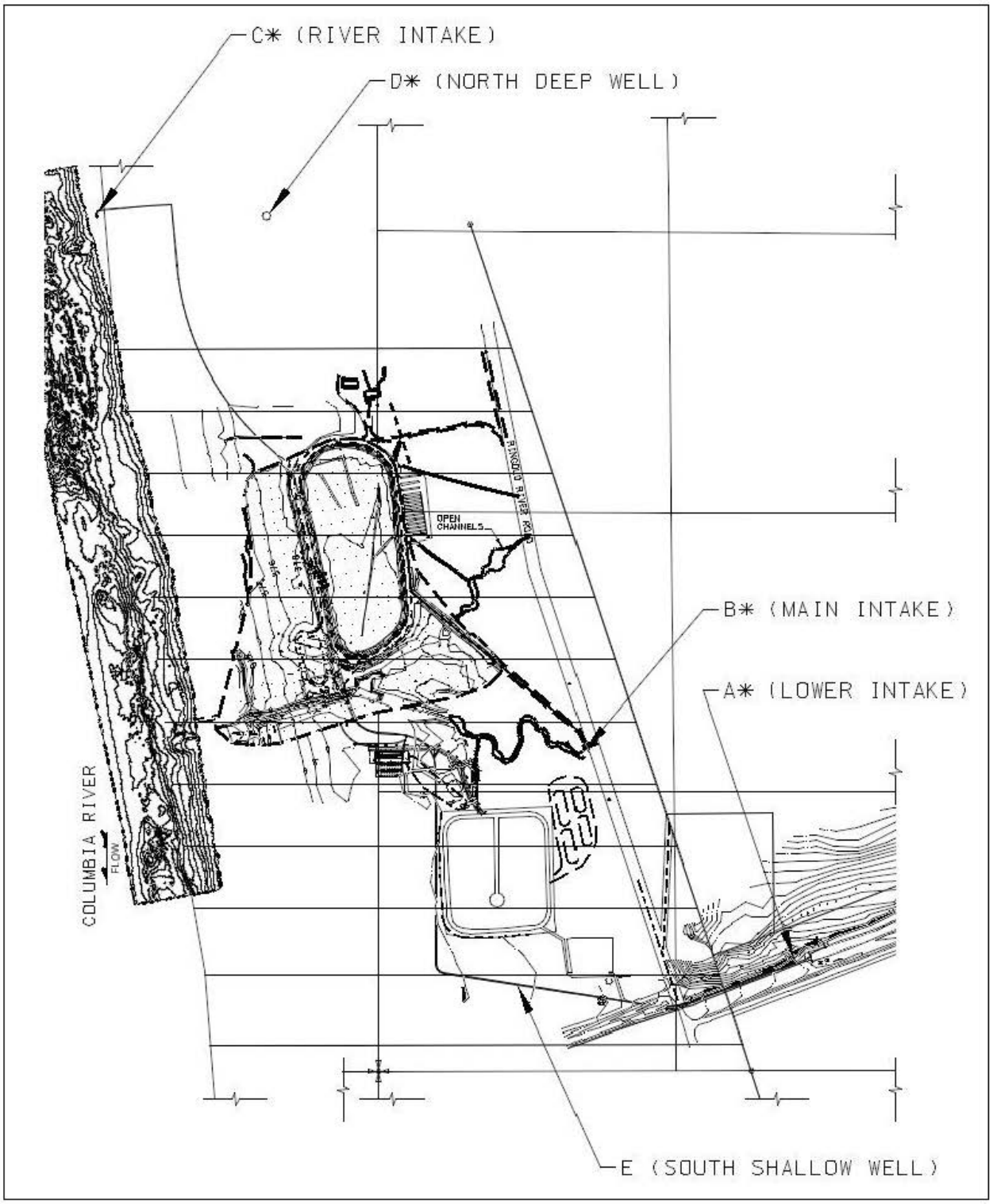
Water quality monitoring was performed for all potential sources of hatchery water supply to ensure that the water quality is suitable for fish rearing and holding. Monthly samples were taken from April through October 2012 for water temperature, agricultural waste products, and seasonal pathogens. Water samples were taken at the sites shown in Table 8 and on Figure 17. An additional site was a standpipe located to the west of the 9-acre pond. In-situ measurements for sites A-E included dissolved oxygen, temperature, conductivity, and pH. Tests also included water temperature measurements at sites A-C. Samples for laboratory analysis were collected at sites A-D and included nutrients, pesticides, herbicides, carbamates, total and dissolved metals, cyanide, iron, manganese, polychlorinated biphenyls (PCBs), hydrocarbons, solids, total dissolved gas, and dissolved nitrogen.

Table 8. RSH Water Quality Sampling Plan

Site	Location	Analyses Conducted
A	Lower Diversion (Upper Spring)	In-situ, laboratory, continuous temperature
B	Main Intake (Lower Spring)	In-situ, laboratory, continuous temperature
C	River Intake (Columbia River near hatchery)	In-situ, laboratory, continuous temperature
D	North Deep Well	In-situ, laboratory
E	South Shallow Well (Domestic Well)	In-situ
	Standpipe	Temperature

Source: USACE June 2012

Figure 17. RSH Water Quality Sampling Locations



A summary of the in-situ measurements collected for the sample sites is provided in Table 9. Both the deep and shallow well sites had very low DO concentrations. A summary of the minimum and maximum water temperature measurements collected at the data logger sites is provided in Table 10. Many of the laboratory results were below detection limits. There were no detected levels of pesticides, carbamates, PCBs, or oil and grease at any of the sites for the first sampling event (4/3/2012). The herbicide Dacthal was detected at both the lower diversion and main intake sites at very low concentrations of 0.21 µg/L and 0.294 µg/L, respectively. No other herbicides were detected.

Table 9. RSH Range of In-situ Water Quality Data

Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)
Lower Diversion	15.8 - 16.1	7.8 - 10.5	7.6 - 8.3	0.73 - 0.77
Main Intake	16.4 - 16.9	8.6 - 9.4	7.6 - 8.3	0.7
River Intake	5.5 - 9.5	11.7 - 13.0	8.0	0.14 - 0.15
Deep Well	18.2 - 18.6	0.9 - 1.5	7.8 - 8.4	0.39 - 0.4
Shallow Well	17.4 - 18.9	0.9 - 2.4	8.7 - 9.2	0.46 - 0.47

Note: Based on data collected on 4/3/2012 and 4/27/2012. mg/L = milligrams per liter; mS/cm = millisiemens per cm.

Table 10. RSH Summary of Daily Water Temperature Data

Site	Minimum Temperature (°C)	Maximum Temperature (°C)
Lower Diversion	15.0	16.6
Main Intake	15.7	16.8
River Intake	5.3	12.8
Standpipe	11.2	11.4

Note: Based on data collected from April through October 2012. °C = degrees centigrade.

All biological analyses were negative except for at the lower diversion site which was positive for bacteria. The range of nutrients detected at the four sites is summarized in Table 11. Different metals were detected at different sites and some metals not detected at any sites. Nickel was the only metal detected at all sites. Arsenic, lead, and zinc were detected at all stations except for the river intake site. Chromium and manganese were detected at both the lower diversion and deep well sites. Cadmium was detected only at the main intake station, and iron was only detected at the river intake station. Test values exceeding the Washington State water quality standards for toxics are shown in Table 12.

Table 11. RSH Summary of Nutrient Data

Site	Nitrate (mg/L)	Nitrate (mg/L)	Ammonium (mg/L)	Total Nitrogen (mg/L)	Phosphorus (mg/L)	Orthophosphate (mg/L)
Lower Diversion	1.82	ND	ND	1.12	ND	ND
Main Intake	1.78	ND	ND	0.71	ND	ND
River Intake	2.12	ND	ND	ND	ND	ND
Deep Well	ND	ND	ND	ND	ND	ND

Note: Based on data collected on 4/3/2012. mg/L = milligrams per liter; ND= Not detected.

Table 12. RSH Data Exceeding Washington Chronic Toxic Substances Criteria

Site	Date	Parameter	Measurement (µg/L)	Standard (µg/L)
Main Intake	4/3/2012	Dissolved Cadmium	4	2.4
Deep Well	4/3/2012	Dissolved Lead	3	0.9

Note: Based on data collected on 4/3/2012. µg/L = micrograms per liter.

3.1.4.4. I-182 Site

Water quality monitoring was performed at the I-182 site from September 2012 through October 2013. Samples were taken from the Yakima River (site K), a side-channel of the Yakima River (site H) and from a pond on the site (site I), as shown on Figure 18. Tests included continuous water temperature measurements. Water samples for laboratory analysis were collected on 4 dates for the pond, on 12 dates for the Yakima River side channel, and on 8 dates for the Yakima River main channel. Monitoring consisted of a monthly program which collected in-situ measurements (temperature, pH, DO, conductivity) and samples for laboratory analysis of nutrients, solids, hardness, dissolved organic carbon (DOC), and total dissolved gas (TDG). The quarterly program conducted every 3 months collected water samples for analysis of metals, pesticides, herbicides, carbamates, biological analysis, algae count and speciation, PCBs, cyanide, iron, and manganese in addition to the monthly program. Water quality sampling dates and analyses are summarized in Table 13.

Figure 18. I-182 Site Water Quality Sampling Locations

Table 13. I-182 Site Water Quality Sampling Dates and Analyses

Date	Analyses Conducted
October 30, 2012	In-situ parameters(temperature, pH, DO, conductivity), nutrients, pesticides, herbicides, carbamates, total and dissolved metals, cyanide, iron, manganese, PCBs, hydrocarbons, solids, TDG, dissolved nitrogen.
November 29, 2012	In-situ parameters, nutrients, solids, hardness, DOC, TDG
January 9, 2013	In-situ parameters, nutrients, solids, hardness, DOC, TDG
January 30, 2013	In-situ parameters, nutrients, pesticides, herbicides, carbamates, total and dissolved metals, biological analysis, algae count and speciation, PCBs, cyanide, iron, manganese.
February 26, 2013	In-situ parameters, nutrients, solids, hardness, DOC, TDG
March 28, 2013	In-situ parameters, nutrients, solids, hardness, DOC, TDG
April 30, 2013	In-situ parameters, nutrients, pesticides, herbicides, carbamates, total and dissolved metals, biological analysis, algae count and speciation, PCBs, cyanide, iron, manganese, solids, hardness, DOC, TDG
May 30, 2013	In-situ parameters, nutrients, solids, hardness, DOC, TDG
June 20, 2013	In-situ parameters, nutrients, solids, hardness, DOC, TDG
July 30, 2013	In-situ parameters, nutrients, pesticides, herbicides, carbamates, total and dissolved metals, biological analysis, algae count and speciation, PCBs, cyanide, iron, manganese, solids, hardness, DOC, TDG
September 5, 2013	In-situ parameters, nutrients, solids, hardness, DOC, TDG
October 10, 2013	In-situ parameters, nutrients, solids, hardness, DOC, TDG

A summary of in-situ measurements collected for the three I-182 sampling sites is provided in Table 14. Both domestic well sites had very low DO concentrations. The pond site had the highest conductivity measurements, while conductivity at both the Yakima River sites were similar except during low flow, when conductivity in the side channel was higher than the main channel. The pH was in the range of 7.0 to 9.5. Four pH measurements exceeded Washington surface water quality standards of pH 8.5. These measurements occurred on July 30, 2013 and September 5, 2013 for both the Yakima River sites.

Table 14. I-182 Site Water Quality Sampling Dates and Analyses

Site	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)	Hardness (mg/L as CaCO3)
(I) Pond [1]	6.5 - 8.4	7.2 - 8.0	0.93 - 0.94	288.6 - 324.2
(H) Yakima River Side Channel [2]	4.3 - 16.7	7.5 - 9.1	0.14 - 0.89	62.3 - 89.4
(K) Yakima River Main Channel [3]	10.0 - 14.1	7.0 - 9.4	0.14 - 0.29	50.4 - 73.8

[1] Data only collected on 11/29/2012, 1/10/2013, and 1/30/2013.
[2] Data collected between October 30, 2012 and October 10, 2013.
[3] Data collected between February 26, 2013 and October 10, 2013.

Many of the laboratory results were below detection limits. There were no detected levels of pesticides, carbamates, or PCBs. Oil and grease was detected at the pond site on October 30, 2012 and January 30, 2013. No herbicides were detected. All biological analyses were negative except for iron bacteria, which was positive at both the Yakima River sites. Algae were detected at both the Yakima River site and the

pond site. The range of nutrients detected at the three sites is summarized in Table 15. Lead and nickel were consistently detected at all three stations. Any exceedances of the Washington State water quality standards for toxics are summarized in Table 16. All of the exceedances were for lead and all occurred at both the Yakima River sites.

Table 15. I-182 Site Summary of Range of Nutrients

Site	Nitrate (mg/L)	Nitrite (mg/L)	Ammonium (mg/L)	Total Nitrogen (mg/L)	Phosphorus (mg/L)	Orthophosphate (mg/L)
(I) Pond [1]	ND	ND	ND	1.38 - 1.6	<0.05	<0.05
(H) Yakima River Side Channel [2]	ND - 0.59	ND	ND	0.06 - 0.068	<0.05 - 0.072	<0.05 - 0.064
(K) Yakima River Main Channel [3]	0.63 - 0.70	ND	ND	0.06 - 0.063	<0.05 - 0.067	<0.05 - 0.06

[1] Monthly data collected between October 2012 and January 2013.
[2] Monthly data collected between October 2012 and October 2013.
[3] Monthly data collected between February 2013 and October 2013.

Table 16. I-182 Site Data Exceeding Washington Chronic Toxic Substances Criteria

Date	Location	Parameter	Measurement (µg/L)	Hardness (mg/L as CaCO3)	Standard [1] (µg/L)
1/30/2013	(H) Yakima Side Channel	Lead	5	89.4	2.2
4/30/2013	(H) Yakima Side Channel	Lead	2	62.3	1.5
4/30/2013	(K) Yakima Main Channel	Lead	4	50.4	1.2
7/30/2013	(H) Yakima Side Channel	Lead	4	65.5	1.6
7/30/2013	(K) Yakima Main Channel	Lead	4	55.6	1.3

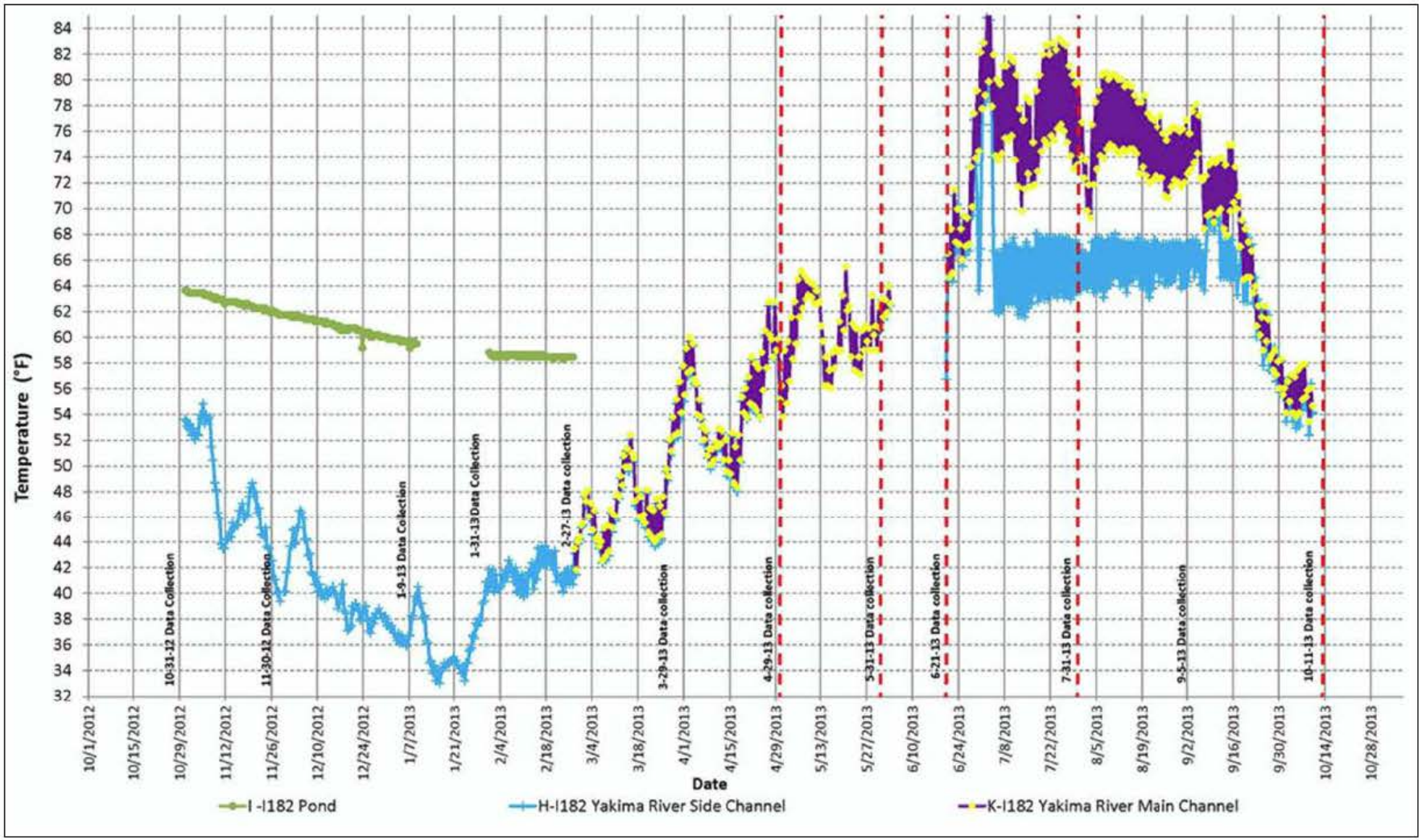
[1] Cadmium, chromium, copper, lead, nickel, silver, and zinc all have standards that are based on water hardness. This means that criteria are calculated using a formula that is a function of water hardness. A lower water hardness makes metals more toxic; therefore, the standard is lower for waters with a lower hardness and higher for waters with a higher hardness.

A summary of minimum and maximum temperature measurements collected at the I-182 sampling sites is provided in Table 17. A plot of the temperature measurements is shown in Figure 19. The temperature data for both Yakima River sites indicate that temperatures in the river are higher than the ideal for adult holding from August through the end of September, when they drop to approximately 55°F. The Yakima main channel temperatures were the higher of the two, reaching over 80°F in July. The Yakima side channel temperatures stayed relatively constant through the period, varying from the upper to mid-60°F range. Water temperatures in both the river and side channel in late February averages in the mid-40°F range and rises to the mid-60°F range in late June when juvenile subyearlings would be released.

Table 17. I-182 Site Summary of Daily Temperature Measurements

Site	Period of Record	Minimum Temperature °F (°C)	Maximum Temperature °F (°C)
(I) Pond	10/30/2013 to 2/26/2013	58.3 (14.6) on 2/20/2013 and on 2/23/2013	63.6 (17.6) on 10/30/2012 and on 10/31/2012
(H) Yakima River Side Channel	10/30/2012 to 10/10/2013	33.0 (0.55) on 1/16/2013	73.2 (22.9) on 9/9/2013
(K) Yakima River Main Channel	2/26/2013 to 10/10/2013	41.8 (5.4) on 2/27/2013	85.0 (29.4) on 7/2/2013 and on 7/3/2013

Figure 19. Temperature Measurements at I-182 Sampling Sites



3.1.5. Climate Change

The climate is warming due to human activities and this is affecting hydrologic patterns and water temperatures. Regionally averaged air temperature rose about 1.5°F over the past century, with some areas experiencing increases up to 4°F, and is projected to increase another 3°F to 10°F during this century. Increases in winter precipitation and decreases in summer precipitation are projected by many climate models, although these projections are less certain than those for temperature (USGCRP 2009).

Higher temperatures in the cool season (October through March) are likely to increase the percentage of precipitation falling as rain rather than snow, and to contribute to earlier snowmelt. The amount of snowpack measured on April 1, a key indicator of natural water storage available for the warm season, has already declined substantially throughout the region. The average decline in the Cascade Mountains, for example, was about 25% over the past 40 to 70 years, with most of this due to the 2.5°F increase in cool season temperatures over that period. Further declines in Northwest snowpack are likely due to additional warming this century, varying with latitude, elevation, and proximity to the coast. April 1 snowpack is likely to decline as much as 40% in the Cascades by the 2040s (USGCRP 2009).

High and base streamflows are likely to change with warming. Increasing winter rainfall is likely to increase winter flooding in relatively warm watersheds on the west side of the Cascade Mountains. Earlier snowmelt, and increased evaporation and water loss from vegetation, will increase stream flows during the warm season (April through September). On the western slopes of the Cascade Mountains, reductions in warm season runoff of 30% or more are likely by mid-century. In some sensitive watersheds, both increased flood risk in winter and increased drought risk in summer are likely due to warming of the climate (USGCRP 2009).

In areas where it snows, a warmer climate means major changes in the timing of runoff: increased stream flows during winter and early spring, and decreases in late spring, summer, and fall. Flow timing has shifted over the past 50 years, with the peak of spring runoff shifting from a few days earlier in some places to as much as 25 to 30 days earlier in others. This trend is likely to continue, with runoff shifting 20 to 40 days earlier within this century. Major shifts in the timing of runoff are not likely in areas dominated by rain rather than snow (ISAB 2007, USGCRP 2009).

Habitat changes due to climate change are likely to create a variety of challenges for ESA-listed fish species. Higher winter stream flows can scour streambeds, damaging spawning redds and washing away incubating eggs (USGCRP 2009). Earlier peak stream flows could flush young salmon and steelhead from rivers to estuaries before they are physically mature enough for the transition, increasing a variety of stresses and the risk of predation (USGCRP 2009). Lower summer stream flows and warmer water temperatures will degrade summer rearing conditions in many parts of the Pacific Northwest for a variety of salmon and steelhead species (USGCRP 2009), and are likely to reduce the survival of steelhead fry in streams with incubation in early summer. Other likely effects include alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition and predation risk from warm-water, non-native species (ISAB 2007). The increased prevalence and virulence of diseases and parasites that tend to flourish in warmer water will further stress salmon and steelhead (USGCRP 2009). Overall, about one-third of the current habitat for the Pacific Northwest's coldwater fish may well no longer be suitable for them by the end of this century as key temperature thresholds are exceeded (USGCRP 2009).

Climate change is also likely to affect conditions in the Pacific Ocean. Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while

cooler ocean periods have coincided with relatively high abundances (USGCRP 2009). It is likely that, as ocean conditions change, abundances of salmon and steelhead will continue to change accordingly, resulting in changes in abundance of adults returning to freshwater to spawn.

For streams and rivers fed by glaciers and snow melt, climate change may reduce the snow pack and summer-time flows may reduce suitable habitat for salmon and steelhead yearling rearing, decreasing their abundance. Climate change may also increase the frequency of major flood events that can scour redds for salmon and steelhead spawning and rearing in the rivers and their tributaries.

Lower summer flows due to a reduced winter snow pack may increase water temperatures that may lead to an increase in the abundance of non-native warm water species that can compete and prey on ESA-listed salmon and steelhead. Warmer water temperatures may also increase the incidence of disease outbreaks and virulence in both the natural-origin and hatchery-origin juveniles.

If climate change contributes to a substantial decline in the abundance of listed salmon and steelhead populations though impacts on habitat and from changes in ocean conditions, the hatchery programs may be used as a "safety net" program to maintain genetic resources. Hatchery programs are somewhat protected from the possible increase in disease prevalence from warmer water temperatures because much of the rearing occurs using well water and the fish are tested at spawning, during rearing, and prior to release to limit disease transmission to the natural-origin populations.

While climate change may well have impacts on the abundance and/or distribution of ESA-listed salmonids, hatchery management and the associated monitoring provide the ability to evaluate hatchery program impacts as abundances change, leading to adjustments accordingly.

3.1.6. Hazardous, Toxic, and Radioactive Waste

No hazardous, toxic or radioactive wastes were found during soils testing conducted at RSH and the I-182 site. The two locations are not within the boundaries of a site designated by the EPA or state of Washington for a response action under Comprehensive and Environmental Response, Compensation and Liability Act (CERCLA), nor are they part of a National Priority List site. There is no indication that any hazardous, toxic, and radioactive wastes are in the project areas.

3.2. Vegetation

Uncultivated sites in the project area at RSH and I-182 are typified by stands of big sagebrush *(Artemesia tridentata)* underlain by bluebunch wheatgrass *(Agropyron spicatum),* brome *(Bromus tectorum),* Idaho fescue *(Festuca idahoensis),* common mullein *(Verbascum thapsus),* yarrow *(Achillea millefolium),* Russian knapweed *(Centaurea repens),* dock *(Rumex* spp.), and buckwheat *(Eriogonum* spp.). Intensive agriculture is typical of a majority of the land base near the sites. Cultivars include mint, asparagus, melon, potatoes, and cereal crops, as well as several orchard varieties. The Ringold hatchery site itself was previously in orchard and feed crops.

At the RSH site, Ringold Spring drains to the Hanford Reach of the Columbia River. Numerous springs, resulting from irrigation run-off, occur throughout the area. A USBR irrigation waste-water canal flows through the area, crossing the hatchery property and draining to the Columbia River. Vegetation in the vicinity of the water supply diversion includes cattail *(Typha latifolia),* reed canarygrass *(Phalaris arundinacea),* dense sedge *(Carex densa),* and woolly sedge *(Carex /anuginosa)* within the spring and main channel. Riparian vegetation along the Columbia River shoreline includes willow species *(Salix* spp.) with occasional Russian olive *(Elaeagnus angustifolia).*

The portion of the I-182 site identified for development of the acclimation facility is a fairly level grass and sagebrush field. The frontage along the Yakima River is a heavily vegetated riparian zone (McMillen 2012).

3.3. Aquatic Resources and Wildlife

3.3.1. Aquatic Resources

3.3.1.1. Columbia River

The Columbia River is the dominant aquatic ecosystem in the RSH area and supports a large and diverse array of plankton, benthic invertebrates, fish and other communities. All major freshwater benthic taxa are represented in the Columbia River (USFWS 2008a). Insect larvae such as caddisflies, midge flies, and black flies dominate. Peak larval insect densities are found in late fall and winter, and the major emergence is in spring and summer. Stomach contents of fish collected in the Hanford Reach reveal that benthic invertebrates are important food items for nearly all juvenile and adult fish. Aquatic insects are a key element supporting the salmon population in the Hanford Reach. Other benthic organisms include clams, limpets, snails, sponges and crayfish (USFWS 2008a).

Forty-five species of fish are known to exist in the Hanford Reach of the Columbia River (USFWS 2008a). The Hanford Reach is noteworthy for the remaining habitat it provides several species of anadromous salmonids. The Hanford Reach is the only remnant of the major mainstem spawning habitat complex in the Columbia River system for fall Chinook salmon (*Oncorhynchus tshawytscha*). The Hanford Reach serves as a migration corridor for other species and stocks of anadromous salmonids—sockeye salmon (*O. nerka*), spring/summer Chinook salmon, coho salmon (*O. kisutch*) and steelhead (*O. mykiss*)—and provides important rearing habitat for juvenile steelhead and sockeye salmon from upstream production areas. American shad (*Alosa sapidissima*), another anadromous fish species, may also spawn in the Hanford Reach. The Hanford Reach also provides important breeding habitat for white sturgeon (*Acipenser transmontanus*; USFWS 2008a).

Other fish of importance in the Hanford Reach are mountain whitefish (*Prosopium williamsoni*), smallmouth bass (*Micropterus dolomieu*), crappie, catfish, walleye (*Sander vitreus*), and yellow perch (*Perca flavescens*; (USFWS 2008a). In addition to white sturgeon, mountain whitefish and sandroller (*Percopsis transmontana*) are two native species that may be present in much higher numbers in the Hanford Reach than in impounded areas. Large populations of rough fish are also present, including carp, redside shiner (*Richardsonius balteatus*), suckers, and northern pikeminnow (*Ptychocheilus oregonensis*; USFWS 2008a).

3.3.1.2. Yakima River

The Yakima River Basin supports anadromous, resident native, and introduced fish species. Anadromous salmonids include Chinook salmon, steelhead and coho. Adult coho currently return to the basin as a result of hatchery smolt releases conducted pursuant to the Columbia River Fish Management Plan. Resident salmonids native to the basin include rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarkii*), bull trout (*Salvelinus confluentus*), and mountain whitefish. Some of the introduced species include brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), smallmouth bass, bluegill, crappie, carp, channel catfish (*Ictalurus punctatus*), bullhead, and walleye.

3.3.2. Wildlife

According to the USFWS (2008a), the Hanford Reach of the Columbia River: (1) provides important stop-over habitat for migratory land and water birds; (2) is wintering habitat for bald eagles, white pelicans, and many waterfowl species, such as mallard, green-winged teal, pintail, goldeneye and gadwall; (3) provides important nesting and breeding habitat for shorebirds, waterfowl, and other aquatic birds; and (4) is a designated Important Bird Area (sites that provide essential habitat for one or more species of birds). Composed of the Columbia River and the near-shore environment, this area extends approximately 1/4-mile inland from the river between Vernita Bridge and RSH.

Wildlife use of the RSH project area is limited with occasional sighting or evidence of raccoon, coyote, jackrabbit, and rodents. Bird use is also limited but more numerous including sparrow, starling, blackbird, robin, raven, and crows. Waterfowl include scoter, ruddy duck, and bufflehead, which are known to rest and feed in the rearing ponds. Gulls, terns, great blue herons, and cormorants frequent the ponds attempting to feed on fingerlings. Various non-lethal deterrent methods are employed by hatchery staff.

3.4. Threatened and Endangered Species

3.4.1. NMFS Protected Species

3.4.1.1. Columbia River

Table 18 shows the federally listed salmon and steelhead species that may be migrating through the Columbia River in the project area. Critical habitat for these species (Table 19) was designated by NMFS on September 2, 2005 (70 FR 52630). Critical habitat in the project area generally extends from bank-to-bank to the ordinary high-water line on each side of the Columbia River.

Table 18. NMFS Protected Salmon and Steelhead Species

ESU/DPS	Listing Status	Life History Type	Recovery Planning Domain
Chinook Salmon (*Oncorhynchus tshawytscha*)			
Upper Columbia River Spring ESU	E – 6/28/05 (70 FR 37160)	Stream	Interior/Columbia River Basin
Steelhead (*Oncorhynchus mykiss*)			
Upper Columbia DPS	T – 1/5/06 (71 FR 834)	Stream	Interior/Columbia River Basin

ESU = Evolutionarily Significant Unit; DPS = Distinct Population Segment. Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered. FR = Federal Register.

Table 19. Critical Habitat Descriptions

Species	Description of Critical Habitat
Upper Columbia River Spring Chinook	Columbia River to Rock Island Dam and tributaries
Upper Columbia River Steelhead	Columbia River to Chief Joseph Dam and tributaries

The Upper Columbia River (UCR) spring Chinook salmon ESU includes all natural-origin, stream-type Chinook salmon from river reaches above Rock Island Dam and downstream of Chief Joseph Dam, including the Wenatchee, Entiat, and Methow River basins. The spring-run components of the following hatchery stocks are also listed: Chiwawa, Methow, Twisp, Chewuch, and White rivers and Nason creeks.

The UCR spring Chinook salmon ESU is not currently meeting viability criteria in the Upper Columbia Salmon Recovery Plan. Increases in natural-origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging; however, average productivity levels remain extremely low. Large-scale directed supplementation programs are underway in two of the three extant populations in the ESU. These programs are intended to mitigate short-term demographic risks while actions to improve natural productivity and capacity are implemented (WDFW 2013).

The Upper Columbia River steelhead DPS includes all natural-origin populations of steelhead in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S./Canada border. The DPS includes all naturally spawned 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: the Wenatchee River, Wells Hatchery (in the Methow and Okanogan Rivers), Winthrop Hatchery, Omak Creek, and the Ringold steelhead hatchery programs. The UCR natural-origin steelhead populations have increased in abundance in recent years, but productivity levels remain low. The proportions of hatchery-origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan river populations. The modest improvements in natural returns in recent years are probably primarily the result of several years of relatively good natural survival in the ocean and tributary habitats (WDFW 2013).

3.4.1.2. Yakima River

The Middle Columbia River Steelhead DPS includes steelhead populations in Oregon and Washington drainages upstream of the Hood and Wind River systems, up to and including the Yakima River. Major drainages in this ESU are the Deschutes, John Day, Umatilla, Walla Walla, Yakima, and Klickitat river systems. Almost all steelhead populations within this ESU are summer-run fish; the exceptions are winter-run components returning to the Klickitat River and Fifteenmile Creek watersheds. The DPS includes all naturally spawning populations of steelhead using tributaries upstream and exclusive of the Wind River, Washington, and the Hood River, Oregon, excluding the upper Columbia River tributaries (upstream of Priest Rapids Dam) and the Snake River. This DPS of steelhead was listed as threatened by NMFS in 1999, with designation reaffirmed in 2006 (WDFW 2013).

3.4.2. USFWS Protected Species

The following federally listed wildlife, fish and plant species protected by the U.S. Fish and Wildlife Service (USFWS) that may occur in Franklin County (RSH) and Benton County (I-182 site) are discussed below (from http://www.fws.gov/wafwo/speciesmap_new.html).

- Bull trout *(Salvelinus confluentus*) – threatened; including designated Critical Habitat
- Gray wolf (*Canis lupus*) – endangered
- Pygmy rabbit (*Brachylagus idahoensis*, Columbia Basin DPS) – endangered
- Ute ladies'-tresses orchid (*Spiranthes diluvialis*) – threatened

The Columbia River DPS of bull trout occurs throughout the entire Columbia River Basin. The Columbia River population segment is composed of 141 subpopulations. The Middle Columbia Recovery Unit encompasses the Yakima River Basin to the confluence with the Columbia River. A single core area encompassing the Yakima River Basin has been identified and includes 13 extant local populations of bull trout, with the mainstem Columbia River considered to contain core habitat, which may be important for full recovery to occur (WDFW 2013). Bull trout may be found in the Columbia River (RSH) and Yakima River (I-182) portions of the project area.

Bull trout, salmon, and steelhead can occur in similar aquatic habitat types. However, bull trout are more sensitive than salmon and steelhead to increased water temperatures, poor water quality, habitat conditions, and low flow conditions; thus, they more often occur in higher elevations with less disturbed habitats. Bull trout also require colder water temperatures than other salmon and trout and are more likely to occur in headwater streams where temperatures tend to be cooler. Because bull trout feed primarily on fish as subadults and adults, they can be a substantial predator of young salmon and steelhead. Juvenile bull trout feed on similar prey as salmon and steelhead (USFWS 2008b). The Columbia and Yakima rivers are considered critical habitat for bull trout (http://www.fws.gov/pacific/bulltrout/pdf/BTCHFR101810.pdf).

The gray wolf was once common throughout most of Washington, but declined rapidly from being aggressively hunted during the expansion of ranching and farming between 1850 and 1900. Wolves were eliminated as a breeding species from the state by the 1930s, although infrequent reports of animals continued in the following decades, suggesting that small numbers of individuals continued to disperse into Washington from neighboring states and British Columbia. Reliable reports of wolves began increasing in Washington in about 2005 due in part to the recent recovery of wolf populations in Idaho, Montana, and Wyoming. Washington now has a small breeding population of wolves in the initial stages of recovery. Five packs are present in the state as of December 2011. The first of these was discovered in Okanogan County in 2008. Single additional packs were found in Pend Oreille County in 2009 and 2010 and in Kittitas and Stevens Counties in 2011. In December 2011, the Washington Fish and Wildlife Commission approved a wolf conservation and management plan for Washington. The plan has two major components: (1) recovery objectives and strategies for downlisting and delisting wolves at the state level, and (2) management strategies to reduce and address conflicts with livestock and big game herds (taken from http://wdfw.wa.gov/conservation/gray_wolf/). The gray wolf is not known to occur in the vicinity of the RSH and I-182 sites.

The pygmy rabbit is the smallest rabbit in North America. It is the only rabbit to dig its own burrows, using the deep loamy soils of habitat dominated by sagebrush, which also makes up most of its diet. For over 100,000 years pygmy rabbits have lived in the Columbia Basin in Washington and the Columbia Plateau and Great Basin of the western U.S. (Oregon, California, Nevada, Utah, Idaho, Montana, and Wyoming). The Columbia Basin pygmy rabbits have been isolated from the rest of the population for at least 10,000 years, which has led to genetic differences between the rabbits in Washington and the other states. The pygmy rabbit was state and federally listed because of population and distribution declines due to habitat changes. Except for a remnant population on the state's Sagebrush Flats Wildlife Area, it was considered near extinct by 2001. A captive breeding program was initiated by WDFW and USFWS in 2001 with the intent of reintroducing rabbits to the wild. In spring 2011, a collaborative recovery effort was renewed with the Oregon Zoo, Washington State University, Northwest Trek Wildlife Park, USFWS and other state wildlife agencies. In spring 2012, 42 wild rabbits from Nevada and Utah and more captive-born rabbits from the Oregon Zoo boosted the local population. The recovery plan for the species includes: (1) reintroducing captive-bred individuals, (2) translocating wild-caught animals from neighboring states, and (3) breeding wild and captive animals together on site (taken from http://wdfw.wa.gov/conservation/pygmy_rabbit/). The pygmy rabbit is not known to occur in the vicinity of the RSH and I-182 sites.

Ute ladies'-tresses is a perennial, terrestrial orchid with stems 8-20 inches tall arising from tuberously thickened roots. Its narrow (0.39 inches) leaves can reach 11 inches in length. The flowering stalk consists of small white or ivory flowers clustered into a spike arrangement at the top of the stem. It blooms generally from late July through August. The orchid occurs along riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. It typically occurs in

stable wetland and seepy areas associated with old landscape features within historical floodplains of major rivers. It also is found in wetland and seepy areas near freshwater lakes or springs. In north-central Washington, Ute ladies'-tresses have been found at Wannacut Lake in Okanogan County (Okanogan watershed) and along a reservoir bordering the Columbia River in Chelan County (Chief Joseph watershed); it is not known to occur in the vicinity of the RSH and I-182 site (taken from http://www.fws.gov/mountain-prairie/species/plants/uteladiestress/).

3.5. Cultural and Historic Resources

3.5.1. Ringold Springs Hatchery

The RSH area of potential effect (APE) was considered to have a low potential for cultural resources because the location of the proposed hatchery improvements occurs within an extensively disturbed area. Previous surveys of the area did not identify any cultural deposits. Given that an intensive survey was completed of the entire RSH in 1996 (Thomas 1996a, b), it was determined that an additional archaeological survey of the APE was not necessary for this project. However, the literature review for the area indicated that the hatchery itself is approaching 50 years of age. A site visit was made to the hatchery on May 14, 2013 by Walla Walla District archaeologists to review the existing facilities and location of proposed improvements, and evaluate potential cultural resources impacts to the facilities.

The literature review and site visit led to the conclusion that the existing 9-acre pond and associated facilities (water intake, release/return channel) are approaching 50 years old (2017 to 2020). The remainder of the existing facility, including the 5-acre pond, housing, maintenance and storage buildings, additional rearing raceways, etc., was constructed between the 1970s and early 2000s. Given that the expansion may not begin until 2016 or later, it is possible that the existing hatchery facilities will become an historic property during the construction of these improvements. However, this site was determined *not eligible* to the National Register of Historic Places. Although the 9-acre pond and associated facilities are likely the result of the Mitchell Act of 1938, this hatchery is one of many constructed to mitigate for lost fish habitat and does not embody a significant design or style that would set it apart from other facilities of the same time period. In fact, the 9-acre pond is remarkable only in its simplicity. The site is not associated with the lives of any significant people. A thorough records search was conducted for this project and there is likely little additional information that will be obtained on this site. The 9-acre pond and associated facilities are not likely to contribute additional information about the history of the area.

3.5.2. I-182 Site

The I-182 site APE has been previously surveyed for archaeological resources. The first survey of the area occurred in the 1940s and identified two cultural resources along the Yakima River, each of which is located almost 1 mile away from the APE (Drucker 1948). Several smaller investigations were conducted in the vicinity of the APE. An investigation in the early 1990s documented the presence of an historic homestead adjacent to the APE (Bailor 1993). The site was identified by the presence of "domesticated plants" and an area that appeared to be a lawn. Although two potentially historic fence posts were documented, no historic structural features were identified in association with this site. During an investigation by Wright (2001), an open cistern was found along the Yakima River to the north of the APE; it was noted that the cistern was likely for water storage and/or an irrigation feature associated with early 1900s attempts to farm the area. Although the age and possible association with a larger water control system was noted, the cistern was not recorded as an historic archaeological site.

In 1999, archaeologists from the Confederated Tribes of the Umatilla Indian Reservation, Cultural Resources Protection Program, conducted a pedestrian survey of the Yakima River shoreline but did not

identify any archaeological sites in or adjacent to the APE. They also completed a pedestrian survey of the entire terrace to the north of the I-182 Bridge in 2009 and did not document any new archaeological sites (Confederated Tribes of the Umatilla Indian Reservation 2009).

Given the previously recorded sites and apparently undisturbed lands, the I-182 site APE was determined to have a high potential for cultural deposits. Although the APE was pedestrian surveyed in its entirety, there was no subsurface testing of the area. Walla Walla District archaeologists decided to systematically shovel test the I-182 site APE to ensure that there are no intact cultural deposits present. Shovel testing was conducted on April 14 and May 1-2, 2013.

The site record for one previously recorded historical archaeological site was updated during the 2013 survey. The site was originally recorded by Bailor (1993) as a potential homestead based on the presence of non-native vegetation. The 2013 survey crew revisited the site and discovered that it was not actually an historic property. There was no evidence for structural elements or any cultural materials. The non-native vegetation was planted by the USACE sometime in the past 20-30 years for wildlife habitat. This area of vegetation is one of many irrigated plots cultivated by the USACE in the floodplain.

An historic irrigation system was identified during the 2013 survey. A concrete pipe was located in a shovel test pit and was later located on the surface to the northwest of this shovel test pit. The survey crew was able to trace the concrete pipe throughout the floodplain to the north and west. However, this site was determined *not eligible* for the National Register of Historic Places. Although portions of the site remain intact, the majority of the site has been disturbed by maintenance and development of the floodplain by the USACE and others. The portions that are still *in situ* are being exposed by wind erosion and have been damaged in places (e.g., holes in pipes). This site would not be likely to contribute additional information about the historic nature of the area.

Although several isolated cultural items (e.g., glass and one sawed bone) and two pieces of shell were discovered in the shovel test pits, these items were of questionable age and were not considered significant finds.

3.6. Socioeconomics

Socioeconomics is defined as the study of the relationship between economics and social interactions with affected regions, communities, and user groups. In addition to providing fish for harvest, hatchery programs directly affect socioeconomic conditions in the local area where the hatchery facilities operate. Hatchery facilities generate economic activity (personal income and jobs) by providing employment opportunities and through local procurement of goods and services for hatchery operations.

The RSH is located in Franklin County, Washington. The estimated population of Franklin County in 2011 was 83,455, or about 1.2% of the total state population. The median household income in the county ($50,731) was lower than that ($58,890) for the state of Washington (USCB 2012). The percent of persons below the poverty level in the county (20.9%) was higher than that (12.5%) for the state of Washington (USCB 2012).

The I-182 site is located in Benton County, Washington. The estimated population of Benton County in 2011 was 180, 678 or about 2.6% of the total state population. The median household income in 2011 ($59,974) was higher than that ($58,890) for the state of Washington (USCB 2012). The percent of persons below the poverty level in the county (12.2%) was slightly lower than that (12.5%) for the state of Washington in 2011 (USCB 2012).

Located adjacent to the southern boundary of the Hanford Reach National Monument, RSH plays an important role in providing visitor access to the Hanford Reach (USFWS 2008a). The RSH provides a primitive launching area on the north shore. Open year-round, this area also allows overnight use, although no improvements are provided. This site serves as a motorboat launch and is also used by non-motorized boaters, primarily as a take-out for floating the Hanford Reach. The Hanford Reach attracts anglers from around the Northwest, providing excellent opportunities to catch fall Chinook salmon, steelhead, sturgeon, whitefish, and smallmouth bass (USFWS 2008a).

As compared to Washington State revenue for 2006 ($289 billion; USCB 2012), total fishing expenditures in Washington accounted for less than 0.2% ($534 21 million) of the total state revenue, and salmon and steelhead angling only accounted for only a portion of that.

4. ENVIRONMENTAL CONSEQUENCES

4.1. Physical Characteristics

4.1.1. Geology and Soils

4.1.1.1. Preferred Alternative

Ringold Springs Hatchery Construction. Expansion of the facilities at RSH will have direct soil disturbance impacts for roadway paving, foundation work for the ponds and pre-fabricated structures, and construction of the new fish ladder and intake structure. There will be no direct or indirect impacts on the geology of the area as a result of the construction, as all disturbances are within the surface soil layer.

I-182 Acclimation Site Construction. Construction at the I-182 site will have direct soil disturbance impacts for site preparation, foundation work for all elements of the new facility, and gravel re-surfacing for the entrance roadway. The construction will have no direct or indirect impacts on the geology of the area as all disturbance is within the surface soil layer.

Hatchery Operations. Hatchery operations would not be expected to have any direct or indirect impacts on the geology or soils at RSH or the I-182 site.

4.1.1.2. No Action Alternative

Continued hatchery operations at RSH would not be expected to have any additional direct or indirect impacts on the geology or soils at RSH. At the I-182 site, some of the area would continue to be managed for wildlife habitat, which would have no direct or indirect impacts on the geology of the area, and little to no direct or indirect impacts on the surface soil layer.

4.1.2. Sediment Quality

4.1.2.1. Preferred Alternative

Ringold Springs Hatchery Construction. One element of the proposed construction is a new water intake structure that will require in-water work, such as the construction of two drilled shafts just offshore of the facility (in the Columbia River) to support the pre-cast concrete intake tower and bridge. Disturbance of sediment in the Columbia River will be required for installation of these in-water support shafts. The sediment at this site is primarily gravel and cobble. The activity associated with the drilling and shaft installation will have no effect on sediment quality in the area. The lower section of the adult fish ladder will be modified and this construction has the potential to disturb sediment in Spring Creek. However, this disturbance is not expected to have an overall impact to sediment quality.

I-182 Acclimation Site Construction. The I-182 site will require a water in-take structure. The fine-grained sediment found in this area is more likely to have higher contaminant burdens due to the agriculture upstream in the Yakima River Basin. Sediment testing prior to the excavation for the water intake structure will determine if clean fill is necessary for backfill over the in-take pipe. This activity should not have a negative effect on the sediment quality of this site.

Hatchery Operations. The effluent from the hatchery facilities will be treated to meet state and federal water quality standards as prescribed by the National Pollutant Discharge Elimination System (NPDES) permit that must be obtained for each operation. However, even with wastewater treatment prior to

discharge, the wastewater would likely contribute some particulates to the receiving water bodies that could cause a negative impact to the sediment quality downstream of the facilities.

4.1.2.2. No Action Alternative

For the no action alternative, there would be no additional direct or indirect impacts to sediment quality in the Columbia River adjacent to RSH, nor in the Yakima River adjacent to the I-182 site.

4.1.3. Hydrology

4.1.3.1. Preferred Alternative

Ringold Springs Hatchery Construction. The construction work to expand the facilities at RSH would have no direct or indirect impacts on groundwater or surface water hydrology. Construction of the water intake and well may have very minor or no direct impacts on surface or groundwater hydrology.

I-182 Acclimation Site Construction. Construction of the facility at the I-182 site would have no direct or indirect impacts on groundwater and only minor direct impacts on surface water hydrology with the construction of the lower fish ladder.

Hatchery Operations. The expanded hatchery facilities at RSH will require increased groundwater withdrawals and surface water withdrawals from the Columbia River. Those withdrawals will have some direct effect on the groundwater hydrology. However, surface water hydrology impacts are expected to be inconsequential relative to the volume of water flow in the Columbia River. Groundwater withdrawals from the Ringold formation aquifer may have some direct effect on flows in Spring Creek, particularly in the dry season. The I-182 site will use primarily Yakima River water with spring water found on the site. This is expected to have an effect on the hydrology of the site during the portion of the year when the hatchery is operational. However, hatchery operations are considered a non-consumptive use as most of the water withdrawals are returned to the river.

4.1.3.2. No Action Alternative

The no action alternative would have no additional direct or indirect effects on groundwater or surface water hydrology at either of the project sites. Current conditions would not change in any way.

4.1.4. Climate Change

4.1.4.1. Preferred Alternative

Ringold Springs Hatchery Construction. The construction to expand the facilities at RSH would not be expected to have a direct or indirect impact on climate change. Also, climate change would not be expected to have an impact on the hatchery construction.

I-182 Acclimation Site Construction. Construction at the I-182 site would not be expected to have a direct or indirect impact on climate change. Also, climate change would not be expected to have any impact on hatchery construction.

Hatchery Operations. Hatchery operations are not expected to directly or indirectly impact climate change. However, operations of the hatcheries may be directly impacted by climate change in several ways. If drought conditions should result, groundwater and surface water resources may become scarce

and withdrawals may have to be limited, which would directly impact the ability of the hatcheries to function as proposed. Another possible direct impact of climate change could be flash-flood events; extreme cases could flood the facilities. Another possibility is that increased warming may mean that hatchery water needs additional cooling before it can be used, which would increase operational costs and energy consumption in order to maintain healthy fish and adequate production levels.

4.1.4.2. No Action Alternative

If no action is taken, RSH and the I-182 site would continue to be managed essentially as they are now; there would be no direct or indirect impacts to climate change. However, continued operation of RSH may be directly impacted by climate change, as discussed above.

4.1.5. Floodplains

4.1.5.1. Preferred Alternative

Ringold Springs Hatchery Construction. The expansion of and modifications to existing facilities at the RSH will be almost entirely above the 100-year floodplain. Only the lower portion of the adult fish ladder and the surface water intake would be within the floodplain. Neither of these features would be adversely impacted by flood water. In addition, due to the insignificant size of these features relative to the floodplain, neither would cause or exacerbate flooding of other property.

I-182 Acclimation Site Construction. Some features of the new facility will be located within the 100-year floodplain. These features include the rearing ponds and water intake structure. Walls of the rearing ponds would be high enough that the ponds are not flooded by a 100-year flood and access to the ponds will be via elevated walkways that are also above the floodplain. Buildings will be located on higher ground outside of the floodplain to prevent their flooding. Only minimal direct or indirect effects would be expected on localized flooding due to the construction of the ponds in the floodplain. Relative to the lower Yakima River floodplain, the ponds are insignificant in size and the removal of this small area from the available floodplain would result in only a minimal increased flood effects to the surrounding area. A floodplain analysis was done and it was determined that the effects of flooding could raise the elevation of a 100-year flood approximately 0.5 feet from the current projected flood elevation at the project site (USACE 2014). This effect is considered to be insignificant by FEMA standards, and would not impact any buildings, structures, utilities, or other known features. The analysis also indicated that all measurable effects would be confined to an area from the hatchery site to approximately 0.5 miles upstream, with a progressively decreasing effect moving upstream from the hatchery. There would be no effect to the flood elevation downstream of the hatchery.

Hatchery Operations. Hatchery operations are not be expected to have any direct or indirect impacts on floodplains, and would not create or exacerbate flooding on other property.

4.1.5.2. No Action Alternative

Under the no action alternative, no change to floodplains in the vicinity of RSH and the I-182 site would occur. There would be no potential for increased flooding on site or other near-by property.

4.1.6. Water Quality

4.1.6.1. Preferred Alternative

Ringold Springs Hatchery Construction. The expansion of and modifications to existing facilities at the RSH will be almost entirely upland. Only the construction of the lower portion of the adult fish ladder and the surface water intake would have the potential to directly impact water quality in the Columbia River or Spring Creek. Construction of the new water intake in the Columbia River will require in-water work to build the support shafts that will support the precast concrete intake tower and bridge. Disturbance of sediment within the Columbia River will be required for installation of these in-water features. The sediment at this site is primarily gravel and cobble, so disturbance is not likely to create a large turbidity plume. Although there will be some turbidity during and immediately after construction disturbance, it is expected to be intermittent over the short in-water construction period (likely 4-6 weeks or less over two in-water work seasons), and small in size relative to the available riverine habitat. Turbidity monitoring downstream of the work will be required to ensure that the construction does not cause exceedances of the state water quality standards. Construction of the lower fish ladder will take place within Spring Creek and the impacts to water quality would be primarily due to sediment disturbance during construction. This disturbance would occur only during lower ladder construction for the portion within the creek, and would occur over a short construction period. In addition, all in-water work would take place during the designated in-water work window to minimize the effects of the turbidity on fish within the affected water bodies.

I-182 Acclimation Site Construction. Construction of facilities at the I-182 site will be mostly above ordinary high water where sediment and erosions control measures will be used to minimize stormwater runoff into the river. Only the construction of the lower portion of the adult fish ladder and the surface water intake would have the potential to directly impact water quality in the Yakima River. Construction of the new water intake will require in-water work such as trenching to bury the intake pipe and placement of a screened water intake structure. Disturbance of sediment in the Yakima River will be required for installation of these in-water features. The sediment at this site is finer-grained materials than is found in the Columbia, so disturbance is more likely to create a turbidity plume in the water column. The turbidity caused by disturbing the sediment during construction would be intermittent and for a short duration while construction is underway, and small in size relative to the available riverine habitat. In addition, all in-water work would take place during the designated in-water work window to minimize impacts to fish within the affected water bodies. If necessary, the area of impact will be isolated using a silt curtain or a coffer dam to isolate the area of disturbance from the rest of the river.

Hatchery Operations. By concentrating large numbers of fish, the proposed hatchery and acclimation facility operations could affect several water quality parameters in the Columbia and Yakima rivers. Effluent from the facilities could have elevated temperature and elevated levels of ammonia, organic nitrogen, total phosphorus, biological oxygen demand, pH, and suspended solids (Sparrow 1981, WDOE 1989, Michael 2003). Chemical use within hatcheries could result in the release of antibiotics, fungicides, and disinfectants into receiving waters (Boxall et al. 2004, Pouliquen et al. 2008, Martinez-Bueno et al. 2009). Other chemicals and organisms that could potentially be released by hatchery operations are polychlorinated biphenyls, pathogens (HSRG 2005, 2009), steroids (Kolodziej et al. 2004), anesthetics, pesticides, and herbicides. The direct discharge of hatchery facility effluent is regulated by the EPA under the CWA through NPDES permits for discharges from hatcheries located on federal lands within the state of Washington.

Fish hatcheries must be approved by several federal agencies for the use a broad spectrum of commercial antibiotics, fungicides, and disinfectants to control bacterial and fungal diseases associated with

aquaculture. The use of the federally regulated products requires hatchery personnel to follow manufacturer's instructions in conditions that are suitable for their safe and effective use. Any departure from the directions and conditions on the product labeling or on special state labels is considered a violation of the law. The use of hatchery treatment chemicals is closely regulated by EPA, and each hatchery has reporting requirements associated with their use.

While the hatchery expansion at RSH and the I-182 site will potentially contribute substances to these rivers, the contribution of substances from these facilities would be small relative to the contribution of these substances from activities such as agriculture and industry. Although there may be a slight degradation of water quality under the preferred alternative over the no action alternative, the facilities would comply with all applicable NPDES permits and wastewater plans to minimize the effects to the adjacent surface and groundwater.

4.1.6.2. No Action Alternative

No changes to the water quality of the Yakima or Columbia rivers would occur under the no action alternative. There would be no potential for increased degradation above existing conditions.

4.1.7. Hazardous, Toxic, and Radioactive Waste

4.1.7.1. Preferred Alternative

Ringold Springs Hatchery Construction. Soils testing has been conducted at the RSH site and no hazardous, toxic or radioactive wastes were discovered. Construction of the expanded facilities will not disturb nor produce hazardous, toxic, or radioactive waste.

I-182 Acclimation Site Construction. Soils testing has been conducted at the I-182 site and no hazardous, toxic or radioactive wastes were discovered. Construction of the facility will not disturb nor produce hazardous, toxic, or radioactive waste.

Hatchery Operations. Operation of the hatchery facilities will not produce nor disturb hazardous, toxic, or radioactive waste. All hatchery waters must be treated to meet the state and federal CWA standards before being released from the facilities.

4.1.7.2. No Action Alternative

Under the no action alternative, there would continue to be no contaminant threats to or resulting from operations at RSH or the I-182 site due to hazardous, toxic, or radioactive waste.

4.2. Vegetation

4.2.1.1. Preferred Alternative

Ringold Springs Hatchery Construction. Construction will have some direct impact on upland vegetation within the hatchery facility boundaries; however, much of the development will be within an existing 9-acre pond that is not vegetated. There will also be some disturbance to riparian vegetation along the Columbia River where the water intake structure and pump will be placed. The adult fish ladder modifications will directly impact a small area of riparian vegetation along Spring Creek. There is also a pipe replacement that will be take place in an existing wetland on the site. This will temporarily disturb wetland vegetation along the length of the pipe.

I-182 Acclimation Site Construction. Clearing of vegetation would occur in an approximately 5-acre area needed for construction of the acclimation facilities. Riverine shoreline vegetation, palustrine forest, and palustrine scrub-shrub vegetation will also be removed and/or temporarily disturbed for portions of the construction including the installation of the surface water intake pipe and the lower part of the adult fish ladder.

Hatchery Operations. Hatchery operations would not be expected to impact vegetation.

4.2.1.2. No Action Alternative

If no action is taken, RSH and the I-182 sites would continue to be managed essentially as they are now; there would be no additional direct or indirect effects to vegetation from construction activities.

4.3. Aquatic Resources and Wildlife

4.3.1. Aquatic Resources

4.3.1.1. Preferred Alternative

Ringold Springs Hatchery Construction. Most of the construction at RSH will occur in upland areas and above ordinary high water, so it would not impact aquatic resources. However, there is a pipe scheduled for replacement that is within a wetland. This pipe replacement will cause temporary and localized impacts to flora and fauna within the wetland. Re-colonization by the aquatic organisms would be expected to begin immediately after the disturbance. Construction of the lower fish ladder and the water intake structure would have some impact on aquatic resources in the Columbia River and Spring Creek, primarily due to substrate disturbance, which would directly impact benthic organisms and indirectly impact aquatic organisms as a result of turbidity created within the water column. This turbidity could impact fish and invertebrates in the water column and bury benthic organisms when the particulates settle out downstream of the construction. Construction activity would be expected to elicit avoidance behavior from more mobile species, and drifting species would be subjected to turbidity for a short duration and in a small area relative to the available aquatic habitat. Construction impacts are not expected to have a permanent, negative effect on aquatic resources, and isolation of the construction area using coffer dams and/or silt curtains and other best management practices will minimize any potential temporary effects to nearby aquatic habitat.

I-182 Acclimation Site Construction. Construction of the upland portion of the I-182 site will have no impact on aquatic resources. Construction of the ponds, fish ladder, and the water intake structure will have some impact on riparian and wetland aquatic resources near the Yakima River's edge primarily due to substrate disturbance, which would directly impact benthic organisms and indirectly impact aquatic organisms as a result of turbidity created within the water column. This turbidity could impact fish and invertebrates in the water column and bury benthic organisms when the particulates settle out downstream of the construction. Construction activity would be expected to elicit avoidance behavior from more mobile species, and drifting species would be subjected to turbidity within the water column. Construction effects would be temporary in the immediate vicinity of the construction and downstream. As the turbidity moves downstream, particulates will settle out of the water column and the more turbid water will mix with the less turbid river water, which would lessen the effect to aquatic organisms as they drift or swim away from the impact area. The disturbed area would be expected to re-populate with benthic organisms by recruitment from upstream undisturbed areas. Construction impacts are not expected to have a permanent, negative effect on aquatic resources, and isolation of the construction area

using coffer dams and/or silt curtains and other best management practices will minimize and potential temporary effects to nearby aquatic habitat.

Hatchery Operations. Water withdrawals from the Columbia and Yakima rivers could result in entrainment of small fish and invertebrates. However, screening will meet NMFS/WDFW fish screen criteria to minimize this effect. Water withdrawal quantities are regulated by the state of Washington and hatcheries are considered non-consumptive users, so effects to fish due to diminished stream flow would be negligible relative to the baseline flow conditions. Effluent from the facility must meet federal water quality criteria for release into the rivers. However, there is the possibility that contaminants, antibiotics, or nutrients from the hatchery operation would reach the river in some measurable quantity resulting in a localized degradation of water quality.

4.3.1.2. No Action Alternative

If no action is taken, RSH and the I-182 sites would continue to be managed essentially as they are now; there would be no additional direct or indirect effects to aquatic resources or aquatic habitat from construction activities.

4.3.2. Wildlife

4.3.2.1. Preferred Alternative

Ringold Springs Hatchery Construction. Construction will have little effect on upland wildlife species that occur at RSH such as birds, coyote, rodents, jackrabbits, and raccoons. Much of the construction will occur within an existing 9-acre pond that does not provide habitat for these species. Some riparian habitat would be impacted by construction of the water intake and temporarily displace any wildlife and birds that may be in this area. Construction of the adult fish ladder should have little impact on wildlife. Migratory waterfowl will be temporarily displaced by construction within the 9-acre pond and possibly by pipe replacement in the wetland area.

I-182 Acclimation Site Construction. The 87-acre I-182 site is currently managed for wildlife use by the USACE Walla Walla District. Clearing of vegetation in approximately 5-acres for construction of the acclimation facilities would displace wildlife and birds by permanently removing habitat. Riverine shoreline vegetation would be removed and/or disturbed for the construction of the surface water intake pipe and the lower part of the fish ladder. Relative to the size of the 87-acre parcel, removal of this small area of habitat would have only a small effect on wildlife in the area.

Hatchery Operations. Hatchery operations would not be expected to affect wildlife except for the non-lethal deterrence of piscivorous birds such as gulls, cormorants, herons, and terns that attempt to feed on fingerling salmon.

4.3.2.2. No Action Alternative

If no action is taken, RSH and the I-182 sites would continue to be managed essentially as they are now; there would be no additional direct or indirect effects to wildlife or their habitats from construction activities.

4.4. Threatened and Endangered Species

The WDFW operates the RSH and will continue to do so after the proposed expansion of facilities. Upon completion of the I-182 facility, the USACE will make a determination on the operations and maintenance of this new facility. In anticipation of operational changes, the WDFW is preparing a Hatchery and Genetic Management Plan (HGMP) for the Ringold Springs Rearing Facility Fall Chinook Program. The HGMP addresses, in detail, the effects of proposed operations at RSH and the I-182 site on all applicable NMFS and USFWS managed ESA species (see Section 3.4). In particular, the HGMP addresses potential impacts on salmonids from the collection of adults and the release of juveniles into the Columbia River ecosystem. Provided below is a summary of the potential impacts to applicable ESA species as found in the draft HGMP (WDFW 2013). The draft HGMP is not yet available for public review, but WDFW will provide the opportunity for public comment, and evaluation by NMFS and USFWS for effects to ESA-listed species.

For the proposed modifications to production at Little White Salmon Hatchery, the HGMP for that hatchery will be modified prior to implementation of changes to the JDM program; the revised HGMP will be submitted for public review and evaluated by NMFS and USFWS for effects to ESA-listed species.

4.4.1.1. Preferred Alternative

Ringold Springs Hatchery Construction. Construction of the new water intake in the Columbia River will require in-water work to build the support shafts that will support the precast concrete intake tower and bridge that connects the intake tower to the on-shore pump. The intake openings will be covered with the appropriate fish-friendly mesh size as required by NMFS to minimize the potential for entrainment of small fish. All in-water work will be conducted within the in-water work window, if possible, to minimize impacts to migratory salmonid species (Chinook salmon, steelhead and bull trout). The adult fish ladder modifications will also be done during the in-water work window so that there will be no impact to URB adult upstream migration. It should be noted that no ESA-listed species are known to spawn in the Spring Creek, which will be impacted by the adult ladder modification work. No effects are expected to gray wolf, pygmy rabbit, or the Ute ladies'-tresses orchid, which are not known to occur in the vicinity of the hatchery.

I-182 Acclimation Site Construction. Construction of the adult ladder will result in minor, short-term impacts to riparian vegetation, water quality, and aquatic organisms in and along the Yakima River. Impacts include the possibility of some increase in turbidity and some noise disturbance to migratory salmonid species in the vicinity. To minimize impact of the construction, all in-water work will be conducted during the in-water work window. No effects are expected to gray wolf, pygmy rabbit, or the Ute ladies'-tresses orchid, which are not known to occur in the vicinity of the I-182 site.

Hatchery Operations. No ESA-listed salmonid populations are expected to be directly impacted by hatchery operations. The four ESUs that may be incidentally affected by hatchery operations are Upper Columbia River steelhead, Middle Columbia River steelhead, Upper Columbia River spring-run Chinook, and Snake River fall Chinook salmon. Bull trout may also be incidentally affected by hatchery adult trapping operations. The following hatchery operations may lead to take of listed salmonids.

- Broodstock trapping operations. In the past, observations of trapped ESA-listed fish species have been low for RSH. Wild steelhead and Snake River fall Chinook strays have been detected, and when possible, removed and returned unharmed to the Columbia River. Impacts to listed spring Chinook and steelhead stocks located in upriver tributaries are unlikely due to stock and habitat

characteristics (Peven 2003). Bull trout have also been encountered in the RSH trap. To reduce the potential for lethal take, the trap is checked at least once a day and, as with other ESA species, bull trout are removed from the trap and returned to the river.

- Rearing programs. Effluent from the rearing operations and facilities must meet Clean Water Act Section 402 NPDES Permit requirements specific to each facility. Indirect take from effluent discharge is unknown. To address concerns about the potential for disease transmission from hatchery to natural fish, a number of policies and procedures are now required within hatcheries in order to reduced disease outbreaks. Indirect take from disease is unknown.

- Release. Hatchery production/density-dependent effects of an increase in fish production from the current level of approximately 3.5 million smolts to 14.5 million smolts (both Ringold and I-182 combined) for annual release is similar to the production/releases from the Spring Creek National Fish Hatchery prior to 2009. Listed steelhead and spring Chinook spawning and rearing habitat occurs in the major and minor tributaries upstream of the release site. Fish produced in these areas would migrate past the hatchery location from spring to late summer. In the area below Bonneville Dam, Lower Columbia River listed smolts will be co-mingled and would be in down-stream migration along with the up-river stocks. The release could potentially affect natural populations through displacement or competition with hatchery released fish.

- Studies conducted in other areas indicate this program size is likely to pose a minimal risk of direct competition due to the migration speed that smolted fish can travel, especially once in the mainstem Columbia River. PIT tagging studies (Bumgarner et al. 2000) have shown that URB releases from RSH moved past McNary Dam within the first two weeks (mean travel days = 14) after volitional release, with some of these fish reaching Bonneville Dam (almost 200 miles downstream) in 2 weeks. In the Columbia River, studies indicate that fish appear to travel quickly. Median travel time of subyearling Chinook in the mainstem Columbia River, from McNary to Bonneville Dam, was estimated to average 8 days (18.1 miles/day) during the years 1997 to 2003 (unpublished WDFW data from 2003). In a study designed to define the migrational characteristics of Chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling Chinook, yearling Chinook, coho salmon, and steelhead were 13.8, 11.2, 10.6, and 21.7 miles/day, respectively.

- Predation risk factors. Releases from RSH for the past 5 years have occurred in late June to early July. This is generally after listed steelhead and spring Chinook smolts from the Upper Columbia River region have past. Steelhead smolts originating above McNary Dam and representing upper Columbia and Snake river origin populations exhibit average peak passage at McNary Dam from May 7 through May 26 (1984-1986 observations reported by the Fish Passage Center, http://www.fpc.org/). The RSH program proposes to release 10.4 million smolts annually. As smolts, they are less likely to compete for food or habitat with listed stocks emigrating downriver. The NMFS has incorporated a Columbia River hatchery production ceiling of 197.4 million fish in their recent hatchery biological opinions to address potential mainstem corridor and ocean effects, as well as other potential ecological effects from hatchery fish.

- Monitoring. Through a comprehensive research, monitoring and evaluation program WDFW will be able to determine if risks to listed stocks and Hanford Reach fall Chinook are acceptable. The proposed monitoring plan will evaluate effects over a 10-year period and make program adjustment as needed based on annual findings.

- Homing and straying of released fall Chinook salmon. On average, about 6.4% of the RSH fall Chinook salmon returns have strayed into non-target hatcheries. Less than 1%, on average, has strayed into non-target spawning areas. Returning fall Chinook may contribute to spawning in the Hanford Reach of the Columbia River and even the lower Snake River. To evaluate any potential ecological impacts, the program will be monitored and evaluated to ensure guidelines are met to minimize straying as outlined in the HGMP. The potential effects of straying are addressed in more detail in the HGMP documents for the hatchery operations.

- Overall increases in URB production would be off-set by a 25% decrease in downstream Tule production.

4.4.1.2. No Action Alternative

If no action is taken, RSH and the I-182 sites would continue to be managed essentially as they are now; there would be no additional effects to NMFS- and USFWS-managed ESA species or their habitats from construction activities.

4.5. Cultural and Historic Resources

4.5.1.1. Preferred Alternative

Ringold Springs Hatchery Construction. The RSH APE has been intensively surveyed and one historic site was documented (the hatchery itself). This site was determined *not eligible* for listing on the National Register of Historic Places due to its lack of integrity and because it is unlikely to further contribute to the understanding of the history of the area. Based on the survey and determination of eligibility, the proposed project will have *no effect* on historic properties. This determination was coordinated with the Washington State Department of Archaeology and Historic Preservation (DAHP) and interested tribes as required under Section 106 of the National Historic Preservation Act. The proposed project at RSH can proceed without additional cultural resources investigations. However, should any human remains, archaeological deposits, or cultural materials be discovered during construction activities, all work in the immediate area of the discovery would cease to allow for the application of appropriate procedures as required for the protection of historic properties and outlined in 36 Code of Federal Regulations (CFR) 800.13 and the Native American Graves Protection and Repatriation Act (NAGPRA).

I-182 Acclimation Site Construction. The I-182 site APE has been previously surveyed and shovel testing was performed in 2013. One historic site was further documented (historic homestead) and determined to not be an historic property as previously thought. Another site was documented (historic irrigation system) but determined *not eligible* for listing on the National Register of Historic Places due to its lack of integrity and because it is unlikely to further contribute to the understanding of the history of the area. Based on the survey and determination of eligibility, the preferred alternative will have *no effect* on historic properties. The no-effect determination was coordinated with the Washington DAHP and interested tribes as required under Section 106 of the National Historic Preservation Act. The proposed project at the I-182 site can proceed without additional cultural resources investigations. However, should any human remains, archaeological deposits, or cultural materials be discovered during construction activities, all work in the immediate area of the discovery would cease to allow for the application of appropriate procedures as required for the protection of historic properties and outlined in 36 CFR 800.13 and the Native American Graves Protection and Repatriation Act (NAGPRA).

Hatchery Operations. Hatchery operations would not be expected to have any direct, indirect or cumulative effects on any known or unknown cultural or historic resources in the RSH and I-182 APEs.

4.5.1.2. No Action Alternative

Under the no action alternative, the existing conditions in the project areas would continue. The RSH would continue to be used to rear and release fish, and the I-182 site would continue to be managed for wildlife. These activities would have *no effect* on historic properties.

4.6. Socioeconomics

4.6.1.1. Preferred Alternative

Ringold Springs Hatchery Construction. The construction will provide temporary contract jobs for design and construction of the facility. The labor and procurement of goods required for construction will provide a short-term, direct increase in local economic activity. Once completed, the improved RSH (and I-182) facility will employ additional full- and part-time staff. This increased economic activity will be long-term and is expected to have a positive, direct impact on the socioeconomics of the area. In addition, the access provided at RSH to the Hanford Reach of the Columbia River would not be affected by construction. There are no negative direct or indirect socioeconomic impacts anticipated for facility construction.

I-182 Acclimation Site Construction. Construction at the I-182 site will provide temporary contract jobs for design and construction of the facility. The labor and procurement of goods required for construction will provide a short-term increase in local economic activity. The increased economic activity is expected to have a positive, direct impact on the socioeconomics of the area. There are no negative direct or indirect socioeconomic impacts anticipated for facility construction.

Hatchery Operations. Hatchery operations will require additional full-time and part-time personnel beyond those currently employed at RSH. The additional employment will contribute to the long-term economics of the region through personal income and jobs, as well as goods, services, and housing demands of the new employees. Fishing and associated expenditures are expected to increase over the long-term with the increased number of adult fish returns to the Zone 6 fishery. There are no negative direct or indirect socioeconomic impacts anticipated for hatchery operations.

4.6.1.2. No Action Alternative

If no action is taken, RSH and the I-182 sites would continue to be managed essentially as they are now; there would be no additional temporary construction jobs or employment opportunities, and no short-term or long-term direct increase to local economic activity.

4.7. Cumulative Effects

4.7.1.1. Preferred Alternative

Cumulative effects are defined as, "The impact on the environment which results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR Section 1508.7). Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. For the release of hatchery fish, the action area is includes

those areas that are accessible to fish released from the proposed hatchery programs and are addressed in the HGMP documents for the RSH and I-182 facilities.

Impacts of the construction of the proposed project are expected to be only minor. Effects of the hatchery operations, with the increased numbers of URB fall Chinook salmon being introduced to the system, are the largest concern related to the proposed project. Those effects are also expected to be minor, however there are other Federal, tribal and state actions expected to occur within the action area and outside of the action area but within the Columbia River Basin migratory corridor and out into the Pacific Ocean. Federal, state, and tribal fisheries will still occur in the Columbia River. Land management and water-use decisions are made by multiple agencies that affect these populations. Development within the watershed will continue, although regional programs are being developed that designate priority watershed and facilitate the development of watershed management plans. There are overarching concerns and legal mandates for the recovery of listed salmon and steelhead populations in the Columbia and Snake River basins; while at the same time, there are social and cultural needs for sustainable fisheries and a sustainable economic use of resources. The NMFS currently distributes funds under the Mitchell Act to operate 62 hatchery programs that annually produce more than 71 million fish. Historically, production levels have been as high as 128.6 million juvenile fish annually, but these levels have been substantially reduced as inflation, maintenance, and other costs have eroded the amount of funding available for fish production.

The hatchery programs and associated fisheries that may impact listed salmon and steelhead within the action area would be managed based on their impacts on ESA-listed fish that are returning to the Columbia River. If the cumulative effects of other hatchery programs, fisheries, pinniped and avian predation on salmonids, habitat restoration projects, ocean conditions and conservation efforts do not allow sufficient escapement of returning adult salmon and steelhead to the action area and above, to meet recovery goals while providing for the operation of the proposed hatchery programs, adjustments to fisheries and to the hatchery production levels may be proposed.

If the cumulative effects of salmon management efforts fail to provide for recovery of listed species, then impacts due to the hatchery programs and fishing in the action area would be substantially diminished. Therefore, the cumulative impacts of the proposed action on recovery actions are expected to be minor because of reporting and monitoring requirements that would ensure compatibility with recovery planning. Management of the hatchery programs and of fishing opportunity is only one element of a large suite of regulations and environmental factors that may influence the overall health of listed salmon and steelhead populations and their habitat. The proposed hatchery program includes a monitoring component so that the hatchery plans can be modified in response to changes in the status of affected listed and non-listed species. Monitoring and adaptive management would help ensure that listed and non-listed species are adequately protected and would help counter-balance any potential adverse cumulative impacts.

The City of Richland is proposing to construct a new bridge over the Yakima River in the vicinity of the I-182 site. This construction will have similar impacts to the upland areas and potential impacts to riparian and riverine areas. The location of the bridge is upstream of the I-182 site and the time-frame for construction of that project is not known.

The climate in the Pacific Northwest is changing due to human activities, and this is affecting hydrologic patterns and water temperatures. Regionally averaged air temperature rose about 1.5°F over the past century (with some areas experiencing increases up to 4°F) and is projected to increase another 3°F to 10°F during this century. Increases in winter precipitation and decreases in summer precipitation are

projected by many climate models, although these projections are less certain than those for temperature (USGCRP 2009).

Higher temperatures in the cool season (October through March) are likely to increase the percentage of precipitation falling as rain rather than snow, and to contribute to earlier snowmelt. The amount of snowpack measured on April 1, a key indicator of natural water storage available for the warm season, has already declined substantially throughout the region. The average decline in the Cascade Mountains, for example, was about 25% over the past 40 to 70 years, with most of this due to the 2.5°F increase in cool season temperatures over that period. Further declines in Northwest snowpack are likely due to additional warming this century, varying with latitude, elevation, and proximity to the coast. April 1 snowpack is likely to decline as much as 40% in the Cascades by the 2040s (USGCRP 2009).

High and base stream flows are likely to change with warming. Increasing winter rainfall is likely to increase winter flooding in relatively warm watersheds on the west side of the Cascade Mountains. Earlier snowmelt, and increased evaporation and water loss from vegetation, will increase stream flows during the warm season (April through September). On the western slopes of the Cascade Mountains, reductions in warm season runoff of 30% or more are likely by mid-century. In some sensitive watersheds, both increased flood risk in winter and increased drought risk in summer are likely due to warming of the climate (USGCRP 2009).

In areas where it snows, a warmer climate means major changes in the timing of runoff, increased stream flows during winter and early spring, and decreases in late spring, summer, and fall. Flow timing has shifted over the past 50 years, with the peak of spring runoff shifting from a few days earlier in some places to as much as 25 to 30 days earlier in others. This trend is likely to continue, with runoff shifting 20 to 40 days earlier within this century. Major shifts in the timing of runoff are not likely in areas dominated by rain rather than snow (ISAB 2007, USGCRP 2009).

Fish habitat changes due to climate change are likely to create a variety of challenges for ESA-listed species of fish. Higher winter stream flows can scour streambeds, damaging spawning redds and washing away incubating eggs (USGCRP 2009). Earlier peak stream flows could flush young salmon and steelhead from rivers to estuaries before they are physically mature enough for the transition, increasing a variety of stresses and the risk of predation (USGCRP 2009). Lower summer stream flows and warmer water temperatures will degrade summer rearing conditions in many parts of the Pacific Northwest for a variety of salmon and steelhead species (USGCRP 2009), and are likely to reduce the survival of steelhead fry in streams with incubation in early summer. Other likely effects include alterations to migration patterns, accelerated embryo development, premature emergence of fry, and increased competition and predation risk from warm-water, non-native species (ISAB 2007). The increased prevalence and virulence of diseases and parasites that tend to flourish in warmer water will further stress salmon and steelhead (USGCRP 2009). Overall, about one-third of the current habitat for the Pacific Northwest's coldwater fish may no longer be suitable for them by the end of this century as key temperature thresholds are exceeded (USGCRP 2009).

Climate change is also likely to affect conditions in the Pacific Ocean. Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (USGCRP 2009). It is likely that, as ocean conditions change, abundances of salmon and steelhead will continue to change accordingly, resulting in changes in abundance of adults returning to freshwater to spawn.

If climate change contributes to a substantial decline in the abundance of listed salmon and steelhead populations through impacts to habitat and from changes in ocean conditions, the proposed hatchery

program may be used as a "safety net" program to maintain genetic resources. The proposed hatchery programs are somewhat protected from the possible increase in disease prevalence from warmer water temperatures because much of the rearing occurs using well water and the fish are tested at spawning, during rearing, and prior to release to limit disease transmission to the natural-origin populations.

While climate change may well have impacts on the abundance and/or distribution of ESA-listed salmonids that may be impacted by the proposed action, the proposed hatchery management described in the HGMP and the associated monitoring provide the ability to evaluate the hatchery program's impacts as abundances change, leading to adjustments in the hatchery management plans.

4.7.1.1. No Action Alternative

If no action is taken, RSH and the I-182 sites would continue to be managed essentially as they are now; there would be no effects from construction or increased hatchery operations that would add to the cumulative effects of human activities and climate change in the area.

5. COMPLIANCE WITH LAWS AND REGULATIONS

5.1. National Environmental Policy Act (NEPA), 1969

The National Environmental Policy Act requires all federal agencies to, among other things, assess the environmental impacts of major federal projects, decisions such as issuing permits, spending federal money, or actions on federal lands; consider the environmental impacts in making decisions; and disclose the environmental impacts to the public. Environmental considerations are fully integrated into the decision-making process as required by the Corps' implementing NEPA regulations, 33 CFR § 230.

This revised draft EA will receive a 15-day public and agency review comment period. Prior to finalization of the document, any comments received from this review would be considered and incorporated into the proposed project, as appropriate. After such time, the USACE will determine if the effects of the preferred alternative would reach a threshold that could significantly affect the quality of the human environment, and whether or not an Environmental Impact Statement is required; or conversely, if the analysis results in a Finding of No Significant Impact (FONSI).

5.2. Endangered Species Act (ESA), 1973

The Endangered Species Act was enacted to protect and conserve endangered and threatened species and critical habitat. Requirements established in 16 United States Code (USC) §1531 ensure activities authorized, funded, and carried out by federal agencies are not likely to jeopardize the continued existence of any listed species or result in adverse impacts to designated critical habitat of a listed species. The USFWS and the NMFS share responsibility for the administration of ESA-listed species.

Information on federally listed species and designated critical habitat is presented in this revised draft EA. A Biological Assessment is being prepared for the proposed action for species under the jurisdiction of the NMFS. The USACE has determined that the proposed action may affect listed salmon and steelhead and their designated critical habitat. Based on the outcome of the Section 7 consultation, the NMFS will likely issue a Biological Opinion (BiOp) that will set forth terms and conditions to minimize impacts of the proposed action and issue an incidental take statement.

A 'no effect' determination has been documented for most species under the jurisdiction of the USFWS. A preliminary determination of 'may affect, but not likely to adversely affect' bull trout has been made which will require informal consultation with USFWS. The USFWS may concur with that determination or the agency may decide that formal consultation will be required which would require a Biological Assessment and a BiOp for that species.

The USACE does not anticipate that implementation of the preferred alternative would result in impacts to ESA-listed species that would jeopardize the existence of those species. All conservation measures, terms and conditions, and reasonable and prudent measures would be implemented to the maximum extent practicable. Any deviations to the proposed plan would require a written variance from the Services. Long-term effects are expected to benefit aquatic species without detriment to waterfowl or other terrestrial species. These effects were described in associated portions of this revised draft EA.

5.3. Magnuson-Stevens Fishery Conservation and Management Act, 1976

This Act, Public Law 94-265 as amended, is designed to actively conserve and manage fishery resources found off the coasts of the United States, to support international fishery agreements for the conservation and management of highly migratory species. This Act established procedures designed to identify, conserve, and enhance Essential Fish Habitat (EFH) for fisheries regulated under a federal fisheries management plan. Federal agencies must consult with NMFS on all proposed actions authorized, funded, or carried out by the agency which may adversely affect EFH.

In the RSH project area, the Columbia River is designated as EFH for salmon species. An assessment of EFH impacts will be provided to NMFS and USFWS for review and consultation as part of the ESA Section 7 consultation process. The proposed in-water construction would be temporary, limited to a relatively small area, and short-term and would result in only minor modifications to EFH. With construction timing and techniques, best management practices, and a Stormwater Pollution Prevention Plan for construction activities, potential impacts to EFH will be minimized.

5.4. Clean Air Act, 1970

This Act (42 USC §7401 *et seq*.) established a comprehensive policy for protection and enhancement of air quality throughout the United States. Its goals are achieved through permitting of stationary sources, restricting the emission of toxic substances from stationary and mobile sources, and establishing National Ambient Air Quality Standards. Title IV of the Act includes provisions for complying with noise pollution standards. Section 118 (42 USC §7418) of the Act specifies that each department, agency, and instrumentality of the executive, legislative, and judicial branches of the Federal Government (1) having jurisdiction over any property or facility, or (2) engaged in any activity resulting, or which may result, in the discharge of air pollutants, shall be subject to, and comply with, all federal, state, interstate, and local requirements respecting the control and abatement of air pollution in the same manner, and to the same extent as any non-governmental entity. Corps of Engineers activities resulting in the discharge of air pollutants must conform to National Ambient Air Quality Standards (NAAQS) and State Implementation Plans, unless the activity is explicitly exempted by EPA regulations.

There would be an intermittent, short-term, extremely localized reduction in air quality during construction of the preferred alternative due to emissions from construction equipment. Any emissions that do occur during construction from motor vehicles are expected to be *de minimus*. After construction, emissions from activities at RSH would be of a similar scope to those of the original facility. Total emissions from the operations of the I-182 facility will be an increase over current conditions, but all operating equipment will be required to meet state and federal emissions standards. There also would be an intermittent increase in noise levels from construction equipment. Efforts to avoid and minimize these effects have been considered when comparing and evaluating construction methods.

5.5. Clean Water Act (CWA), 1972

The Clean Water Act (33 USC §1251 *et seq*.) established the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common

name with amendments in 1977. The CWA made it unlawful to discharge any pollutant into navigable waters, unless a permit was obtained.

Section 404 – This section authorizes the Secretary of the Army to permit the discharge of dredged or fill material into waters of the United States at specified disposal sites. Disposal sites are evaluated and authorized through the application of the Section 404(b)(1) Guidelines, further described in 40 CFR 230.

Although USACE Civil Works does not permit itself through Section 404, per 33 CFR 336.1(a), the USACE complies with all applicable substantive legal requirements, including application of Section 404(b)(1) Guidelines to evaluate compliance with the CWA. The construction contract will require that all material used as fill within waters of the U.S. be clean fill from a commercial source, or re-use of suitably clean excavated material returned to the same location as back-fill. A Section 404(b)(1) Evaluation will be prepared for this project and submitted to WDOE along with the application for a CWA Section 401 Water Quality Certification.

Section 401 – Section 401(a)(1) requires certification from the state in which a discharge would occur to waters of the United States and is applicable to construction and operation of facilities. The state must certify that the discharge would not violate the states' water quality standards. The EPA retains jurisdiction in limited cases.

Although the USACE does not issue Section 404 permits to itself, the USACE seeks a State Water Quality Certification per 33 CFR 336.1(a)(1) when its activities result in a Section 404 discharge. The required Section 401 Water Quality Certification will be obtained from WDOE. The Section 404(b)(1) Evaluation, wetland delineation, and any additional necessary information, such as a Joint Aquatic Resources Permit Application (JARPA), will be submitted to WDOE. The WDOE would be responsible for project review and issuance of the 401 Water Quality Certificate, which would likely include terms and conditions to avoid and/or ameliorate impacts from the preferred alternative, including BMPs and turbidity monitoring requirements.

Section 402 – Section 402(a)(1) authorizes the EPA or states in which the EPA has delegated such authority to issue permits for the discharge of any pollutant or combination of pollutants under procedures established to implement the National Pollutant Discharge Elimination System (NPDES) program. Regulated categories of discharges generally include point-source discharges and stormwater runoff. Permit conditions are usually required to ensure compliance with all applicable effluent and water quality standards.

For the proposed project, a NPDES permit would be required from the EPA and will be obtained prior to proposed disturbance and work.

The overall effects to water quality and effects from discharges and disposal into navigable waters, including wetlands, have been described in the pertinent sections of this revised draft EA, and will be further described in the Section 404(b)(1) Evaluation.

5.6. Fish and Wildlife Coordination Act (FWCA), 1958

The FWCA directs federal agencies to prevent the loss and damage to fish and wildlife resources in 16 USC §661-667e; specifically, wildlife resources shall be given equal consideration in light of water-resource development programs. Consultation with the USFWS is required when activities result in the

control of, diversion or modification to any natural habitat or associated water body, altering habitat quality and/or quantity for fish and wildlife.

The proposed project is not a water-resource development project and therefore, the FWCA does not apply.

5.7. Coastal Zone Management Act (CZMA), 1972

The CMZA was enacted to preserve, protect, develop, and where possible, restore or enhance the resources of the Nation's coastal zone (including the Great Lakes) for this and succeeding generations. Federal, state and local authorities, and international organizations are encouraged to coordinate coastal management related to land use practices affecting the coastal and ocean resources of the United States, and balance economic development with environmental conservation.

The proposed activities at RSH and at the I-182 site do not occur within the regulatory boundaries of the CZMA; therefore, the CZMA does not apply.

5.8. Marine Protection, Research, and Sanctuaries Act (Section 103), 1972

This Act, also known as the Ocean Dumping Act, prohibits the dumping of materials into the ocean that would degrade or endanger human health or the marine environment.

The proposed project does not require the disposal of materials into ocean waters; therefore, this Act is not applicable.

5.9. Marine Mammal Protection Act

This Act established a federal responsibility to conserve marine mammals within waters of the United States. With certain specified exceptions, the Act establishes a moratorium on the taking and importation of marine mammals.

The location of the proposed project is not within the vicinity of marine mammals or their critical habitat. However, the projected increase is adult salmon returns as a result of the proposed increase in hatchery production will provide an increase in the available food source throughout the range of marine mammal habitat both in the lower Columbia River and in the Pacific Ocean.

5.10. Bald and Golden Eagle Protection Act, 1940

This Act provides for the protection of bald and golden eagles by prohibiting (except under certain specified conditions) the taking, possession, and commerce of such birds.

The proposed project is not expected to have a long-term adverse effect on eagles that might be present in or flying through the project area. Golden eagles may be present in the vicinity of the RSH and I-182 project areas. Bald eagles are known to occur in the vicinity of these two project areas, and could be disturbed by construction activities occurring in and near the Columbia and Yakima rivers; eagles might be flushed from perches and might temporarily avoid these areas. However, there would be no long-term effects to bald eagles. Therefore, the proposed project is in compliance with this Act.

5.11. Migratory Bird Treaty Act, 1918

This Act makes it unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not.

The proposed project would not result in the taking of any migratory birds and therefore, is in compliance with this Act.

5.12. Wild and Scenic Rivers Act, 1968

This Act applies only to rivers designated by Congress as "wild and scenic" in order to safeguard the special character of these rivers. Under this Act, federal agencies may not assist the construction of a water resources project that would have a direct and adverse effect on the free-flowing, scenic, and natural values of a federally designated wild or scenic river.

There are no designated wild and scenic rivers in the project area. Therefore, this Act is not applicable to the proposed project.

5.13. National Historic Preservation Act (NHPA Section 106), 1966

This Act is designed to protect and preserve cultural resources and ensure that development does not cause harm or degradation to historic integrity and significance. Section 106 of the NHPA requires all federal agencies to consider the potential effects of their undertakings on historic properties eligible for or currently listed on the National Register of Historic Places (National Register, (http://www.cr.nps.gov/nr/). Historic properties include archaeological sites, historic structures or the remnants of sites or structures, and areas of historic, cultural or traditional significance.

Corps of Engineers archaeologists have determined that the proposed project will have no effect on historic properties. This determination was coordinated with the Washington Department of Historic Preservation, the Confederated Tribes of the Umatilla Indian Reservation, the Nez Perce Tribe, the Confederated Tribes and Bands of the Yakama Nation, Wanapum, and the Confederated Tribes of the Colville Reservation. The Washington DAHP responded by email dated December 10, 2013 concurring with the USACE determination of "no historic properties affected" by the proposed action.

5.14. Executive Order 11990, Protection of Wetlands, 24 May 1977

The purpose of this Executive Order is to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In planning their actions, federal agencies are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

At the RSH and I-182 sites, riparian vegetation will be temporarily disturbed when the water in-take structures and ladder construction and/or modifications take place. The area of impact due to construction will be minimized as much as possible, and most of the disturbed areas allowed to revegetate immediately after construction in completed. There will be only a minor permanent loss of riparian area resulting from the proposed project features that are adjacent to the river (intake structures and fish ladders).

5.15. Comprehensive Environmental Response, Compensation, and Liability Act – Superfund (CERCLA), 1980

This Act established a method to assign liability to parties responsible for the release of hazardous wastes and established a trust fund (Superfund) for the cleanup of associated lands through either short-term removals or long-term remediation to reduce the dangers to public health and the environment associated with hazardous substances.

The RSH and I-182 project areas are not within the boundaries of a site designated by the EPA or state of Washington for a response action under CERCLA, nor are they part of the National Priority List (http://www.epa.gov/superfund/sites/npl/index.htm). Therefore, this Act is not applicable to the proposed project.

5.16. Executive Order 12898, Environmental Justice, 11 February 1994

This Executive Order requires federal agencies to minimize health impacts on subsistence, low-income, or minority communities, ensuring no persons or group of people bear a disproportionate burden of negative environmental impacts resulting from the execution of this country's domestic and foreign policies.

No subsistence, low-income, or minority communities would be affected by the proposed project since all work would occur within the confines of a state of Washington fish hatchery (RSH) and on federally owned land (I-182). Consequently, the proposed project is in compliance with this Executive Order because no environmental justice implications exist for the project area.

5.17. Analysis of Prime and Unique Farmlands – Farmland Protection Policy Act, 1994

This Act, without authorizing federal agencies to regulate the use of private or non-federal lands, encourages federal agencies to minimize the impact of federal programs on the unnecessary and irreversible conversion of farmland (prime or unique) to nonagricultural uses. It follows that federal programs shall be administered in a manner that, as practicable, will be compatible with state and local government and private programs and policies to protect farmland.

The proposed project is within the confines of a state of Washington fish hatchery (RSH) and on federally owned land (I-182). The proposed project is in compliance with this Act because the activity would not occur on lands utilized for agricultural purposes.

5.18. Executive Order 13186, Migratory Birds, 10 January 2001

This order further strengthens the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, the Fish and Wildlife Coordination Act, the Endangered Species Act, and the National Environmental Policy Act. Federal actions resulting in any "take" (intentional or otherwise) of a migratory bird are required to develop Memoranda of Understanding with the USFWS to promote the conservation of migratory bird populations and resources.

There would be no take of migratory birds resulting from the proposed activity; therefore, the proposed project is in compliance with this Executive Order.

5.19. Executive Order 11988 – Floodplain Management

Executive Order 11988 regarding floodplain management was signed May, 24, 1977. The order requires federal agencies to recognize the value of floodplains and consider the public benefits from their restoration and preservation. The objective is to avoid long and short-term adverse impacts to the base floodplain (100-year flood interval), and to avoid direct and indirect support of development in the base floodplain when there is a practicable alternative. This order directs federal agencies to evaluate the potential effects of proposed actions on floodplains and to avoid undertaking actions that directly or indirectly induce growth in the floodplain or adversely affect natural floodplain values.

The RSH expansion will have no permanent impact on the floodplain. The proposed I-182 site will have some development of facilities within the floodplain. However, the development is relatively minor and will occur in an undeveloped area where it will result in only a small diminishment of floodplain capacity in the area directly upstream. The development of the site will not induce growth and further development of the area.

5.20. Executive Order 13514 – Federal Leadership in Environmental, Energy and Economic Performance, 5 October 2009

Federal agencies shall increase energy efficiency; measure, report, and reduce their greenhouse gas emissions from direct and indirect activities; conserve and protect water resources through efficiency, reuse, and stormwater management; eliminate waste, recycle, and prevent pollution; leverage agency acquisitions to foster markets for sustainable technologies and environmentally preferable materials, products, and services; design, construct, maintain, and operate high performance sustainable buildings in sustainable locations; strengthen the vitality and livability of the communities in which federal facilities are located; and inform federal employees about and involve them in the achievement of these goals.

The proposed project will have little effect on over-all energy efficiency or greenhouse gas emissions, and will incorporate measures to efficiently use and re-use water resources. The project design incorporates wastewater management that will prevent pollution to the adjacent waters. It will also have no adverse effect on the viability or livability of nearby communities. Therefore, the proposed project is in compliance with this Executive Order.

6. COORDINATION

6.1. *U.S. v Oregon* Parties and Strategic Work Group

Agency and stakeholder involvement for the proposed changes to the JDM program have been coordinated through *U.S. v. Oregon* Production Advisory Committee meetings; the committee also assisted with the development and review of alternatives. The *U.S. v. Oregon* Production Advisory Committee meets monthly.

In August 2011, as a part of the Columbia River Fish Mitigation Program, the USACE formally initiated studies to address adjustments in the JDM program that are necessary to achieve in-kind and in-place mitigation objectives. In February 2012, the USACE developed a draft John Day Alternative Study, which presented mitigation objectives, feasibility level alternatives, conceptual designs, and cost estimates for recommended adjustments to the program. In June 2012, the USACE received comments from the *US v. Oregon* parties. These comments included the recommendation that USACE use the total adult production method and actual smolt-to-adult ratio data to calculate the production level required to produce the 30,000 adult spawners, which constitute the authorized mitigation program for John Day. The USACE accepted this methodology and revised the alternatives study to reflect the change. Comments received on the draft alternatives study were included in the final study report published in October 2012 (USACE 2012).

The following entities participated in coordination and review of the alternatives study:

- Bonneville Power Administration (FCRPS BiOp, Accord partner)
- U.S. Bureau of Reclamation (FCRPS BiOp, Accord partner)
- U.S. Bureau of Indian Affairs (*U.S. v. Oregon* party)
- National Oceanic and Atmospheric Administration (FCRPS BiOp, *U.S. v. Oregon* party)
- U.S. Fish and Wildlife Service (*U.S. v. Oregon* party)
- Oregon Department of Fish and Wildlife (*U.S. v. Oregon* party)
- Washington Department of Fish and Wildlife (*U.S. v. Oregon* party)
- Idaho Department of Fish and Wildlife (*U.S. v. Oregon* party)
- Confederated Tribes of the Umatilla Indian Reservation (Accord Partner, *U.S. v. Oregon* party)
- Confederated Tribes of the Warm Springs Reservation of Oregon (Accord Partner, *U.S. v. Oregon* party)
- Confederated Tribes and Bands of the Yakama Nation (Accord partner, *U.S. v. Oregon* party)
- Nez Perce Tribe (Accord partner, *U.S. v. Oregon* party)
- Confederated Tribes of the Colville Indian Reservation (*U.S. v. Oregon* party)
- Shoshone-Bannock (*U.S. v. Oregon* party)
- Columbia River Intertribal Fish Commission (representing Treaty Tribes)

6.2. Public Review

An initial draft EA was issued for a 30-day public review period on 26 March 2013. The draft EA was provided to federal and state agencies, tribes, organizations and groups, and interested publics.

This revised draft EA was prepared because of a design change to the proposed action at RSH. Due to maintenance concerns, the water in-take is no longer entirely a submerged structure. In addition, this revised draft EA was informed by and revised to reflect and address the agency and public comments received from review of the initial draft EA, as appropriate.

The revised draft EA is being issues for a 15-day public review period. The revised draft EA will also be provided to federal and state agencies, tribes, organizations and groups, and interested publics. Public concerns identified in comments will aid in determination of whether or not an Environmental Impact Statement (EIS) is necessary for the proposed action. If it is determined that an EIS is not required, a Finding of No Significant Impact (FONSI) will be signed, concluding the National Environmental Policy Act process.

7. LITERATURE CITED

Bailor, T. 1993. Cultural Resource Inventory of the Proposed Richland West Sewer Line Project.

Boxall, A.B., L.A. Fogg, P.A. Blackwell, P. Kay, E.J. Pemberton, and A. Croxford. 2004. Veterinary medicines in the environment. *Rev Environ Contam Toxicol*. 2004:1-91.

Bumgarner, J.D., L. Ross, and H. Fuss. 2000. Ringold Springs Hatchery Test Facility. WDFW Fiscal Year 2000 Annual Report. Washington Department of Fish and Wildlife, Olympia.

Confederated Tribes of the Umatilla Indian Reservation. 2009. Inventory of Unsurveyed Lands within the McNary Project Area, Umatilla County, Oregon, Benton, Franklin, and Walla Walla Counties, Washington. Confederated Tribes of the Umatilla Indian Reservation, Pendleton, OR.

Dawley, E.M., R.D. Ledgerwood, T.H Blahm, R.A. Kirn, and A.E. Rankis. 1984. Migrational Characteristics and Survival of Juvenile Salmonids entering the Columbia River estuary during 1983. Annual Report to the Bonneville Power Administration, Portland, OR.

Drucker, P. 1948. Appraisal of the Archaeological Resources of the McNary Reservoir, Oregon and Washington. Smithsonian Institute, Washington D.C.

HSRG 2009. Columbia River hatchery reform system wide report. Available from http://www.hatcheryreform.us/hrp/reports/system/welcome_show.action.

ISAB (Independent Scientific Advisory Board). May 11, 2007. Climate Change Impacts on Columbia River Basin Fish and Wildlife. Report ISAB 2007-2. Independent Scientific Advisory Board for the Northwest Power and Conservation Council; Portland, OR.

Kolodziej E.P., T. Harter, and D.L. Sedlak. 2004. Dairy wastewater, aquaculture, and spawning fish as sources of steroid hormones in the aquatic environment. *Environ Sci Technol*. 38:6377-6384.

Martínez-Bueno M.J., M.D. Hernando, A. Agüera, and A.R. Fernández-Alba. 2009. Application of passive sampling devices for screening of micro-pollutants in marine aquaculture using LC-MS/MS. Talanta. 77:1518-1527.

McMillen, LLC. 2012. Fall Chinook Lower River Acclimation and Adult Capture Facility Study. Prepared for The Confederated Tribes and Bands of the Yakama Nation.

Michael, J.H., Jr. 2003. Nutrients in salmon hatchery wastewater and its removal through the use of wetland constructed to treat off-line settling pond effluent. *Aquaculture* 226:213-225.

Newcomb, R.C. May 1958. Ringold Formation of Pleistocene age in type locality, the White Bluffs, Washington. *American Journal of Science* 256:328-340.

Peterson, R.E. and G.W. Patton. December 2009. Water Quality Sampling Locations Along the Shoreline of the Columbia River, Hanford Site, Washington. PNNL-19052, Pacific Northwest National Laboratory, Richland, WA.

Peven, C.M. 2003. Population Structure, Status and Life Histories of Upper Columbia Steelhead, Spring and Summer/fall Chinook, Sockeye, Coho Salmon, Bull Trout, Westslope Cutthroat Trout, Non-migratory Rainbow Trout, Pacific Lamprey, and Sturgeon. Peven Consulting, Inc., Wenatchee, WA.

Poston, T.M., R.W. Hanf, R.L. Dirkes, and L.F. Morasch (eds). 2003. Hanford Site environmental report for calendar year 2002. PNNL-14687, Pacific Northwest National Laboratory, Richland WA.

Poston, T.M., R.W. Hanf, R.L. Dirkes, and L.F. Morasch (eds). 2005. Hanford Site environmental report for calendar year 2004. PNNL-15222, Pacific Northwest National Laboratory, Richland, WA.

Pouliquen H., C. Thorin, J. Haury, M. Larhantec-Verdier, M.L. Morvan, R. Delépée, and H. Le Bris. 2008. Comparison of water, sediment and plants for the monitoring of antibiotics: a case study on a river dedicated to fish farming. *Environmental Toxicology and Chemistry*. 2008 Nov 3:1.

Sparrow, R.A.H. 1981. Hatchery Effluent Water Quality in British Columbia. Bio-Engineering Symposium for Fish Culture (FCS Publ. 1): pages 162 to 166.

Thomas, B. 1996a. A Cultural Resource Survey of the Washington Department of Fish and Wildlife's Ringold Hatchery Expansion, Franklin County, WA, Short Report 519. Archaeological and Historical Services, Eastern Washington University, Cheney.

Thomas, B. 1996b Archaeological Test Excavations Conducted at the Washington State Department of Fish and Wildlife's Ringold Hatchery Expansion Area, Franklin County, WA, Short Report 533. Archaeological and Historical Services, Eastern Washington University, Cheney.

USACE. (U.S. Army Corps of Engineers). 1969. Design Memorandum No. 46 for the Spring Creek National Fish Hatchery. Portland District.

USACE. October 2012. John Day Mitigation Alternatives Study, Final Submittal. Prepared by Tetra Tech, Inc. in partnership with R2 Resource Consultants for the Portland District.

USACE. February 2013. Post-Authorization Change Report, John Day Mitigation Program, 90% Submittal. Prepared by Tetra Tech, Inc. for the Portland District.

USACE. October 2013. John Day Mitigation, Design Documentation Report, 60 Percent Submittal, Modification 2. Prepared by Tetra Tech, Inc. for the Portland District.

USACE. November 2013. John Day Mitigation, Design Documentation Report for I-182 Acclimation Facility, 60 Percent Submittal. Prepared by Tetra Tech, Inc. for the Portland District.

USACE. February 2014. Analysis of the 1 Percent Annual Exceedance Water Surface Elevation: Yakima River at I-182 Bridge. Portland District.

USCB (United States Census Bureau). 2012. Online State and County QuickFacts. 2011 Census Data. Available at http://quickfacts.census.gov/qfd/index.html.

USFWS (U.S. Fish and Wildlife Service). 2008a. Final Hanford Reach National Monument Comprehensive Conservation Plan and Environmental Impact Statement. Pacific Region.

USFWS. 2008b. 5-year Status Review: Summary and Assessment of Bull Trout (*Salvelinus confluentus*). Fish and Wildlife Service, Portland, OR.

U.S. Geological Survey. 1995. Nitrate concentrations in ground water of the central Columbia Plateau. Open file report 95-445, U.S. Geological Survey, Tacoma, WA.

USGCRP (U.S. Global Change Research Program). 2009. Global Climate Change Impacts in the United States. Cambridge University Press, New York. Located at http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts

WDFW (Washington Department of Fish and Wildlife). January 2013. Hatchery and Genetic Management Plan (HGMP), Ringold Springs Rearing Facility Fall Chinook Program. Preliminary Draft report.

WDOE (Washington Department of Ecology). 1989. Quality and Fate of Fish Hatchery Effluents during the Summer Low Flow Season. Publication No. 89-17. Olympia.

WDOE. April 2010. Yakima River Pesticides and PCBs Total Maximum Daily Load. Volume 1, Water Quality Study Findings. Publication No. 10-03-018. Olympia.

Wright, M. 2001. Cultural Resource Inventory Report No. 01-McNa-005: Physical Hazard Removal Yakima River Cistern. U.S. Army Corps of Engineers, Walla Walla District. Walla Walla, WA.