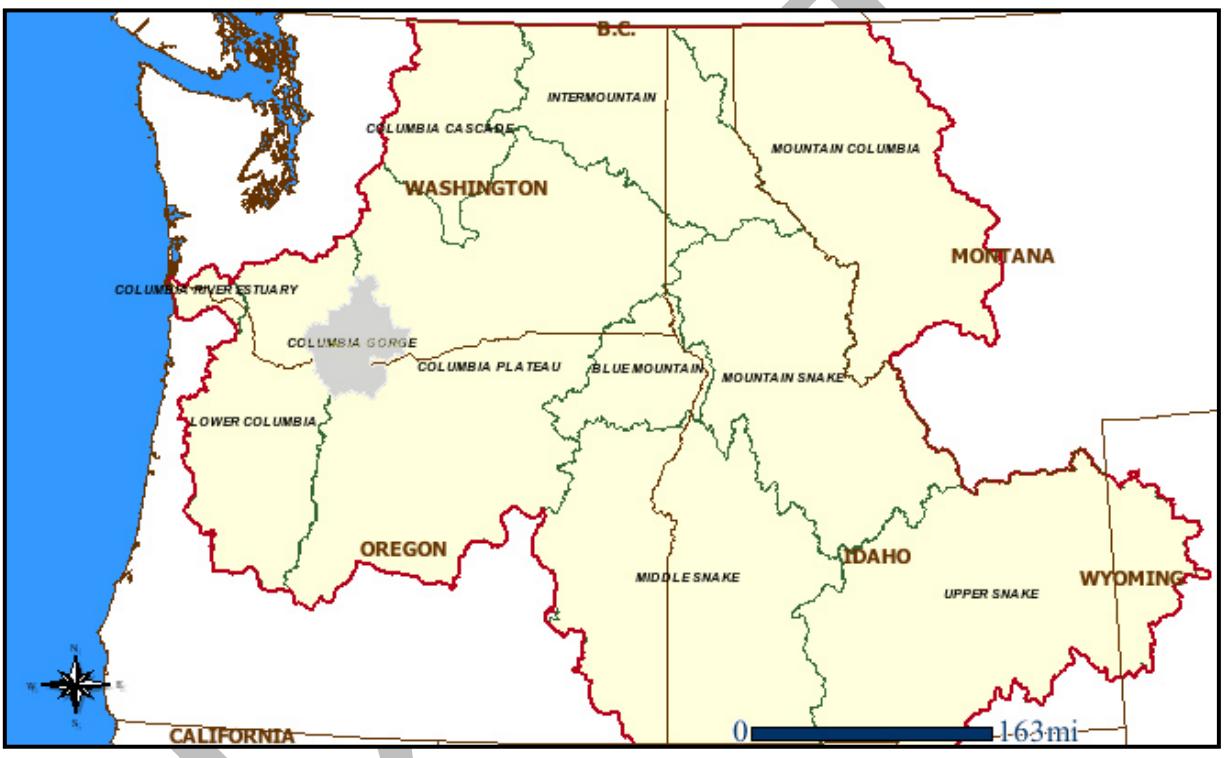
U.S. Fish and Wildlife Service - Pacific Region

Columbia Basin Hatchery Review Team

Columbia River Basin, Columbia Gorge Province

Little White Salmon, Big White Salmon and Wind River Watersheds



Carson, Spring Creek, Little White Salmon and Willard National Fish Hatcheries

Assessments and Recommendations

August 2007

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Summary

Long-term conservation needs of natural salmonid populations and their inherent genetic resources require a reexamination of the role of hatcheries in basin-wide management and conservation strategies. Hatcheries must be viewed as part of the environmental and ecological landscape to help achieve both conservation and harvest goals. These goals need to be part of a holistic and integrated strategy that combines habitat, hydropower and harvest needs for conserving and managing fishery resources. These strategies must establish short- and long-term goals for both hatchery-propagated and naturally-spawning populations.

To ensure that its hatchery programs are best meeting conservation and harvest goals, the US Fish and Wildlife Service (Service) began, in October 2005, a three-year review of 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. The goal of this review is to ensure that Service hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the conservation of naturally-spawning populations of salmon, steelhead and other aquatic species. The Service's review process is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project[1]. The Service plans to complete its reviews by the end of 2008.

The report presented here provides benefit/risk assessments and recommendations for salmon and steelhead propagation programs conducted at four National Fish Hatcheries in the Columbia River Gorge region of Washington State: Carson National Fish Hatchery (NFH), Little White Salmon NFH, Willard NFH, and Spring Creek NFH.

The Review Team considered, as a foundation for its assessments, four characteristics of each salmonid stock in each watershed potentially affected by the four hatcheries: *biological significance, population viability, habitat* conditions, and *harvest* goals or contributions. The Review Team attempted to use both short- (15 years) and long-term (50–75 years) goals for each salmonid stock, as identified by the fishery comanagers[2], as a foundation for assessing the benefits and risks of the Service's hatchery programs. Source documents not readily available to the general public, including appendices and background documents for this report, are accessible via the Service's hatchery review website.[3]

Carson NFH

Facility Overview: Carson NFH is located at river kilometer (rkm) 29 of the Wind River, north of the town of Carson, WA. The hatchery was authorized by Special Act 50 Stat. 220, May 28, 1937, and placed into operation in December 1937 to mitigate for the effects of federal water projects, primarily Bonneville Dam. The hatchery was reauthorized by the Mitchell Act (16 USC 755-757; 52 Stat. 345) May 11, 1938 and amended on August 8, 1946, (60 Stat. 932) for conservation of fishery resources in the Columbia River Basin. The hatchery was remodeled in 1956 to establish a hatchery-supported run of spring Chinook in the Wind River, and is currently used for adult

[1] *www.lltk.org/HRP.html*

[2] *Comanagers in the Washington state side of the Columbia Gorge region are the Washington Department of Fish and Wildlife, Yakama Nation, National Marine Fisheries Service (NOAA Fisheries), and the U.S. Fish and Wildlife Service.*

[3] *www.fws.gov/Pacific/fisheries/HatcheryReview/*

collection, egg incubation and rearing of spring Chinook. It also provides eggs and fish for reintroducing spring Chinook runs in other Columbia River tributaries, as desired.

Carson NFH is upstream of a natural barrier falls (Shipherd Falls) located approximately 3 km upstream of the mouth of the Wind River. Those falls historically precluded all anadromous salmonids, except summer-run steelhead, from the upper watershed. A fishway ladder around the falls was constructed in 1955 to allow Carson NFH spring Chinook access back to the hatchery.

The current personnel plan for the hatchery lists seven full-time employees. The annual operation and maintenance (O&M) budget (FY2006) for the hatchery is $538,124 from NOAA Fisheries (Mitchell Act) plus $50,668 from the Service's USFWS Fisheries Program. Costs for monitoring and evaluation (M&E) activities in 2006 was approximately $108,000 and includes $83,377 for tagging and marking. Capital improvements to Carson NFH totaled 1,757,085 during the period 2000- 2006.

Spring Chinook salmon

Program overview: The program is intended to operate as a *segregated harvest* program within the Wind River watershed with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Carson NFH is to collect 1,400 adults and spawn a minimum of 1,000 adults (500 females) with an on-station release of 1.4 million yearling smolts into the Wind River. Those on-station releases support recreational and tribal fisheries in the Wind River, the lower Columbia River, and Bonneville pool Carson NFH formerly provided 250,000 eyed eggs to the Umatilla Tribe for reintroduction of spring Chinook to the Walla Walla River. However, that responsibility was transferred to Little White Salmon NFH because of the presence of brook trout in spring-fed Tyee Creek, the source water for Carson NFH, and an inadequate screen on the water intake for the hatchery. The water intake screen for the hatchery was replaced (in 2007) which may allow Carson NFH to resume responsibility for the reintroduction transfer program. The spring Chinook broodstock at Carson NFH was originally developed in the late 1950's and early 1960's from natural origin adults trapped at Bonneville Dam 1955-1964 during their upstream migration. Based on molecular genetic analyses, Carson NFH spring Chinook are believed to represent a composite stock derived from both upper Columbia and Snake river populations. NOAA Fisheries does not include Carson NFH spring Chinook with the lower Columbia River Chinook salmon ESU or with any other Chinook ESU representing natural populations.

Benefits: Spring Chinook from the Carson NFH provide significant harvest benefits to recreational and tribal fishers in the Wind River. Mean sport and tribal harvests of spring Chinook in the Wind River for 1989-1998 were 2,615 and 868 adults, respectively. In 2001, almost 5,000 and 1,900 spring Chinook were harvested in the Wind River in recreational and tribal fisheries, respectively, with an escapement of 12,075 adults back to the hatchery. In addition, a mean of 2,575 adult spring Chinook were surplused to tribes from Carson NFH, 1990-1999. Carson NFH has also been the principal source of eyed eggs and fish for spring Chinook reintroduction programs in the Umatilla and Walla Walla Rivers, as well as the source of fish for successful spring Chinook hatchery programs elsewhere (e.g., Little White Salmon NFH, Leavenworth NFH).

Risks: The Review Team did not identify any major or significant risks of the spring Chinook program. The Team was initially concerned that Carson NFH spring Chinook may be posing a significant ecological risk to natural populations of steelhead in the Wind River, but ongoing field studies have not revealed any significant ecological effects of introduced spring Chinook on native

populations of steelhead. In this context, spring Chinook have not established a naturalized population despite nearly 50 years of propagation and some ongoing natural spawning of hatchery-origin fish in the Wind River.

Recommendations for current program: The Review Team identified 21 specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program at Carson NFH. These recommendations include: (a) working with the local watershed group to develop additional (or improved) fishing access sites to the Wind River because of the high proportion of returning adults that escape the fishery; (b) installation of a fish counter and trap at the entrance of the hatchery ladder to enumerate returning adults and prevent them from existing the facility, respectively; (c) continuation of ongoing studies to evaluate potential ecological interactions between hatchery-origin spring Chinook and natural populations of steelhead in the Wind River; and (d) improved public outreach facilities.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the existing spring Chinook program. These alternatives include the current program with full implementation of all program specific recommendations (Alternative 1) and termination of the existing program with decommissioning of the facility (Alternative 6). As a *short-term* goal (up to 15 years), the Review Team recommends continuation of the existing program (Alternative 1) but with a reduction of on-station releases by up to 250,000 yearling smolts (from 1.4 to 1.15 million smolts) to accommodate a conservation program (Alternative 5) that would assist with reintroduction of native species, particularly spring Chinook, in the Big White Salmon River after removal of Condit Dam. This reintroduction program would be limited to three generations or 15 years. The Review Team also supports the spring Chinook reintroduction program in the Walla Walla River and assumes that Carson NFH will be able to resume those former responsibilities for those programs because a new water intake screen was installed in 2007. As a long-term goal (15+ years), the Team recommends resumption of the current program (1.4 million smolt release, Alternative 1) contingent upon the successes of the spring Chinook reintroduction efforts in the White Salmon River, reintroduction efforts elsewhere (e.g., Walla Walla River), and potential program changes at Little White Salmon, Willard, and Spring Creek NFHs (see following sections on those programs).

Spring Creek NFH

Facility Overview: Spring Creek NFH is located at river mile 167 along the north (Washington) shore of the Columbia River, 20 miles upstream of Bonneville Dam. Spring Creek National Fish Hatchery (NFH) was authorized by Special Act 24 Stat. 523, March 03, 1887 and Special Act 30 Stat. 612, July 01, 1898 and placed into operation in September 1901 to support the commercial fishing industry in the Columbia River. The hatchery was reauthorized by the Mitchell Act (16 USC 755-757; 52 Stat. 345) May 11, 1938 and amended on August 8, 1946, (60 Stat. 932) for mitigation of Bonneville Dam and conservation of fishery resources in the Columbia River Basin. The hatchery was remodeled in 1948 to prevent inundation by the pool behind Bonneville Dam. The hatchery was again remodeled in 1970 to expand operations to meet commitments under the John Day Mitigation Act. The hatchery is currently propagating tule fall Chinook salmon and includes adult broodstock collection, egg incubation, rearing, and on-station release of 15.1M subyearling smolts. The tule fall Chinook stock was developed from wild fish native to the White Salmon River. The hatchery has reared this stock since 1901.

Spring Creek NFH is located along the north bank of the Columbia River approximately two miles downstream from the mouth of the Big White Salmon River. A private utility dam (Condit Dam), built in 1913 and located at RM 3.1 of the Big White Salmon River, is scheduled for removal in 2008. All upstream migration of salmon and steelhead has been blocked at Condit Dam since its construction. Approximately eight miles of Chinook salmon habitat exists upstream of the dam. Tule fall Chinook currently propagated at Spring Creek NFH represent the stock of choice for reintroducing fall Chinook to the upper Big White Salmon River.

The current personnel plan for the hatchery lists ten full-time employees, plus the information and education manager for the Columbia River Gorge hatcheries. The annual operation and maintenance (O&M) budget (FY2006) for the hatchery is $943,871 and includes $559,141 from the Army Corps of Engineers (John Day Mitigation), $353,007 from NOAA Fisheries (Mitchell Act), and $31,723 from the Service's USFWS Fisheries Program. Costs for monitoring and evaluation (M&E) activities in 2006 was approximately $1,196,178 and include $803,509 for tagging, marking, and adult biosampling. Capital improvements to Spring Creek NFH totaled $1,114,396 during the period 1998-2006.

Tule Fall Chinook Salmon

Program overview: The program is intended to operate as a *segregated harvest* program within the Bonneville pool with returning hatchery-origin adults used for broodstock. The broodstock objective at Spring Creek NFH is to collect 10,000 adults and spawn a minimum of 8,000 adults (4,000 females) with an on-station release of 15.1 million subyearling smolts into the Bonneville pool. At the present time, approximately 4.5 million smolts are released in March and the remaining fish are release in late April or early May. Those on-station releases support commercial, tribal, and recreational fisheries in the ocean, lower Columbia River, and Bonneville pool. The tule fall Chinook broodstock at Spring Creek NFH was originally developed in the early 1900's from natural origin adults trapped in the Big White Salmon River. NOAA Fisheries includes Spring Creek NFH tule fall Chinook with the lower Columbia River Chinook Salmon ESU, which is currently listed as *threatened* under the ESA.

Benefits: Tule fall Chinook from the Spring Creek NFH provide significant harvest benefits to commercial, tribal, and recreational fishers in the ocean, lower Columbia River, and Bonneville pool. Mean harvest harvests of Spring Creek NFH tule fall Chinook for 1990-1999 were approximately 18,000 and 19,000 fish in the ocean and Columbia River, respectively, with a mean return greater than 19,000 adult fish back to the hatchery. Adult fish recaptured at the hatchery in excess of broodstock needs are provided to the tribes and food banks. Tule fall Chinook propagated at Spring Creek NFH are considered the genetic repository for the original stock native to the Big White Salmon River; consequently, the hatchery confers a conservation benefit towards long-term maintenance of that stock. Natural spawning habitat of this stock was further reduced in the early 1940s after construction of Bonneville Dam when the pool behind the dam inundated the lower portion of the Big White Salmon River.

Risks: The long history of hatchery propagation as a *segregated* broodstock (hatchery-origin fish used for broodstock) poses domestication risks to this stock, particularly considering its genetic repository role and anticipated restoration role for the Big White Salmon River. Early releases from the hatchery in March – necessary to prevent overcrowding of growing pre-smolts prior to the scheduled April-May release – require Bonneville Power Administration to spill water at Bonneville Dam to bypass smolts around the turbines and facilitate their rapid downstream passage through the project. However, this spill contributes to super-saturation of the tailwater

with nitrogen gas, thus posing a significant risk to chum salmon eggs which are incubating in redds downstream (lower Columbia River chum are currently listed as *threatened* under the ESA). In addition, the lack of automated electronic monitoring of water chemistry associated with a water reuse system (90% of the water used for rearing is reuse) poses a demographic risk to the hatchery stock when fish are on station (August-May). The physical location of the freshwater intake for the hatchery, a spring immediately adjacent to a major highway, also poses a demographic risk to the hatchery stock from possible vehicle intrusions, spills, and vandalism.

Recommendations for current program: The Review Team identified 19 specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program at Spring Creek NFH. These recommendations include: (a) reduction of the size of the program from 15.1 M smolts to 10.5 M smolts to reduce on-station risks and the potential need for a March release; (b) installation of electronic meters and equipment to continuously monitor water chemistry parameters associated with the water reuse system; (c) replumbing of the hatchery building to allow effluent water to be discharged into a settling pond instead of the water reuse system or directly into the Columbia River; (d) construction of a physical barrier and cover that would protect the hatchery's fresh water supply; and (e) continuation of ongoing studies to evaluate genetic contributions of hatchery origin fish to natural-origin fall Chinook smolts in the Big White Salmon River.

Alternatives to Current Program: The Review Team considered the pros and cons of four alternatives to the existing tule fall Chinook program, including (a) the current program with full implementation of all program specific recommendations (Alternative 1), including reducing on station releases from 15.1 to 10.5 M smolts and (b) termination of the existing program with decommissioning of the facility (Alternative 4). As a *short-term* goal (up to 15 years), the Review Team recommends continuation of the existing program with implementation of all recommendations (Alternative 1) but with a further reduction of on-station releases to approximately 10.1-10.2 M smolts to accommodate rearing of up to 350,000 subyearling tule fall Chinook smolts for reintroduction and restoration of natural populations in the Big White Salmon River after removal of Condit Dam. The available space could also be used to assist with reintroduction of other species such as spring Chinook, coho, chum, bull trout, and steelhead. However, with the exception of chum salmon, only tule fall Chinook should be reared to the full smolt stage on station because of the current water supply for the hatchery. As a *long-term* goal, the Team recommends continuation of tule fall Chinook mitigation program (Alternative 1), but including a revaluation of regional management priorities and continued implementation of methods for managing tule fall Chinook strays in the Bonneville Pool so that the program is consistent with conservation and recovery objectives of the region. This includes continued monitoring of the reintroduction and restoration of fall Chinook in the Big White Salmon River.

Little White Salmon NFH

Facility Overview: Little White Salmon NFH is located on the Little White Salmon River one mile upstream of its confluence with the Columbia River. The Little White Salmon River joins the Columbia River at river mile 162. Drano Lake, a natural depression at the mouth of the river, is a popular sport and tribal fishing area at the confluence of the the Little White Salmon and Columbia Rivers. The Little White Salmon NFH was placed in operation following official Congressional authorization in 1898 with the intent to supplement the commercial fishing industry. The hatchery's role expanded during the 1930's under the Mitchell Act to one of

mitigation for the loss of habitat due to the completion of Bonneville Dam in 1938. The hatchery currently propagates *upriver bright* (URB) fall Chinook and *Carson*-strain spring Chinook salmon. A natural barrier falls immediately upstream of the hatchery precludes upstream migration by salmon and steelhead. In 1975, the Little White Salmon NFH and Willard NFH were administratively combined to form the Little White Salmon/Willard NFH Complex (Complex).

The current personnel plan for the hatchery lists nine full-time employees, which includes the complex manager and deputy manager. The annual operation and maintenance (O&M) budget (FY2006) for the Little White Salmon / Willard NFH Complex is $1,211,424 with $774,376 from NOAA Fisheries (Mitchell Act), $207,389 from Bonneville Power Administration, $63,699 from the Army Corps of Engineers (John Day Mitigation), and $165,960 from the Service's USFWS Fisheries Program. Costs for monitoring and evaluation (M&E) activities in 2006 were approximately $422,227 and includes $274,966 and $122,261 for tagging and marking at Little White Salmon and Willard NFH, respectively. Capital improvements to Little White Salmon and Willard NFH Complex totaled $7,055,475 during the period 2000- 2006.

Upriver Bright (URB) Fall Chinook Salmon

Program overview: The program is intended to operate as a *segregated harvest* program within the lower Little White Salmon River with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Little White Salmon NFH is to collect and spawn a minimum of 1,940 adults (930 females) to yield a minimum of 4.46 million green eggs for an on-station release of 2.0 million subyearling smolts into the Little White Salmon River. The program also transfers 1.7 million subyearling pre-smolts to the Yakama Nation for acclimation and release into the Yakima River. On-station releases support commercial, recreational and tribal fisheries in the ocean, lower Columbia River, and Bonneville pool, particularly in Drano Lake. Releases in the Yakima River support tribal fisheries and restoration of natural populations in the Yakima River. The URB bright fall Chinook broodstock at Little White Salmon NFH was originally developed in the late 1970's from natural origin adults trapped at Bonneville Dam. The URB fall Chinook program was established a Little White Salmon/Willard complex in 1988. The natural population origin of those fish is unknown. NOAA Fisheries does not include Little White Salmon NFH URB fall Chinook with the lower Columbia River Chinook salmon ESU or with any other Chinook ESU representing natural populations.

Benefits: URB fall Chinook released from Little White Salmon NFH provide significant harvest benefits to recreational and tribal fishers in Drano Lake. Tribes harvested 3,571 and 3,866 URB fall Chinook from Drano Lake in 2004 and 2005, respectively. In 2006, 600 fish were harvested in the recreational fishery in Drano Lake. Mean harvests in the Columbia River and ocean fisheries for brood years 1990-1999 were 1,227 and 1,973 adults, respectively, and accounted for 15% and 24% of all CWT recoveries. Ocean harvest occurs predominantly in Alaska and British Columbia. URB fall Chinook transferred to and released from the Prosser Tribal Hatchery on the Yakima River contributed an average of 1,605 (32% of returns) and 1,677 (33% of returns) adults to harvests in the Columbia River and ocean respectively, with an additional 1,750 adults (35%) escaping to natural spawning areas of the Yakima River.

Risks: URB fall Chinook released from Little White Salmon NFH stray to the Big White Salmon River and spawn after fish representing the ESA listed Lower Columbia River Chinook ESU have spawned. This natural spawning and superposition of redds poses genetic (interbreeding) and demographic (disruption of redd produced by tule fall Chinook) risks to naturally spawning tule fall Chinook that are considered the native stock of the region. Similarly, URB fall Chinook

released into the Yakima River do not represent a native or endemic population but, instead, represent a genetically segregated hatchery stock that has been propagated artificially in the Columbia River Gorge region for nearly 30 years. The Review Team concluded that the release and natural spawning of those fish in the Yakima River may not be consistent with restoration goals for fall Chinook in the Yakima River or genetic conservation goals for naturally spawning populations upstream of the pool behind McNary Dam. In general, the release of URB fall Chinook at Little White Salmon NFH appears to result in significant straying within the Bonneville pool, including straying to areas upstream of the The Dalles Dam.

Recommendations for current program: The Review Team identified 16 specific recommendations to reduce risks and/or improve benefits of the current URB fall Chinook program at Little White Salmon NFH. These recommendations include: (a) meeting with the Yakama Nation to review natural population restoration goals in the Yakima River and broodstock management goals for fish released into the Yakima River; (b) installation of a fish counter between the hatchery ladder and the adult holding pond to assist with broodstock collection and surplusing of adult fish in excess of broodstock needs; (c) assess the feasibility of developing a terminal fishery on URB fall Chinook at the mouth of the Big White Salmon River, or reduce on-station releases, to reduce genetic and ecological risks to natural populations; and (d) develop a PIT tag program for on-station releases to assess downstream migration rates to Bonneville Dam and to detect their return as adults at Bonneville for managing terminal fisheries in the Bonneville pool.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the existing spring Chinook program. These alternatives include the current program with full implementation of all program specific recommendations (Alternative 1) and termination of the existing program with decommissioning of the facility (Alternative 6). The Team recommends immediate implementation of Alternative 1 to investigate options for reducing genetic and ecological risks to listed fall Chinook in the Big White Salmon River and to reconcile potential inconsistencies between the current stock and management-conservation goals for natural populations in the Yakima River and mainstem Columbia River upstream of the McNary pool. As a *short-term* goal (up to 15 years), the Review Team recommends transitioning from the current "segregated" URB fall Chinook broodstock at Little White Salmon NFH to a "stepping-stone" URB fall Chinook program that is genetically integrated with the Priest Rapids Hatchery stock or other stock representing a natural population in the mid-Columbia region. Such a program would most likely involve the annual transfer of gametes or eyed eggs from an upriver collection facility to Little White Salmon NFH so that those gametes or fish could be integrated genetically with returning adults trapped at Little White Salmon NFH. As a *long-term* goal (15+ years), the Team recommends continuation of the stepping stone URB fall Chinook program but recognizes the potential need for long-term cooperative agreements with comanagers detailing responsibilities and funding needs. The Review Team also concluded that increasing releases upstream of John Day Dam and reducing releases in the Little White Salmon River would be consistent with the biological attributes of URB fall Chinook salmon, the Team's operational principles, and the desire for in-kind and in-place mitigation for John Day Dam.

Spring Chinook Salmon (*Carson NFH strain)*

Program overview: The program is intended to operate as a *segregated harvest* program within the lower Little White Salmon River with returning hatchery-origin adults used exclusively for broodstock. The broodstock objective at Little White Salmon NFH is to collect and spawn a

minimum of 1,170 adults (760 females) to yield a minimum of 1.11 million green eggs for an on-station release of 2.0 million yearling smolts into the Little White Salmon River. In addition, up to 250,000 yearlings are transferred and released directly into the Walla Walla River to assist with a tribal reintroduction program. This latter responsibility may be transferred back to Carson NFH after replacement of the water intake screen there. On-station releases support recreational and tribal fisheries in the lower Columbia River, and Bonneville pool, particularly in Drano Lake. Little White Salmon NFH spring Chinook are derived from the Carson NFH and NOAA Fisheries does not include them with the lower Columbia River Chinook salmon ESU or with any other Chinook ESU representing natural populations.

Benefits: Spring Chinook released from Little White Salmon NFH provide significant harvest benefits to recreational and tribal fishers in Drano Lake. Approximately 25% of all coded wire recoveries occurred in Drano Lake with a mean annual harvest of 1,289 spring Chinook. Approximately 20% of all recoveries occurred in the mainstem Columbia River with a mean return of 1,507 adults back to the hatchery (53% of adult returns). Adult spring Chinook trapped at the hatchery in excess of broodstock needs are provided to the tribes and food banks.

Risks: The Review Team did not identify any significant risks of the spring Chinook program at Little White Salmon NFH. In general, these fish do not stray from the Little White Salmon River to a level that would be a concern. However, the direct transfer and release of these fish in the Walla Walla River, particularly in the absence of acclimation prior to release, could pose genetic risks to other stocks of Chinook salmon in the mid-Columbia and lower Snake River regions via stray rates there.

Recommendations for current program: The Review Team identified six specific recommendations to reduce risks and/or improve benefits of the current spring Chinook program at Little White Salmon NFH. These recommendations include: (a) discontinuation of the prophylactic use of erythromycin-medicated feed and reevaluation of on station rearing densities if the incidence of bacterial kidney disease (BKD) increases; (b) perform a three-year test of the new baffled raceways vs. standard raceways including evaluation of the current rearing density of 0.2 relative to a lower density of 0.1; and (c) **:** PIT tag 15,000 fish prior to release to determine rate of outmigration to Bonneville Dam and to detect returning adults at the dam to assist with fisheries management in the Bonneville pool and Drano Lake.

Alternatives to Current Program: The Review Team considered the pros and cons of five alternatives to the current spring Chinook program. These alternatives include the current program with full implementation of all program specific recommendations (Alternative 1) and termination of the existing program with decommissioning of the facility (Alternative 5). The Team recommends implementation of Alternative 2, which is to develop a new "stepping-stone" spring Chinook conservation and harvest broodstock program that is integrated genetically with the Klickitat Hatchery spring Chinook broodstock. Comanagers have identified the Klickitat River population of spring Chinook salmon as the stock of choice for reintroducing spring Chinook to the Big White Salmon River after removal of Condit Dam. The new broodstock at Little White Salmon NFH would continue to provide harvest benefits in Drano Lake and the lower Columbia River while, at the same time, assisting with the reintroduction of a highly-valued species/race of Chinook salmon in the Big White Salmon River.

Willard NFH

Facility Overview: Willard NFH is located on the Little White Salmon River approximately five miles upstream of the Little White Salmon NFH. A barrier falls immediately upstream of the Little White Salmon NFH precludes upstream migration of salmon and steelhead to the Willard NFH. However, Willard NFH can release juvenile salmonids which migrate downstream over the falls to the Columbia River. In the past, adult broodstock were collected and spawned at Little White Salmon NFH, and the fertilized were eggs transported to Willard NFH for incubation, hatch, and rearing prior to release. The Columbia River Research Laboratory, a satellite research station of the Western Fisheries Research Center, U.S. Geological Survey (USGS), Seattle, WA, is co-located adjacent to Willard NFH (Cook, WA). Willard NFH was authorized by an amendment to the Mitchell Act to mitigate for fisheries lost due to the construction and operation of hydroelectric dams on the Columbia River. The earliest reports available indicate that the Willard was initially planned and constructed as a fall Chinook facility. However, the very cold water temperatures at Willard NFH inhibited the rearing of fall Chinook, but those temperatures were adequate for rearing coho salmon and spring Chinook.

For many years, 1.0 million yearling coho salmon were released on site, with brood stock collection at Little White Salmon NFH. Due to funding shortfalls in the Mitchell Act and shifting priorities, this program was discontinued in 2004. Since 2004, no fish have been released into the Little White Salmon River from Willard NFH.

The hatchery currently rears coho salmon, in support of the Yakama Nation's coho reintroduction program in the Wenatchee River, and White River spring Chinook in support of a captive breeding program to recover an endangered natural population in the Wenatchee River basin. This latter program is not reviewed here because it was transferred to Willard NFH only recently (2006).

In 1975, the Little White Salmon NFH and Willard NFH were administratively combined to form the Little White Salmon/Willard NFH Complex (Complex). Administration of the Complex occurs at the Little White Salmon facility. Complex facilities are managed, staffed, and budgeted as a single entity. The current personnel plan for Willard NFH lists four full-time employees, which includes the hatchery manager, two fish culturists, and a fish biologist.

Wenatchee River Coho Salmon

- ***Program overview:*** The Yakama Nation, with assistance from the Service, conducts this program with the goal of reintroducing coho salmon to the Wenatchee River, Washington. The program was initiated in 1999 with the release of hatchery-origin coho from Eagle Creek and Willard NFHs (lower Columbia "early-returning" stocks) in 1999. The initial goal of the program was to establish a self-sustaining hatchery-propagated stock in the Wenatchee River. That goal has been achieved. At the present time, returning hatchery-origin adults are trapped in the Wenatchee River at Dryden Dam (near Cashmere, WA) and Tumwater Dam, and at Leavenworth NFH on Icicle Creek. Adult coho are transported to Entiat NFH (on Entiat River) and spawned. Fertilized eggs are incubated initially at Entiat NFH. Eyed eggs are transferred from Entiat NFH to Willard NFH for hatching and rearing. Yearling coho are transferred back to the Wenatchee River for acclimation and release from several locations, including Leavenworth NFH. At the present time, returning hatchery-origin adults are used exclusively for broodstock. Current goals of the program are to establish naturally spawning populations and then integrate natural-origin fish in the broodstock as part of a naturalized, Wenatchee River stock. Willard NFH currently receives 670,000 eyed eggs annually and transfers back approximately 650,000 yearling pre-smolts (19-

21/lb.) for acclimation and release in the Wenatchee River one year later. The long-term goal is to attain a level of abundance and viability sufficient to support tribal harvest and conservation goals in the Wenatchee River. The Wenatchee River coho program is reviewed here for the purpose of evaluating Service options and potential priorities for Willard NFH and the Little White Salmon / Willard NFH complex.

Benefits: The program as successfully achieved its first major goal of establishing a self-sustaining hatchery run of coho salmon in the Wenatchee River basin.

Risks: The Review Team did not identify any significant risks of the current program, although the continued transfer of yearlings from Willard NFH to Leavenworth NFH does pose some disease risks to spring Chinook reared on station.

Recommendations for current program: The Review Team identified only one specific recommendation for the current Wenatchee River coho reintroduction program at Willard NFH: the Service should continue to seek funding on behalf of the Yakama Nation and continue to provide facilities and logistic support for the program.

Alternatives to Current Program: The Review Team considered the pros and cons of six alternatives to the existing spring Chinook program. These alternatives include the current program with implementation of all program specific recommendations (Alternative 1) and termination of the existing program with decommissioning of the facility (Alternative 6). The Team generally supports three alternatives contingent on Service and comanager priorities. As an immediate recommendation, the Team recommends implementation of Alternative 1 and continued support of the Yakama Nation's coho reintroduction program in the Wenatchee River. The team also supports, as a short term goal (up to 15 years), establishment of a bull trout recovery program for the Big White Salmon River (or other locations) if artificial propagation is considered a priority in support of bull trout recovery (Alternative 3). The Team also supports potential use of Willard NFH for rearing and releasing upriver bright fall Chinook as part of "Spring Creek NFH reprogramming" (Alternative 5) that would eliminate release of URB fall Chinook downstream of Bonneville Dam.

Little White Salmon, Willard NFH complex alternatives

The Review Team identified four additional alternatives for the current programs at Little White Salmon and Willard NFHs when treated together as a complex. Three of four alternatives deal with various aspects of the White River spring Chinook captive breeding program. This is a new program designed to help recover endangered spring Chinook in the White River within the Wenatchee River basin. The fourth alternative includes use of an auxiliary incubation facility, Carson Depot Springs, for incubation and propagation of chum salmon, or other listed species, in support of ESA priorities in the Columbia River Gorge region.

Conclusions

The Review Team concluded that the current spring Chinook salmon program at the Carson NFH is providing a significant harvest mitigation benefit within the Wind River basin and in fisheries in the mainstem lower Columbia River. Recent ongoing studies and other available information indicate that ecological interactions between hatchery-origin spring Chinook and natural populations of steelhead

within the Wind River basin are either minor or nonsignficant. In general, the spring Chinook program at Carson NFH appears to be providing significant harvest benefits with little biological risks to natural populations in the Wind River.

The Review Team similarly concluded that the current tule fall Chinook program at Spring Creek NFH is providing significant harvest mitigation benefits to tribal fisheries in the Bonneville pool and to recreational and commercial fisheries in the mainstem lower Columbia River and coastal waters of the United States and Canada. However, the current water supply and reuse system poses demographic and fish health risks to the hatchery stock, and the Team recommends that the size of the program be reduced from 15.1 million to 10.5 million fall Chinook subyearlings to reduce those risks via lowered rearing densities.

The fall Chinook stock at Spring Creek NFH was initially developed in the early 1900's from natural-origin adult spawners in the Big White Salmon River; consequently, the Review Team supports the use of this stock and facilities at Spring Creek NFH to assist with recovery of the natural fall Chinook population of the Big White Salmon after removal of Condit Dam. The Team advises the Service to complete stock identification work on present natural spawners in the Big White Salmon and work with co-managers to develop a restoration strategy for the natural population in this watershed. The Team also recognizes that the presence of nearby large-scale hatchery production programs require means of controlling (tule fall Chinook) or excluding (URB fall Chinook) most hatchery-origin adults from the natural production areas of the Big White Salmon River.

The Team was somewhat uncomfortable with the present lack of defined recovery strategies for listed fall Chinook, coho, and chum salmon in the tributaries of Bonneville Pool. The Big White Salmon River in particular was not addressed in the development of the state of Washington component of the Lower Columbia recovery plan. The Team understands that inter-agency discussions are ongoing concerning restoration of salmon and steelhead in the Big White Salmon River following the proposed removal of Condit Dam, but a detailed restoration strategy has not yet been developed. The Team strongly advises the Service to closely track completion of the Lower Columbia Recovery Plan and adjust future program goals for Gorge NFHs consistent with those identified recovery strategies.

The Review Team concluded that the current upriver bright fall Chinook salmon program at the Little White Salmon NFH is also providing a significant harvest mitigation benefit to tribal fisheries in the Bonneville pool, particularly Drano Lake, and recreational and commercial fisheries in the mainstem lower Columbia River and coastal waters of the United States and Canada. However, the Team was concerned with the genetic and ecological impacts of this introduced mid-Columbia stock on the viability and recovery of natural populations of fall Chinook populations within the lower Columbia River ESU. The Team was also concerned about biological and management inconsistencies between the current URB fall Chinook stock and conservation/restoration goals for URB fall Chinook in the Yakima River and mid-Columbia region. The Team concluded that this program should transition to a new "stepping-stone" broodstock program that is integrated genetically with the Priest Rapids Hatchery stock or other mid-Columbia stock with a naturally-spawning component. As a long-term goal, the Team recommends reducing releases of URB fall Chinook in the Bonneville pool region with increased upriver releases within the historic natural population areas of upriver bright fall Chinook. Such a management adjustment would also best serve the goal of providing *in-place* and *in-kind* mitigation for the loss of upriver bright fall Chinook spawning habitats inundated by the pools behind John Day Dam and other projects (e.g., McNary Dam).

Large hatchery fall Chinook mitigation programs such as those at Little White Salmon and Spring Creek NFHs release large numbers of juvenile fish into the lower Columbia River. The Team is aware

of little information which allows fishery managers to assess any impacts which these programs may have on the continued viability of listed naturally spawning fall Chinook salmon in the lower Columbia River including the Columbia River estuary. The Team encourages further assessment of this possible interaction and future adjustment to production programs as necessary to reduce or eliminate possible adverse effects on natural populations.

The Review Team concluded that the current spring Chinook salmon program at Little White Salmon NFH is providing a significant harvest mitigation benefit within Drano Lake and in fisheries in the mainstem lower Columbia River. The Team proposes that the Service work closely with the Yakima Nation and the Washington Department of Fish and Wildlife to transition to a suitable local broodstock such as the Klickitat spring Chinook stock. This would allow the present mitigation program to proceed with reduced impact on nearby natural production areas and would allow this program to support the proposed reintroduction of spring Chinook into the Big White Salmon.

The Review Team concluded that the current coho salmon program at Willard NFH is providing a long-term conservation benefit to the reintroduction of coho salmon to tributaries of the upper Columbia River. The Team notes that the facilities and water supply at Willard NFH are capable of playing an important role in several proposed conservation and reintroduction programs. As upper river facilities are developed which can provide support to this reintroduction program and as the natural production of coho in the upper Columbia increases, the Team expects that this role for Willard NFH will be phased out and supplanted by other conservation programs.

Overall, the Team concludes that the National Fish Hatcheries of the Columbia River Gorge are playing a valuable and effective role in partially mitigating for the effects of habitat destruction in this section of the Columbia River caused by hydroelectric development. These facilities are also uniquely situated to support reintroduction and restoration of native salmon species in the tributary streams of the Columbia River Gorge.

I. Introduction

In the past 150 years, habitat alterations, hydroelectric development and consumptive fisheries have affected the productivity, abundance, spatial distribution, and diversity of natural populations of salmon and steelhead (*Oncorhynchus mykiss*) in the Pacific Northwest. To mitigate for those impacts, hatcheries have been used to increase the number of fish available for harvest. However, long-term conservation needs of natural salmonid populations and their inherent genetic resources now require a reexamination of the role of hatcheries in basin-wide management and conservation strategies.

Hatcheries need to be part of a holistic and integrated strategy that combines habitat, hydropower and harvest needs for conserving and managing fishery resources. These strategies must establish short- and long-term goals for both hatchery-propagated and naturally-spawning populations. However, modifying hatchery programs and operations to achieve both conservation and harvest goals in a coordinated manner is difficult and complex. Scientific uncertainties exist regarding the ability of hatcheries and hatchery-origin fish to directly assist with recovery of naturally-spawning populations while, at the same time, sustaining major fisheries. Uncertainties also exist regarding genetic and ecological interactions between natural- and hatchery-origin fish. Only an objective, collaborative, science-based approach can address these problems in a manner that is both scientifically defensible and accepted by the public.

In an effort to improve its hatchery programs and to ensure that existing facilities are best meeting conservation and harvest goals, the U.S. Fish and Wildlife Service (Service) initiated, in October 2005, a three-year review of the 21 salmon and steelhead hatcheries that the Service owns or operates in the Columbia River Basin. The goal of these reviews is to ensure that Service hatcheries are operated in accordance with best scientific principles, and contribute to sustainable fisheries and the recovery of naturally-spawning populations of salmon, steelhead and other aquatic species.

This internal review is modeled after the recent Puget Sound and Coastal Washington Hatchery Reform Project.[4] That project provided a solid template and operational tools (e.g. software spreadsheets, population dynamic models) for reviewing Service hatcheries in the Columbia River Basin. Much of the background information necessary for reviewing hatcheries in the Columbia River Basin has already been compiled in Hatchery and Genetic Management Plans (HGMPs),[5] Comprehensive Hatchery Management Plans (CHMPs),[6] and the Artificial Propagation Review and Evaluation (APRE)[7] database developed by the Northwest Power and Conservation Council (NWPCC).

Based on the recommendations of a Hatchery Review Working Group (Working Group),[8] the Assistant Regional Director for Fisheries (ARD) has assembled a Columbia Basin Hatchery Review Team (Review Team). This Review Team, comprised of Service and other federal agency scientists, has adapted the Puget Sound and Coastal Washington Hatchery Scientific Review Group's (HSRG) scientific framework, principles and hatchery review tools and is applying them to create

[4] *For more information on this project, and for all project publications, see www.hatcheryreform.org.*

[5] *For more information on HGMPs, visit www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Hatchery-and-Genetic-Management-Plans.cfm.*

[6] *For more information on CHMPs, visit www.fws.gov/pacific/Fisheries/CHMP.htm.*

[7] *For more information on APRE, visit www.nwcouncil.org/fw/apre/.*

[8] *The Working Group was appointed in November 2004 by the Service's Assistant Regional Director for Fisheries, Pacific Region. The Working Group's report and all other Columbia Basin Hatchery Review documents are available from the project's website, www.fws.gov/pacific/fisheries/hatcheryreview/.*

recommendations for each hatchery program and facility. The team provides continuity with the HSRG because two members (including the chair) served on the HSRG, the vice chair served on the policy-makers' Hatchery Reform Coordinating Committee, and three other team members represented the Service at HSRG regional review meetings. The Service has contracted for project facilitation with Long Live the Kings (LLTK), a non-profit organization devoted to restoring wild salmon to the waters of the Pacific Northwest. LLTK has provided facilitation, communications and coordination for the Puget Sound and coastal Washington hatchery review process.

Review Team members include:

- **Don Campton** (Chair), Senior Scientist, USFWS, Abernathy Fish Technology Center, Longview, Washington.
- **Douglas DeHart** (Vice Chair), Senior Fishery Biologist, USFWS, Pacific Regional Office, Portland, Oregon.
- **Ray Brunson**, Fish Health Biologist, USFWS, Olympia Fish Health Center, Olympia, Washington.
- **Tom Flagg**, Supervisory Fish Biologist, NOAA Fisheries, Manchester Research Station, Manchester, Washington.
- **Joe Krakker**, Fishery Biologist, USFWS, Lower Snake River Compensation Plan Office, Boise, Idaho.
- **Larry Marchant**, Project Leader and Manager, USFWS, Spring Creek NFH, Underwood, Washington.
- **Doug Olson**, Hatchery Assessment Team Leader, USFWS, Columbia River Fisheries Program Office, Vancouver, Washington.
- **Larry Telles**, Fishery Biologist and Deputy Manager, USFWS, Quilcene NFH, Quilcene, Washington.
- **Dave Zajac**, Fish and Wildlife Biologist, USFWS, Western Washington Fish and Wildlife Office, Lacey, Washington.
- **David Carie** (alternate), Fisheries Management Biologist, USFWS, Mid-Columbia Fishery Resource Office, Leavenworth, Washington.
- **Susan Gutenberger** (alternate), Supervisory Microbiologist, USFWS, Lower Columbia River Fish Health Center, Willard, Washington.

Team support members include:

- **Michael Schmidt** (Facilitator), Fish Program Coordinator, Long Live the Kings, Seattle, Washington.
- **Amy Gaskill and Cheri Anderson** (Outreach), External Affairs Specialists, USFWS, Pacific Region Fisheries Program, Pacific Regional Office, Portland, Oregon.

The Fisheries ARD has also appointed a Hatchery Oversight Team (Oversight Team), consisting of line supervisors with policy and managerial responsibilities, as the Service's primary internal mechanism to oversee the review process, monitor its progress, and transmit communications and reports from the Review Team to the ARD and project leaders within the Service's Pacific Region Fisheries Program. The Oversight Team, along with the ARD, will be the primary contact group

between the Service and its partners for developing mechanisms and policies for implementing, or modifying, the Review Team's recommendations.

The review process began in October 2005 with the Warm Springs National Fish Hatchery (NFH). This hatchery is located on the Warm Springs River, in the Deschutes River watershed/Columbia Plateau province, in Oregon. This review was conducted as a pilot to help the Service test and refine the review process. Fishery co-managers and stakeholders were involved in the review process and asked to comment on draft reports and recommendations. The final report for Warm Springs NFH was released in May, 2006 (available at www.fws.gov/Pacific/fisheries/hatcheryreview/reports.html).

Following this pilot review, the Service adjusted the process for reviewing federal hatcheries in three regions: Mid-Columbia, Lower Columbia, and Lower Snake River (Fig. 1). Facilities in these regions include five NFHs in the Lower Columbia region (Eagle Creek, Carson, Little White Salmon, Willard and Spring Creek NFHs); three NFHs in the Mid-Columbia region (Leavenworth, Entiat and Winthrop NFHs); three NFHs in the Snake River region (Dworshak, Kooskia and Hagerman NFHs); and nine federally-owned hatcheries operated by the states of Washington, Oregon or Idaho as part of the Lower Snake River Compensation Plan (LSRCP). The Service plans to complete reviews of all National Fish Hatcheries by December 2007 and all federally owned facilities in the Snake River region by December 2008.

Figure 1. Regions of the Columbia River Basin Hatchery Review Project

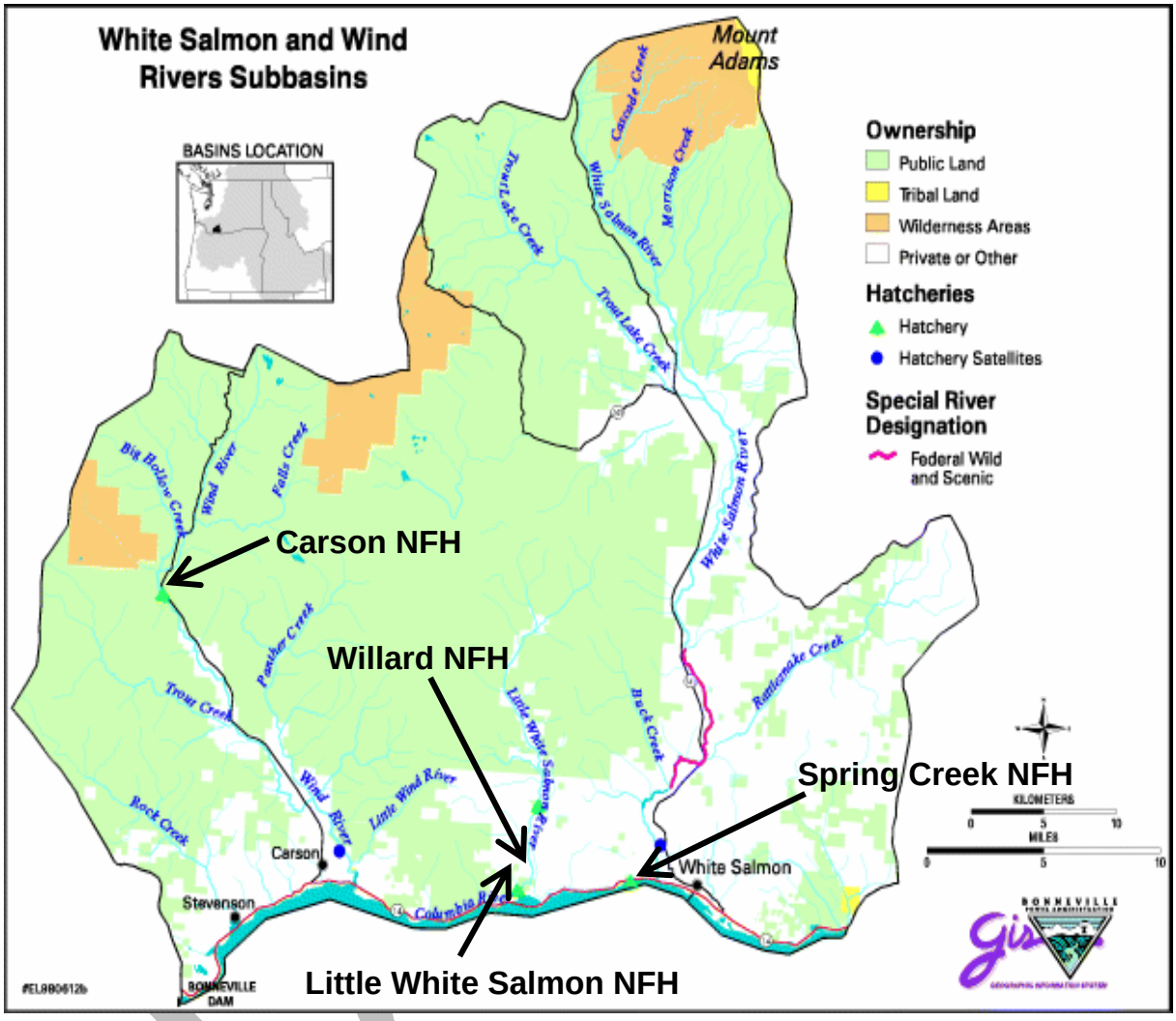

Figure 2. National Fish Hatcheries in the Columbia River Gorge reviewed in this report[9]

[9] *Modified figure from Rawding. 2000. Draft White Salmon River Subbasin Summary- http://www.cbfwa.org/FWProgram/ReviewCycle/fy2001cg/workplan/WhiteSalmon.doc.*

II. Components of this Report

This report provides assessments and recommendations developed from a comprehensive review of current propagation programs at four National Fish Hatcheries in the Columbia River Gorge Province (Carson NFH, Spring Creek NFH, Little White Salmon NFH and Willard NFH). Recommendations presented herein are based on the best scientific information available at the time of the review. This information includes peer-reviewed scientific information in published works (scientific journals, etc.), agency reports, and pertinent information directly accessible via electronic download. In its review, the Team followed three fundamental principles it adopted from the HSRG (Mobrand et al. 2005[10]): (1) hatchery programs need to have well-defined goals in terms of desired benefits; (2) they must be scientifically defensible; and (3) they need to have programmatic flexibility to respond adaptively to new information.

The Review Team reviewed a large number of background documents, toured the four NFHs and other facilities (e.g. Condit Dam) and habitat features, and received presentations on a variety of Gorge salmonid management issues. The Team then met with biologists representing the co-managers and stakeholders to discuss the purpose of the review, hatchery operations, stock goals, and specific issues the co-managers and stakeholders wanted the Review Team to consider. Workshops for gathering that information used the recently-developed All-H Analyzer (AHA) decision support tool[11] to document goals, premises and explore alternatives (Appendix A). All source documents not readily available to the general public are accessible via the Service's hatchery review website[12]. Appendix B of this report summarizes the hatchery information on which the review and recommendations are based.

Based on the information gathered, the Review Team assessed benefits and risks of each hatchery program relative to current or short-term (10-15 years) goals and then drafted a set of preliminary recommendations that would increase or maintain benefits while minimizing or reducing risks, respectively. The Team also examined possible program alternatives at each of the four hatcheries to address long-term (15-50 years or greater) conservation and/or harvest goals. The review concluded with an oral presentation of these findings to the co-managers. The Review Team developed a draft report, circulated it to comanagers for initial comment, and then posted it on the Team's website for one month for public comment. The final report presented here was prepared after written comments on the draft report were received from co-managers and interested stakeholders. Review Team responses to those comments are presented in Appendix C. The complete texts of all written comments received are compiled in Appendix D.

Watershed Overview

The following report contains background overviews of the Wind, Big White Salmon and Little White Salmon river watersheds, and Bonneville pool area behind Bonneville Dam. Each overview includes information on geography, fisheries, conservation, habitat, and the current status of each salmonid

[10] *Mobrand, L., J. Barr, L. Blankenship, D.E. Campton, T.T.P. Evelyn, T.A. Flagg, C.V.W. Mahnken, L.W. Seeb, P.R. Seidel, and W.W. Smoker. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.*

[11] *For more information on AHA, see* AHA Technical Discussion Paper *on the Publications page of www.hatcheryreform.org.*

[12] *www.fws.gov/Pacific/fisheries/hatcheryreview/*

stock within the respective areas. Information on the status and hatchery propagation of each stock is summarized in a table for quick reference.

Stock Status

An understanding of the current status of each salmonid stock in each watershed was necessary for assessing the benefits and risks associated with each hatchery program. The Review Team summarized the current status of each stock in terms of four population parameters: *biological significance*, *viability, habitat*, and *harvest*. Each of those parameters was given a generalized rating of "high", "medium", or "low" as a foundation for assessing the benefits and risks of each hatchery program. The Review Team also needed to understand the short-term (10–15 years) and long-term (50 years or greater) goals for each salmonid stock within each watershed relative to the four population parameters. However, it was neither the mandate nor the responsibility of the Review Team to perform detailed, scientific assessments of population status. Instead, the Review Team relied on the consensus assessments of the co-managers: the Yakama Nation, Washington Department of Fish and Wildlife (WDFW), National Marine Fisheries Service (NOAA Fisheries), and our own Service biologists. The Review Team also relied on the subbasin plans of the Northwest Power and Conservation Council (NWPCC)[13] and reports of the Willamette River and Lower Columbia Region Technical Recovery Team (WLC-TRT).[14]

Biological significance is a measure of the biological uniqueness of a particular stock relative to other stocks of the same species. This measure considers the genetic origins of the stock (e.g. native or non-native), biological attributes that are unique or shared with other stocks (e.g. life history, physiological, or genetic attributes), and the extent to which the stock may be considered one component of a larger population structure, including population subdivisions within the stock. In general, a stock is defined as either *low*, *medium* or *high* biological significance depending on its level of uniqueness and the ability of other stocks to potentially replace it in the occupying habitat if local extirpation were to occur. Stocks with *high* biological significance usually have one or more unique biological characteristics that may reflect local adaptations and would be difficult to replace by other stocks of the same species. Consequently, biological significance is not based on the degree to which the stock may be considered essential for recovery or harvest, but rather on its own innate biological attributes within the watershed in which the stock occurs. For example, a particular stock or population may be abundant and productive and, therefore, considered to have high *management* significance for harvest or recovery. However, that stock would not necessarily be considered to have high *biological* significance unless it possessed biological attributes not shared by other stocks of the same species or if all other stocks within the region or DPS/ESU[15] were substantially less viable. This approach thus distinguishes the *evolutionary legacy* of a stock within a particular watershed from co-manager decisions regarding the potential *management value* of that stock. In this context, *biological significance* ratings are based on the factors described by Mobrand et al. (2005)[16].

Population viability measures the ability of a stock to sustain itself under current environmental conditions. NOAA Fisheries has assembled several *Technical Recovery Teams* (TRT) to assess

[13] *http://www.nwcouncil.org/fw/subbasinplanning/Default.htm*

[14] *http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Willamette-Lower-Columbia/Index.cfm*

[15] *Distinct Population Segment (DPS) and Evolutionarily Significant Unit (ESU). ESU is NOAA Fisheries designation for a Distinct Population Segment (DPS) of Pacific Salmon under the U.S. Endangered Species Act. NOAA Fisheries has retained DPS designations for steelhead.*

[16] *Mobrand, L., et al. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.*

viabilities and develop recovery criteria for ESA-listed salmon and steelhead populations throughout the Pacific Northwest. Those assessments involve significant mathematical modeling and attempt to predict extinction probabilities over the next 100 years based on four viability parameters: abundance, productivity, spatial structure, and diversity.[17] Preliminary viability estimates for listed salmonid stocks in the lower Columbia region have been compiled by the WLC-TRT, [18] and more rigorous updated estimates are currently available for populations of Lower Columbia coho.[19] Where available, the Review Team relied on those viability estimates, as developed by the Willamette River and Lower Columbia TRT; otherwise, the Review Team relied on the viability criteria of Mobrand et al. (2005)[20]. The goal here was to establish a qualitative understanding of the current viability for each salmonid stock potentially affected by each Service hatchery program as a foundation for assessing potential benefits and risks of those programs. However, estimating the viability of a natural population, including *integrated* hatchery stocks, is difficult because those estimations require detailed evaluations of natural reproductive output and enumeration of natural-origin adult returns over multiple generations. . In contrast, the viability of *segregated* hatchery stocks is relatively simple and is determined primarily by the number of hatchery-origin adult recruits (R) recaptured in fisheries, the hatchery, or other areas per adult spawner (S) one generation earlier (R/S).

Habitat conditions for a particular stock are assessed quantitatively through estimates of the *capacity* and *productivity* of the habitat to support adult spawners and juveniles (e.g. via spawner-recruit models), and to subsequently produce smolts in sufficient numbers to yield returning adults. In this context, premises regarding habitat refer primarily to natural populations and the specific watersheds in which hatcheries are located. These premises are important for assessing the ability of the local habitat and watershed to support self-sustaining natural populations and genetically *integrated* hatchery broodstocks, including assessment of risks posed by hatchery-origin fish spawning naturally. The productivity and capacity of a watershed are difficult to estimate directly, but the *Ecosystem Diagnosis and Treatment* (EDT) model attempts to predict those parameters for a "focal species" based on empirical estimates of a variety of habitat parameters (www.mobrand.com/MBI/edt.html). Where available, the Review Team relied on EDT predictions of current and future habitat conditions (productivity and capacity) for each salmonid stock in the pertinent watersheds associated with a Service hatchery. Habitat and capacity parameters can also be adjusted iteratively in spawner-recruit population dynamic models to yield results that best fit empirical estimates of total adult returns and/or smolt output under current conditions (Appendix A). This latter approach allows co-managers and others to evaluate potential alternative strategies for improving long-term population viabilities via habitat enhancements or other management actions.

Harvest on salmonid fishes occurs at different locations and times and can be assessed by the mean number of adult fish harvested annually in mixed stock ocean fisheries, mainstem Columbia River fisheries, and/or terminal fisheries within the particular sub-basin or watershed under consideration

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[17] *McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmon populations and the recovery of evolutionary significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, Seattle, WA 156pp. Also see www.nwfsc.noaa.gov/trt/trt_Columbia.htm*

[18] *Willamette/Lower Columbia Technical Recovery Team (Paul McElhany, Tom Backman, Craig Busack, Steve Kolmes, Jim Myers, Dan Rawding, Ashley Steel, Cleve Steward, Tim Whitesel, Chuck Willis). 2004. Status evaluation of salmon and steelhead populations in the Willamette and Lower Columbia River Basins. Available at: www.nwfsc.noaa.gov/trt/wlc_docs/wlc_pop_eval_7_28_04.pdf*

[19] *McElhany, Paul., Craig Busack, Mark Chilcote, Steve Kolmes, Bruce McIntosh, Jim Myers, Dan Rawding, Ashley Steel, Cleve Steward, David Ward, Tim Whitesel, Chuck Willis. 2006. Revised viability criteria for salmon and steelhead in the Willamette and Lower Columbia Basins (Review Draft, April 1, 2006). Available at: www.nwfsc.noaa.gov/trt/viability_report_revised.cfm*

[20] *Mobrand, L., et al. 2005. Hatchery reform in Washington State: principles and emerging issues. Fisheries 30(6): 11-23.*

(Appendix A). Harvest parameters can be adjusted in a manner analogous to adjusting habitat parameters (as described above) to identify levels of harvest that are sustainable under a particular set of habitat conditions as measured by productivity and capacity.

Hatchery Programs

Hatchery programs are associated with many salmonid stocks. In general, hatchery programs can be classified according to their type and purpose.

Hatchery programs are classified as either *integrated* or *segregated* according to the genetic goals for the broodstock. Hatchery programs (or broodstocks) are classified as *integrated* if natural-origin fish are systematically included in the broodstock each year with the goal that the natural environment will primarily determine the genetic constitution of hatchery-origin fish. The integrated strategy manages hatchery and wild fish as one population (or one gene pool) that spawns in two different environments but recognizes that the phenotypic performances of hatchery and wild fish can be quite different even when the two components are genetically the same. *Segregated* programs or broodstocks are intended to maintain the hatchery population as a distinct, genetically segregated population via the exclusive use of hatchery-origin adults for broodstock. The segregated strategy creates a hatchery-adapted population that can facilitate management goals (e.g. harvest) but which can also increase genetic and ecological risks to natural populations.

Hatchery programs need to be defined also in terms of their intended benefits. The primary purpose of most hatchery programs is to achieve *conservation* or *harvest* benefits (or both). A secondary purpose can also be conservation or harvest, but often includes education, research, socioeconomic or cultural/ceremonial benefits. These purposes should be closely linked to the goals of hatchery programs. Although *mitigation* is often stated as a "purpose" of a hatchery program, mitigation typically refers to the replacement of wild fish with hatchery fish without defining specific goals in terms of desired benefits (e.g., *mitigate* for fish losses associated with hydropower dams).

Operational Considerations

The Review Team considered all components of each hatchery program. Major features and issues of each program were summarized into the following subcategories: (a) program goals and objectives; (b) broodstock choice and collection; (c) hatchery and natural spawning, including adult returns; (d) incubation and rearing; (e) release and outmigration; (f) facilities and operations; (g) research, monitoring, and accountability, and (h) education and outreach.

Benefit and Risk Assessment

In conducting this review, the Review Team considered a wide range of possible benefits and risks potentially conferred and imposed, respectively, by hatchery programs.

Benefits considered include:

- Contributions to tribal and non-tribal harvests (commercial and recreational).
- Short- and long-term conservation benefits (both demographic and genetic).
- Research opportunities afforded by the program.

- Educational, cultural, ceremonial and socioeconomic benefits conferred by the program and the hatchery facility itself.

Risks considered include:

Genetic Risks

- Risks from artificial propagation on the genetic constitution and fitness of hatchery-origin fish representing the cultured stock.
- Risks from natural spawning by hatchery-origin adults on the mean fitness of natural-origin fish of the same species in target and non-target watersheds.

Demographic Risks

- Pre-release risks from the hatchery facility and operations on the abundance of the propagated stock including the following: pre-spawning mortality associated with trapping, holding and/or bypassing adults; disease risks associated with overcrowding or high rearing densities of cultured fish, inadequate fish health protocols and water flow alarms to prevent catastrophic fish losses in the hatchery; poaching by humans; and predation by birds, mammals and fish at the point of release or on the hatchery grounds (e.g. by otters and birds).
- Post-release risks to the abundance of the propagated stock, including congregation of released fish at the release point and/or unnatural surface feeding (conditioned by hatchery rearing) that may increase vulnerability of released juveniles to predators, thus decreasing smolt-to-adult survival.
- Demographic risks from the hatchery operations on the abundance of other stocks and species within the watershed in which the hatchery is located (e.g., effects of a barrier weir for trapping adults for hatchery broodstock).

Ecological Risks

- Competition, predation, and disease transfer from hatchery-origin adults and juveniles of the propagated stock to naturally spawning populations of the same species or stock in target and non-target watersheds.
- Competition, predation, and disease transfer from hatchery-origin adults and juveniles of the propagated stock to naturally spawning populations of different species in target and non-target watersheds, including non-salmonid fish species of particular concern (e.g. lamprey).
- Risks from the hatchery facility and operations on the aquatic biota and ecosystem within the target watershed, including the effects of hatchery effluent, water intake, use of chemicals, and upstream/downstream passage of fish and other aquatic species in the watershed.
- Risk of antibiotic use resulting in developing resistant strains of pathogenic organisms that infect salmonid fishes, other aquatic species, and humans.
- Producing fish that are not qualitatively similar to natural fish of the same species in size, growth rate, morphology, behavior, physiological status or health, which may adversely affect the performance of natural fish via competition or predation.

- The Team recognizes that hatchery-origin juveniles and adults may ecologically impact other fish species and populations in the estuary and ocean environment; however, little information on these *cumulative effects* is currently available

Physical Risks

- Risks from the hatchery facility and operations to human health and safety, including potential contaminants.

The Team evaluated the benefits and risks of all operational and physical components of the hatchery program These components are the same as those outlined above under *Operational Considerations.* Those evaluations then formed the bases of the Team's recommendations.

Recommendations

After careful assessment of the benefits and risks conferred by a hatchery program, the Review Team developed a series of recommendations to increase the likelihood of achieving the desired goals and benefits of the program and/or reducing biological and other risks. Recommendations for the current hatchery programs are grouped into the same categories as listed above under *Operational Considerations*. Recommendations for current programs are intended to address short-term goals and needs.

Alternatives

The review team then identified several alternatives to the current program, as suggested by comanagers or inferred from long term goals for salmonid stocks within the region, with an overall assessment of the value and merits (pros and cons) of those potential alternatives relative to the current program. By default, the following alternatives were included in each assessment: (a) the current program with full implementation of all recommendations and (b) termination of the current program and decommission of the hatchery in favor of alternative mitigation strategies (e.g., habitat restoration, construction of a new hatchery elsewhere, etc). The Team then selected a recommended alternative, or combination of alternatives, that the Team concluded would provide the greatest benefit-risk ratio in support of long-term harvest and conservation goals in the future.

III. Bonneville Pool Overview

The reach of the Columbia River adjacent to the four Columbia Gorge NFHs was impounded by the construction of Bonneville Dam in 1938. The Bonneville Pool area contains several significant tributaries including Wind River, Big White Salmon River, Hood River and Klickitat River. ESA-listed lower Columbia spring Chinook, lower Columbia fall Chinook (tules), lower Columbia coho, lower Columbia steelhead and mid-Columbia steelhead occur in this area. An ESA recovery plan is under preparation and is expected to be complete for the lower Columbia in early 2008. A Lower Columbia Restoration Plan for the Washington tributaries upstream to the Little White Salmon River was completed in 2005. Bonneville Pool also lies within fishery management zone 6 and supports very significant tribal treaty fisheries. Beyond production at the four NFHs, WDFW and the Yakama Nation conduct a hatchery program in the Klickitat River Basin rearing spring Chinook, coho, and steelhead (see Klickitat Anadromous Fishery Master Plan, 2004). ODFW conducts spring Chinook and steelhead hatchery programs in the Hood River basin. ODFW also operates Oxbow Fish Hatchery on Herman Creek and Cascade Fish Hatchery on Eagle Creek. Both facilities primarily rear coho for off station release. In addition, ODFW operates several large production programs at Bonneville Fish Hatchery immediately below Bonneville Dam.

Non-Federal Salmon and Steelhead Hatcheries in the Region[21]

Oxbow State Hatchery (Oregon Department of Fish and Wildlife)

Oxbow Hatchery is located approximately 1 mile east of Cascade Locks, Oregon, off Interstate 84. The site is at an elevation of 100 feet above sea level, at latitude 45° 40 ' 32 " N and longitude 121° 51 ' 31 " W. The site area is 33.5 acres, owned by ODFW. The hatchery obtains its water supply from Oxbow Springs through gravity flow. The Oxbow Springs flow dwindles to about 300 gpm in the summer and fall and is not used for rearing fish during that period. The water rights are for 116.51 cfs. Herman Creek Ponds (upper and lower) are operated as satellite facilities. The Upper Herman Creek facility is located on Herman Creek about 1/4 mile east of the main hatchery. The site is at an elevation of approximately 85 feet above sea level, at latitude 45° 40 ' 33 " N and longitude 121° 51 ' 15 " W. The Lower Herman Creek facility is located near the mouth of Herman Creek approximately ½ mile north of the main hatchery. The site is at an elevation of 80 feet above sea level, at latitude 45° 40 ' 70 " N and longitude 121° 51 " 50 " W.

The Oxbow Hatchery was originally constructed in 1913 to provide additional rearing facilities for Bonneville Hatchery. It was relocated to its present site in 1937 following the construction of Bonneville Dam. Oxbow operated as a state-funded hatchery until 1952 when it was remodeled and expanded as part of the Columbia River Fisheries Development Program (Mitchell Act)—a program to enhance declining fish runs in the Columbia River Basin. The hatchery is presently used for interim egg incubation and early rearing of spring Chinook, coho, and sockeye. No adult fish are collected or spawned at Oxbow and there are no fish released at this facility. Upper and Lower Herman Creek Ponds are used as interim rearing sites for coho transferred in from other facilities.

[21] *See Figure x (To Be Completed).*

Cascade State Hatchery (Oregon Department of Fish and Wildlife

Cascade Hatchery is located along Eagle Creek, 2.5 miles west of Cascade Locks, Oregon, off of Interstate 84 (Exit 41). The site is located at an elevation of 100 feet above sea level, at latitude 45 o 38 ' 30 " N and longitude 121 o 55 ' 33 " W. The area of the site is 3.8 acres, owned by US Forest Service, Mt. Hood National Forest District. Water is supplied by gravity flow from Eagle Creek. The total water right is 20,197 gpm.

Cascade Hatchery was authorized under the Mitchell Act and began operating in 1959 as part of the Columbia River Fisheries Development Program – a program to enhance declining fish runs in the Columbia River Basin. The facility is used for egg incubation and rearing of coho.

Cascade Hatchery participates in both harvest and conservation programs. The Tanner Creek (014) Coho program is a harvest program used to mitigate for the loss of fishing and harvest opportunities due to habitat loss and migration blockage resulting from the Columbia Basin hydropower system. The Mid-Columbia/Leavenworth (508) Coho program is a conservation program for the restoration of an extirpated population.

Tanner Creek (014) Stock: Produce 1,000,000 smolts (63,889 pounds) for release into the Umatilla River System. Produce 500,000 fingerlings (3,333 pounds) for transfer to Bonneville Hatchery. Produce 1,612,000 coho fingerlings (10,747 pounds) for transfer to Upper Herman Creek Ponds (Oxbow Hatchery). Produce 600,000 fingerlings (20,000 pounds) for transfer to Clatsop Economic Development Council (CEDC) net pens. Mid-Columbia/Leavenworth (508) Stock: Produce 700,000 smolts (35,000 pounds) for release into the Wenatchee River System.

No adults return to Cascade Hatchery. Tanner Creek (014) Stock: Adult collection and spawning takes place at Bonneville Hatchery. Mid-Columbia/Leavenworth (508) Stock: Eggs are received from Leavenworth National Fish Hatchery.

Parkdale Hatchery (Confederated Tribes of Warm Springs)

Powerdale Dam is located on the Hood River, Oregon at river mile (RM) 4.0. When sufficient adults (Hood River released Deschutes stock) begin returning to the Hood River broodstock will be collected there. Currently, broodstock is taken at the Pelton Trap on the Deschutes River.

When sufficient adults begin returning to Powerdale Dam, broodstock will be collected at Powerdale Dam, taken to Parkdale Fish Facility where they will be held, spawned and incubated to the eyed egg stage. Eyed eggs will be transported to Round Butte Hatchery on the Deschutes River for final incubation and rearing. Extended rearing will take place in the Pelton Ladder cells on the Deschutes River. Currently, all phases of the hatchery operation, including adult broodstock collection and early rearing occur at Round Butte Hatchery. Extended rearing occurs in rearing cells in the old Pelton Ladder.

There are two acclimation sites in the West Fork Hood River. Blackberry Creek acclimation site is located at RM 8.5 and Jones Creek acclimation site is located at RM 14.5. Facilities at both sites include portable ponds. Approximately 55,000 spring Chinook are trucked from Pelton Ladder to Blackberry Creek acclimation and 40,000 spring Chinook to Jones Creek acclimation (95,000 totals into the West Fork) where they remain for two weeks and are volitionally released into the West Fork Hood River. Non-migrants are trucked and released at the mouth of Hood River.

One acclimation pond at the Parkdale Fish Facility is used to volitionally release 30,000 spring Chinook over a two-week period. Again, non-migrants are trucked and released at the mouth of Hood River.

Winter steelhead stock 050 was founded in 1991 by collecting wild Hood River winter steelhead. The first collection effort in 1991 was done by angling and was not very successful. The first effective year of broodstock collection was in 1992 and used the Powerdale Fish Facility, located at Powerdale Dam, Hood River (RM 4.0). Each year since 1992, the broodstock has been sub-sampled from throughout the Hood River wild winter steelhead run, which passes the dam en route to the natural production areas above the dam. Most of the Hood River winter steelhead population spawns in this upper basin production area. All of the fish passing the dam are collected in the trap. Candidates for winter steelhead stock 050 are selected randomly throughout the run. The broodstock consisted of 100% wild fish from 1991 to 1995, and has included a proportion of returning hatchery fish stock 050 since 1996. The number of wild and hatchery winter steelhead counted at Powerdale Fish Facility and the numbers of fish taken for brood, by gender, since the founding of the stock are available.

Klickitat Hatchery (Yakama Nation)

The hatchery is located in a remote area on the Klickitat River at river mile 42, near the town of Glenwood, Washington. The hatchery transferred to the Yakama Nation in 2005 from the Washington Department of Fish and Wildlife and is used for adult collection, incubation, and rearing of spring Chinook and the incubation and rearing of URB fall Chinook and coho (Type N).

Klickitat Hatchery was authorized and constructed under the Mitchell Act and began operation as part of the Columbia River Fisheries Development Program. The purpose of the hatchery is to produce adult fall Chinook, Type-N coho, and spring Chinook that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries.

Production Goals: Spring Chinook Produce 600,000 yearlings, 300,000 sub yearlings for on-station release Produce 1,200,000 subyearlings for release into the upper Klickitat River URB Fall Chinook Produce 4,000,000 subyearlings for on-station release Coho (Type N) Produce 1,350,000 yearlings for on-station releases

Water Supply: Water rights total 28,338 gpm from four sources: Indian Ford Springs, an unnamed spring (designated Indian Ford “B”), Wonder Springs, and the Klickitat River. Facilities:

Adult Holding: 1 concrete adult holding pond - 12,000 cf Incubation: 72 full stacks of vertical tray incubators (1008 trays) 28 shallow troughs Early Rearing: None Raceways: 22 concrete raceways - 3,000 cf each 12 vinyl raceways - 1,600 cf each (BPA experimental program) Rearing Ponds: 3 rearing/release ponds - 82,800 cf, 80,213 cf, and 39,560 cf

Other facilities associate with the Klickitat Hatchery includes Lyle Falls Fishway and Broodstock collection facility, Castile Falls fishway and McGreedy Creek acclimation site.

IV. Wind River Watershed[22]

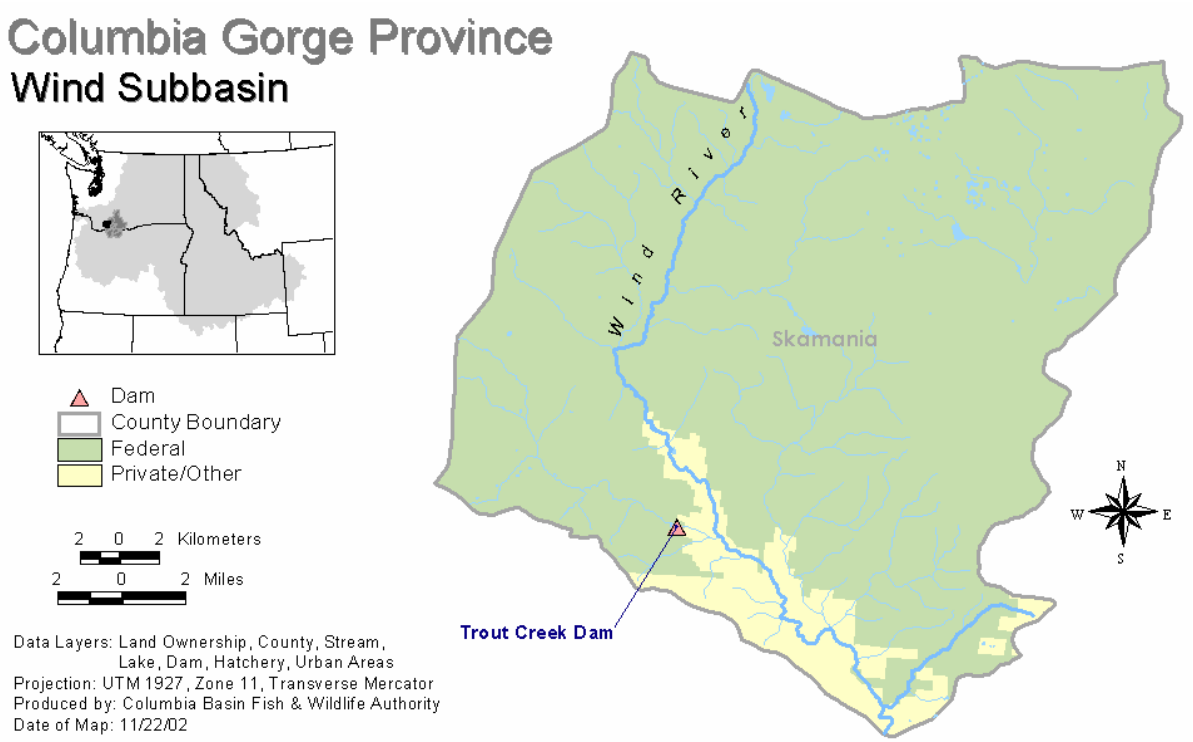

Figure 3. Wind River Watershed[23]

[22] *Primary source documents for information in this section include:.*

[23] *APRE Columbia Gorge Province Report - http://www.nwcouncil.org/fw/apre/provincereports/Columbia%20Gorge%20Province%20Report.doc*

Wind River Overview

Watershed Description[24]

The Wind River subbasin covers about 143,504 acres (224 sq. miles) in central Skamania County. The headwaters of the mainstem arise in the McClellan Meadows area in the southern Gifford Pinchot National Forest (GPNF). The major tributaries in the basin include the Little Wind River, Bear Creek, Panther Creek, Trout Creek, Trapper Creek, Dry Creek, Falls Creek, and Paradise Creek. Elevation in the basin ranges from 80 to 3,900 feet. The northwest portion of the basin is steep and the northeast portion is relatively flat and consists of high elevation meadows. Trout Creek, a major tributary to the west, has a broad alluvial bench (Trout Creek Flats) in the upper central portion of the basin. A broad alluvial valley extends along several miles of the middle mainstem before entering into a steep V-shaped canyon in the lower 20 miles of stream. The lower southeast portion of the basin, including the Panther Creek and Little Wind River basins, is quite steep. Shipherd Falls, actually a set of four 10-15 foot falls, is located at approximately RM 2 and historically blocked all anadromous fish except for steelhead, until it was laddered in the 1950s. Basin geologic history consists of old and new volcanic activity combined with more recent glacial and alluvial processes. The older basalt flows date back 12 to 25 million years, while the newer ones emanating from Trout Creek Hill are as recent as 300,000 years ago. The older material, which makes up most of the basin, is the most susceptible to erosion due to weathering into finer material. Relatively recent glacial activity contributed glacial sediments and has shaped river valleys. Alluvial deposits from the massive Bretz Floods, which originated from eastern Washington during the late Pleistocene, have resulted in highly erodible soils in portions of the lower basin.

Fisheries[25]

Spring Chinook Harvest - Hatchery Produced

- Spring Chinook harvested in ocean commercial and recreational fisheries from Oregon to Alaska, in addition to Columbia River commercial and sport fisheries

- CWT analysis indicated that upriver spring Chinook are impacted less by ocean fisheries than other Columbia River Chinook stocks; CWT recovery data suggest that Carson Hatchery spring Chinook are recovered primarily as recreational harvest, incidental commercial harvest, and hatchery escapement.

- From 1938-1973, about 55% of upriver spring Chinook runs were harvested in directed Columbia River commercial and sport fisheries; from 1975-2000 (excluding 1977), no lower river fisheries have targeted upriver stocks and the combined Indian and non-Indian harvest rate was limited to 11% or less

[24] *from – Vol. II , Chapter J – Wind River; Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plans, Dec., 2004 unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report)*

[25] *from – Vol. II , Chapter J – Wind River; Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plans, Dec., 2004 unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report)*

- Beginning in 2001, selective fisheries and abundance based management agreement through *US vs. Oregon* has enabled an increase in Columbia harvest of hatchery spring Chinook

- WDFW and the Yakama Indian Nation negotiate an annual harvest plan for sharing the Little White Salmon Hatchery surplus between the sport fishery and the tribal commercial and subsistence fisheries in Drano Lake

- Sport harvest in the Wind River from 1993-2002 averaged 5,130; with a record 18,036 harvested in 2002

- Tribal harvest averaged 869 and tribal hatchery subsistence distributions averaged 3,189 from 1993-2002

Tule Fall Chinook Harvest

- Fall Chinook are harvested in ocean commercial and recreational fisheries from Oregon to Alaska, in addition to Columbia River commercial gill net and sport fisheries

- Columbia River commercial harvest occurs in August and September, but flesh quality is low once tule Chinook move from salt water; the price is low compared to higher quality bright stock Chinook

- Fall Chinook destined for areas upstream of Bonneville Dam are harvested in August and September Treaty Indian commercial and subsistence fisheries

- Annual harvest dependent on management response to annual abundance in Pacific Salmon Commission (PSC) (US/Canada), Pacific Fisheries Management Council (PFMC) (US ocean), and Columbia River Compact forums

- Ocean and lower Columbia River harvest limited to 49% due to Endangered Species Act (ESA) limit on Coweeman tule fall Chinook.

- Fall Chinook originating upstream of Bonneville Dam are subject to Federal Court Agreements regarding Indian and non-Indian harvest sharing

- CWT data analysis of the 1971-1972 brood years from Spring Creek NFH indicates that the majority of Bonneville Pool Hatchery fall Chinook stock harvest occurred in British Columbia (28%) and Washington (38%) ocean commercial and recreational fisheries

- Bonneville Pool tule stock fall Chinook are important contributors to the Columbia River estuary (Buoy 10) sport fishery; in 1991, Bonneville Pool Hatchery fish comprised 25% of the Buoy 10 Chinook catch

- Sport harvest in the Wind River averaged 9 fall Chinook annually from 1977-1986

Upriver Bright Fall Chinook Harvest

- Fall Chinook are harvested in ocean commercial and recreational fisheries from Oregon to Alaska, and in Columbia River commercial gill net and sport fisheries

- URB fall Chinook migrate farther north in the ocean than lower Columbia Chinook, with most ocean harvest occurring in Alaska and Canada

- URB fall Chinook are also an important sport fish in the mainstem Columbia from the mouth upstream to the Hanford Reach, and an important commercial fish from August into early October

- Fall Chinook destined for above Bonneville Dam are and extremely important fish for Treaty Indian commercial and subsistence fisheries during August and September

- CWT data analysis of the 1989-94 brood URB fall Chinook from Priest Rapids Hatchery indicates that the majority of the URB fall Chinook stock harvest occurred in Alaska (24%), British Columbia (23%), and Columbia River (42%) fisheries during the mid 1990s

- Current annual harvest dependent on management response to annual abundance in PSC (U.S./Canada), PFMC (U.S. ocean), and Columbia River Compact forums

- Columbia River harvest of URB fall Chinook is limited to 31.29% (23.04% Indian/ 8.25% non-Indian) based on Snake River wild fall Chinook ESA limits

- Fall Chinook originating upstream of Bonneville Dam are subject to Federal Court Agreements regarding Indian and non-Indian harvest sharing.

Chum Harvest

- Currently very limited chum harvest occurs in the ocean and Columbia River and is incidental to fisheries directed at other species

- Columbia River commercial fishery historically harvested chum salmon in large numbers (80,000-650,000 in years prior to 1943); from 1965-1992 landings averaged less than 2,000 chum, and since 1993 less than 100 chum

- In the 1990s November commercial fisheries were curtailed and retention of chum was prohibited in Columbia River sport fisheries

- The ESA limits incidental harvest of Columbia River chum to less then 5% of the annual return

Summer Steelhead Harvest

- No directed non-Indian commercial fisheries target Wind River summer steelhead; incidental mortality currently occurs during the Columbia River fall gill net fisheries

- Summer steelhead are harvested in the Columbia River Treaty Indian fall commercial and recreational fisheries in Zone 6

- Current steelhead harvest is primarily in the lower Wind and Cowlitz of hatchery steelhead from other Columbia basins which temporarily enter the Wind River before continuing their Columbia River migration

- Summer steelhead sport harvest in the Wind River from 1977-1982 averaged 1,373 and declined to an average annual harvest of 421 fish from 1983-1991; since 1981, regulations limit harvest to hatchery fish only

- ESA limits Wind wild summer steelhead fishery impact (Indian and non-Indian combined) to 17% per year

Winter Steelhead Harvest

- No directed commercial fisheries target Wind River winter steelhead; incidental mortality currently occurs during the lower Columbia River spring Chinook tangle net fisheries

- Harvest occurs in the Columbia River Zone 6 winter commercial tangle net fishery and in tribal ceremonial and subsistence fisheries

- Winter steelhead sport harvest data in the Wind River are not available but approximately 25-50 wild winter steelhead are estimated to be harvested annually; since 1991, regulations limit harvest to hatchery fish only

- ESA limits fishery impact (tribal and non-tribal) of Wind River wild winter steelhead to 17% per year

Conservation[26]

Focal salmonid species in Wind River watersheds include fall Chinook, chum, coho, summer steelhead and winter steelhead. Bull trout do not occur in the subbasin. Salmon and steelhead numbers have declined to only a fraction of historical levels (Table 1). Extinction risks are significant for all focal species except summer steelhead – the current health or viability ranges from very low for chum, low for fall Chinook, coho, and winter steelhead, and above medium for summer steelhead.

Table 1. Status of focal salmonid and steelhead populations in the Wind River subbasin.

Focal Species	ESA Status	Hatchery Component[1]	Historical numbers[2]	Recent numbers[3]	Current viability[4]	Extinction risk[5]
Fall Chinook	Threatened	No	2,500 - 3,500	0 – 400	Low	~50%
Chum	Threatened	No	25,000 -28,000	<100	Very Low	~70%
Coho	Proposed	No	1,200 -10,000	200 – 300	Low	~70%
Summer steelhead	Threatened	No	2,000 – 5,000	100 – 800	Med +	~10%
Winter steelhead	Threatened	No	300 - 2700	100	Low +	~70%

[1] *Significant numbers of hatchery fish are released in the subbasin.*

[2] *Historical population size inferred from presumed habitat conditions using Ecosystem Diagnosis and Treatment Model and NOAA back-of-envelope calculations.*

[3] *Approximate current annual range in number of naturally-produced fish returning to the subbasin.*

[4] *Prospects for long term persistence based on criteria developed by the NOAA Technical Recovery Team.*

[5] *Probability of extinction within 100 years corresponding to estimated viability*

[26] *from – Vol. II , Chapter J – Wind River; Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plans, Dec., 2004 unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report)*

Other species of interest in the Wind River include coastal cutthroat trout and Pacific lamprey. These species have been affected by many of the same habitat factors that have reduced numbers of anadromous salmonids. Recovery actions targeting focal salmonid species are also expected to provide significant benefits for these other species. Cutthroat will benefit from improvements in stream habitat conditions for salmonids. Lamprey are expected to benefit from habitat improvements in the estuary, Columbia River, and mainstem, and in the Wind Subbasin, although specific spawning and rearing habitat requirements for lamprey are not well known.

Habitat[27]

Current habitat conditions are the result of natural and stochastic events. In the Wind River these events include volcanic eruptions, earthquakes, fire, erosion/sedimentation, steam bank vegetation, large woody debris, and peak flow (USFS 1996). Human activities including riparian and upslope timber harvest, hydro and splash damming, water withdrawal, road building, and rural development have negatively affected fish and wildlife habitat

The USFS classified stream channels in the Wind River based on the Rosgen classification system, which incorporates channel slope, meander width ratio, channel entrenchment, sinuosity, and width to depth ratio. Channels were classified as A, B, C, or E (USFS 1995). Low gradient meandering stream channels (generally Rosgen C and E channels) contain substrate and water velocity preferred by salmonids for spawning and early rearing. In addition, coho and Chinook salmon prefer these channels for rearing to the smolt stage. Rosgen "A" and "B" channels have moderate to low sinuosity, moderate to low width to depth ratio, moderate to high gradient and high to moderate entrenchment. “A” and “B” channels are dominant in this watershed and provide excellent steelhead rearing habitat and limited spawning habitat. Rawding (1999a) summarized the movements of steelhead in Wind River from the available data. In general, steelhead adults holdover in the canyon areas of “B” channels, move into “C” channels or suitable spawning habitat in “B” channels for spring spawning. After emergence, fry seek out margin habitat of these channels for early rearing and most fish are likely to overwinter near their natal areas. At age one in the late spring and early summer, a portion of the parr migrate into “B” channels and remain there until they smolt at age two or three. Redd survey data indicate that the “C” channels in the Trout Creek flats, Panther Creek, Middle Wind, and Upper Wind have provided the highest spawning densities for steelhead. In contrast the “B” channels in the Lower Wind, Lower Panther Creek, and Lower Trout Creek have produced up to 75% of the smolts in the Wind River (Rawding 1999b).

Due to the diverse life history movements exhibited by steelhead in the basin, all anadromous habitat is important to steelhead for specific life history stages and it is essential to maintain the connectivity between these habitats. Human caused impacts to “B” channels are less than to “C” channels because riparian areas of “B” channels are less accessible, the increased stream gradient flushes sediment more efficiently, and the boulder-bedrock substrate maintains channel stability and natural pool/riffle ratios in “B” channels. As a general rule, “C” channels in the Wind River are more degraded and have poorer habitat quality as compared to “B” channels and “C” channels have been and will remain the focus of most restoration activities.

[27] *Text from Wind River Subbasin Summary, November 15, 2000 Draft D. Rawding Subbasin Team Leader; prepared for The Northwest Power Planning Council unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report)*

Both salmon and steelhead currently have access to over 95% of the potential spawning and rearing habitat in the Wind River system because of the fish ladder at Shipherd Falls. Minor blockages occur near the upper extent of steelhead use in the Wind River in Tyee Springs, Youngman Creek, and Oldman Creek. These blockages total approximately less than two miles of "B" and "C" channel habitat. The single largest loss of habitat occurred with the flooding of the lower Wind River after the construction of Bonneville Dam. The dam inundated the primary spawning area for fall Chinook salmon and rendered the habitat unusable for this purpose.

The USFS manages 89% of the land within the Wind River subbasin. The President's Forest Plan (ROD) categorizes the Wind River Basin as a Tier 1, Key Watershed that provides critical habitat for anadromous salmonids. The quality of habitat in the Wind River Subbasin will be largely determined by federal management. Habitat is currently considered fair to excellent depending on the location. Some areas in the Trapper Creek wilderness are in pristine condition with excellent habitat. However, most habitat in the subbasin is degraded compared to historic conditions. Habitat problems noted in the subbasin plan are mainly related to timber harvesting practices and rural development. This is evidenced by maximum water temperatures exceeding 24° C (75° F), increased peak flows, increased sedimentation, lack of large woody debris, increased width-to-depth ratios, and lack of riparian vegetation (USFS 1996). Throughout the subbasin there continues to be a need to restore riparian vegetation, reduce sediment delivery to streams, enhance channel complexity, and ensure adequate recruitment of large woody debris into the system. The Washington Department of Ecology has designated stream segments of the Wind River subbasin as water quality impaired. The 303(d) list identifies segments that do not meet the standards of the federal Clean Water Act. DOE is presently conducting a TMDL for water temperature in this subbasin.

Current Status of Salmonid Stocks

The co-managers have identified 8 principal salmonid stocks in the Wind River watershed, two of which (chum and tule fall Chinook salmon) are severely depressed.

- Wind River hatchery spring Chinook salmon (segregated harvest)
- Wind River tule fall Chinook salmon (severely depressed natural)
- Upriver bright fall Chinook (introduced + strays)
- Wind River summer steelhead (natural)
- Wind River winter steelhead (natural)
- Wind River chum salmon (severely depressed natural)
- Wind River cutthroat trout (natural)
- Wind River resident rainbow trout (natural)

The following tables summarize the current status and management premises of those stocks, as identified by the co-managers. Habitat assessments were obtained from: Northwest Power and Conservation Council. 2004. Wind River Subbasin Plan. Available at: www.nwcouncil.org/fw/subbasinplanning.

Population viability from Technical Recovery Team, July 2004 report. Status evaluation of salmon and steelhead populations in the Willamette and Lower Columbia River *Available at:www.nwr.noaa.gov/salmon-recovery-planning.*

Table 1. Wind River hatchery spring Chinook (Carson NFH)

Management Premises and Goals	
ESA Status	*Not Listed.*
Biological Significance	*Low to medium.* This is an introduced hatchery stock. Spring Chinook salmon were not native to the Wind River. This stock has been and is used for reintroducing spring Chinook salmon into watersheds where the native population was extirpated, for example Umatilla and Walla Walla rivers in eastern Oregonian.
Population Viability	*High.* A 10-year average of 9 recruits per spawner (R/S) for brood years 1990-99.
Habitat	*Low.* Habitat capacity for naturally produced spring Chinook salmon smolts is very low (two to three smolts per redd).
Harvest	*High.* For every fish returning to the hatchery another 1.1 was harvested. An average 5,487 fish harvested, broodyear 1990-99 10-year average. Nearly all harvest was in the Columbia and Wind rivers.
Hatchery Program	
Facilities	Carson NFH.
Type	Segregated.
Authorization and Funding	Mitchell Act.
Primary Purpose	Harvest.
Secondary Purposes	Re-introduction to areas upstream of Bonneville Dam.
Broodstock Origin(s)	Wild Spring Chinook salmon trapped during upstream migration at Bonneville Dam, 1955-64.

Table 2. Wind River tule fall Chinook

Management Premises and Goals	
ESA Status	*Threatened.*
Biological Significance	*Medium to High*. There are few intact spawning areas remaining for the Columbia River Gorge populations (TRT 2004). Hatchery releases discontinued after 1976 (Wind River Subbasin Plan 2004).
Population Viability	*Low*. Heavily influenced by spawning of hatchery fish from Spring Creek NFH (tules), Bonneville hatchery (upriver bright), and Little White Salmon NFH (upriver bright). Historical abundance estimated at 2,500 to 3,500 adult fish, with current abundance 0 to 400 adult fish (Wind River Subbasin Plan 2004).
Habitat	*Low*. Natural spawning occurs in the lower Wind River, and possibly Little Wind River, downstream of Shipherd Falls. Bonneville Dam inundated the primary habitat in the lower Wind River. Smolt capacity now estimated at 206,608 smolts (Wind River Subbasin Plan 2004).
Harvest	*Moderately High.* Harvested at similar rate as tule fall Chinook from Spring Creek NFH.

Table 3. Wind River upriver bright fall Chinook

Management Premises and Goals	
ESA Status	*Not Listed.*
Biological Significance	*Low*. Historically not found in the Wind River. This is an introduced hatchery stock from adult hatchery strays from Bonneville hatchery and Little White Salmon NFH (Wind River Subbasin Plan 2004). Upriver bright fall Chinook salmon originated primarily upstream of Celilo Falls (The Dalles Dam).
Population Viability	*Low*. Natural spawning influenced heavily by hatchery strays from Bonneville hatchery and Little White Salmon NFH. Average spawning escapement has averaged 397, for years 1988-2001 (Wind River Subbasin Plan 2004).
Habitat	*Low*. This is an introduced hatchery stock. Upriver bright fall Chinook salmon originated primarily upstream of Celilo Falls (The Dalles Dam).
Harvest	*Moderately High.* Harvested at similar rates as Bonneville hatchery and Little White Salmon NFH upriver bright fall Chinook salmon.

Table 4. Wind River summer steelhead

Management Premises and Goals	
ESA Status	Threatened.
Biological Significance	High. Historically present throughout Wind River watershed. Historic abundance estimated between 2,000 and 5,000 adults. Releases of hatchery steelhead into the Wind River (Skamania stock) were discontinued in 1994. Natural production sustained by genetically distinct wild fish (Wind River Subbasin Plan 2004).
Population Viability	Low to Medium. In recent years 2000 to 2006, population abundance has been highly variable, ranging from 200 to over 1,000 adults (Rawding and Cochran 2007).
Habitat	Medium. Historic logging and splash dam practices impacted spawning and rearing habitat in the upper Wind River and tributaries. Bonneville Dam inundated habitat in the lower Wind River. Smolt density model estimates current production at 62,273 smolts (Wind River Subbasin Plan 2004).
Harvest	Low. Catch and release fisheries in recent years of high abundance (Rawding WDFW pers comm.).

Table 5. Wind River winter steelhead

Management Premises and Goals	
ESA Status	Threatened.
Biological Significance	High. The Wind River is near the eastern range for winter steelhead for the Washington side of the Columbia River. Historical abundance estimated between 300 and 2,500 adults (Wind River Subbasin Plan 2004).
Population Viability	Low. Current abundance has ranged from 20 to 53 adults for years 2000-2006 (Rawding and Cochran 2007).
Habitat	Low. Historically restricted to area downstream of Shipherd Falls. Bonneville Dam inundated habitat in the lower Wind River.
Harvest	Low.

Table 6. Wind River chum

Management Premises and Goals	
ESA Status	Threatened.
Biological Significance	High. Before Bonneville Dam, the Wind River was estimated at supporting 25,000-30,000 adult chum salmon (Wind River Subbasin Plan 2004).
Population Viability	Low. Current abundance is less than 100 adults, with Bonneville Dam counts typically less than 100 adults (Wind River Subbasin Plan 2004).
Habitat	Low. Historically restricted to area downstream of Shipherd Falls. Bonneville Dam inundated the primary habitat in the lower Wind River.
Harvest	Low.

Other Species of Concern

Table 7. Additional salmonid and non-salmonid native fish species present in the Wind River[28]

Common name	Scientific Name
Salmonid	
Mountain whitefish	*Prosopium williamsoni*
Sea-run Cutthroat Trout	*Oncorhynchus clarki clarki*
Non-Salmonid	
White Sturgeon	*Acipenser transmontanus*
Pacific lamprey	*Lampetra Tridenata*
Longnose dace	*Rhinichthys cataractae*
Speckled dace	*Rhinichthys osculus*
Redside shiner	*Richardsonius balteatus*
Sculpins	*Cottus* sp.
Three-spine stickleback	*Gasterosteus aculeatus*

Carson NFH spring Chinook releases are moderate in magnitude and have been reduced from 2 million to 1.17 million Yearlings currently under U.S. vs. Oregon. Juvenile out-migration trapping and PIT tag monitoring at Bonneville Dam indicate that Carson spring Chinook exit the Wind River quickly after release, further reducing potential density dependent effects. The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions, as the fish should quickly migrate from the release site The available information, while limited, is consistent with the hypothesis that predation by hatchery-origin fish is, most likely, not a major source of mortality to naturally reproducing populations, at least in freshwater environments of the Columbia River basin (Enhancement Planning Team 1986). Predation and possible disease transmittance within the facility is a possibility from otters (Lontra canadensis) and to a lesser extent from King Fishers (Ceryle alcyon), Great Blue Herons (Ardea herodias) and mink (Mustela vison).

Salmon and Steelhead Hatcheries in the Watershed[29]

Carson National Fish Hatchery (U.S. Fish and Wildlife Service)

Carson NFH was authorized by Special Act 50 Stat. 220, May 28, 1937, and placed into operation in December 1937 to mitigate for the effects of federal water projects, primarily Bonneville Dam. The hatchery was reauthorized by the Mitchell Act (16 USC 755-757; 52 Stat. 345) May 11, 1938 as amended on August 8, 1946, (60 Stat. 932) to assist with the conservation of fishery resources in the Columbia River Basin as specified in the Act. The hatchery was remodeled in 1956 to establish a hatchery spring Chinook run in the Wind River, and is currently used for adult collection, egg

[28] Cite
[29] See Figure 3.

incubation and rearing of spring Chinook. It also provides eggs for re-establishing spring Chinook runs in other Columbia River tributaries, as needed.

Carson National Fish Hatchery (NFH) is located at river kilometer (rkm) 29 on the Wind River, Skamania County, Washington within the Columbia River basin. The actual position of the hatchery is 45°52'05" Latitude and 121°58'23" Longitude. The hatchery has five buildings involved in fish production, four residences, and a large pond cover. Currently, there are no plans for new buildings; however, the hatchery would like to construct an outreach/visitor center near the main entrance.

The hatchery is funded by National Ocean and Atmospheric Administration (NOAA) Fisheries and FWS Hatchery Cyclical Maintenance. Their 2006 operational budget was $588,792. Costs for M & E in 2006 was approximately $108,377 (includes $83,377 for tagging).

Funding Source	**Amount**
NOAA-Fisheries(Mitchell Act)	$538,124
FWS –Hatchery Cyclical Maintenance	$50,668
Total	$588,782

Capital Improvements to the Carson NFH have totaled 1,757,085 during the period 2000- 2006.

Carson NFH Spring Chinook

Operator: U.S. Fish and Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal***: Support commercial, tribal, and recreational fisheries in the lower Columbia and Wind rivers. Based on a desired 0.5% smolt-to-adult return rate (harvest plus escapement back to the hatchery), the program goal would be to achieve a mean harvest of 5,700 adult spring Chinook per year based on the current size of the program, although a specific harvest goal has not been established. .

- ***Broodstock escapement goal***: Provide an escapement back to the hatchery of at least 1,400 hatchery-origin adult spring Chinook for a segregated broodstock program. Achieve a 0.1% survival from smolt release to adult recovery at the hatchery to maintain brood stock.

- ***Conservation goal***: The hatchery program has no direct conservation goals within the Wind River drainage. Carson NFH spring Chinook represent an introduced hatchery stock within the Wind River, are not included with the Lower Columbia River Chinook ESU (currently listed as *threatened* under the ESA), and are not included in recovery planning for the ESU. However, the Carson NFH has been a principal stock for reintroducing spring Chinook in areas of the Columbia River Basin where natural populations have been extirpated.

- ***Escapement goal for natural-origin adults***: No specific escapement goal exists for natural origin spring Chinook in the Wind River. Spring Chinook are not native to the Wind River and field data indicate that a naturalized population has not been established, although some natural spawning by hatchery-origin fish does occur.

- ***Research, education, and outreach goals***: Provide visitation opportunities during regular business hours, seven days a week, and develop education programs to promote public understanding of the Carson NFH and the biology of Pacific salmon, but no specific long-range goals currently exist.

Objectives

- Trap 1,400 adult spring Chinook for broodstock to obtain a minimum of 1,000 adult spring Chinook (minimum of 500 females) for broodstock.

- Spawn a minimum of 500 females to yield 2.2 million (M) fertilized eggs.

- Release 1.17 M yearling spring Chinook smolts annually from the hatchery directly into the Wind River. Carson NFH previously released approximately 2.0 M smolts per year (under U.S. vs. Oregon), but rearing densities and release numbers were reduced in response to Banks (1994)[30]

- Provide 250,000 yearling smolts annually to the Umatilla Tribe for reintroduction of spring Chinook to the Walla Walla River. This component of the program was transferred temporarily to Little White Salmon NFH because of brook trout in the intake water source at Carson NFH and inadequate screening to preclude entrainment. A new screen that excludes brook trout was installed during the summer of 2007.

Program Description

Carson NFH operates as part of the Columbia River Fisheries Development Program under U.S. v. Oregon and is funded through the Mitchell Act. Propagation of spring Chinook at Carson NFH began in 1955 after a fish ladder was constructed at Shipherd Falls, two miles upstream from the mouth of the Wind River, to allow for upstream passage of adult salmon to the hatchery.[31] Spring Chinook are not native to the Wind River watershed; consequently, approximately 500 spring Chinook salmon were trapped annually from 1955 through 1964 at Bonneville Dam (Washington side of Columbia River) to initiate the broodstock and establish the population at Carson National Fish Hatchery. Genetic data suggest that the Carson NFH stock was derived from a mixture of upper Columbia and Snake River populations passing Bonneville Dam[32]. Although small numbers of spring Chinook were counted past the newly constructed Shipherd Falls fish ladder in 1956, 1957, and 1958, the first returns spring Chinook back to Carson NFH did not occur until 1959 when 107 fish entered the hatchery (99 jacks, 2 adult females and 6 adult males). Carson NFH has maintained this population of spring Chinook since that time. Annual adult returns to Carson NFH averaged 3,797 fish between 1980 and 2001, with over 10,000 spring Chinook returning each year in 1990, 2000 and 2001. (Table 1.12b, Carson NFH HGMP).

Spring Chinook eggs, fry, and fingerlings from the Carson NFH have been transferred to a many localities including Alaska (over 2 million eggs in the early 1970's), Oregon (22.9 million eggs from 1957 to 1993), Idaho (15.9 million eggs from 1960 to 1980), and several hatcheries in Washington (29.7 million eggs from 1957 to 1991). The "Carson stock" was the primary source of spring Chinook currently propagated at Little White Salmon and Leavenworth NFHs and has been the source of reintroduced spring Chinook in the Umatilla (Oregon) and Walla Walla (Washington) rivers.

[30] Banks, J.L. 1994. Raceway density and water flow as factors affecting spring chinook salmon(Oncorhynchus tshawytscha) during rearing and after release. Aquaculture 119:201-217.
[31]. *Carson NFH was also expanded in 1956, in part to accommodate for spring Chinook production.*
[32] Campton, D.E. 2000. *Genetic Comparisons among Hatchery and Wild Populations of Spring Chinook Salmon in the Methow River Basin. Unpublished report, U.S. Fish and Wildlife Service, Abernathy Fish Technology Center, Longview, Washington.*

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- Spring Chinook are not native to the Wind River. Historically, steelhead were the only anadromous salmonid species able to migrate upstream of Shipherd Falls prior to construction of the fishway ladder.

- Carson NFH stock was derived from upstream migrating adults trapped at Bonneville Dam, 1955-1964.

- Broodstock are derived each year from hatchery-origin adults returning to the hatchery (segregated broodstock program). Genetic data suggest that both Snake River and upper Columbia stocks of spring Chinook contributed to the origin of the stock. Because of their mixed stock origin, NOAA Fisheries does not include Carson NFH spring Chinook with any recognized ESU of Chinook salmon.

- The broodstock has received no imports of "non-Carson" eggs or fish from other hatcheries or populations since inception of the program.

- Hatchery-origin spring Chinook are trapped at the Carson NFH from May to August. Adults volitionally ascend the ladder and the adult holding pond. No weir exists on the Wind River.

- If brood stock numbers are insufficient to meet hatchery production objectives, the hatchery will rear fewer fish. However, under current Service policies, Carson stock from Little White Salmon NFH or Leavenworth NFH Complex would be acceptable as imports at Carson NFH.

Hatchery and Natural Spawning, Adult Returns

- Adults are randomly selected and spawned over a two to three week period (one to three spawn takes, one take per week) from mid to late August.

- Jacks (3 year old males) are included in the broodstock in proportion to their occurrence up to 10% maximum of the spawned males. On average, approximately 6% of the males spawned have been jacks.

- Males and females are spawned pairwise, 1:1 ratio.

- The adult escapement and trapping goal at the hatchery is set to account for 55%:45% female:male ratio among returning adults. This requires trapping more females than required to obtain sufficient numbers of males for pairwise spawning.

- Coded wire tag recoveries in the Wind River and at Carson NFH through BY1998 accounted for 92.5% of the adults. Another 7.2% of the tags fish were recovered from the Drano Lake fishery (Little White Salmon River) and at Little White Salmon NFH . Few CWTs have been recovered outside the Wind River, Drano Lake or Little White Salmon NFH (0.15% from the White Salmon River; 0.07% from the Kalama River; 0.03%, from the Deschutes River; and 0.07%, from the John Day Pool behind John Day Dam.

- The geometric mean number of spring Chinook spawning naturally in the Wind River was 195 fish per year for BY 1990-1999 (2% of all recoveries). In 2004, WDFW identified 614 spring Chinook spawners in the Wind River, with 112 hatchery origin and three natural origin fish in the upper Wind River upstream of Beaver Campground. In 2005, 237 spawners were found in the Wind River, with 69 hatchery origin and no natural origin adults in the upper river (Dan Rawding, pers. comm.).

- Escapement and natural spawning of Carson NFH spring Chinook raises concerns regarding virus and disease transmission to wild fish populations in the Wind River, although, no virus has been detected among Chinook or steelhead juveniles collected from Wind River in limited fish health sampling.

- In 2001, almost 5,000 and 1,840 spring Chinook were harvested in recreational and tribal fisheries, respectively, in the Wind River, with an escapement of 12,075 adults back to the hatchery. The mean sport and tribal harvests for 1989-1998 were 2615 and 868 adults, respectively. Mean percent recoveries for BY1990 through BY1999 releases were 47% at the hatchery, 51% in Columbia River harvests, 2% from spawning grounds in the Wind River, and 0.1% in the ocean fishery.

- A mean of 2,575 adult spring Chinook were surplused to tribes from Carson NFH, 1990-1999.

- Erythromycin injections for spring Chinook salmon brood stock are used to control bacterial kidney disease (BKD) among spring Chinook adults held for broodstock prior to spawning. This treatment helps control mortality in adults and reduce vertical transmission of *Renibacterium. salmoninarum,* the causative agent of BKD, from parents to progeny via eggs.

- Female spawners are individually tested for *Renibacterium*, based on an enzyme-linked immunosorbent assay (ELISA). Fertilized eggs from high risk females are culled and buried. These procedures have significantly reduced the prevalence of BKD among spring Chinook reared on station.

- Smolt-to-adult returns (SARs) back to the hatchery averaged 0.254% for BY1979-BY2003).

- Spring Chinook returning to Carson NFH are composed of a higher proportion of age 4 and lower proportion of age 3 fish (jacks) than is typical of other spring Chinook hatchery stocks.

Incubation and Rearing

- Tyee Springs (44^{o} F) and Tyee Creek are the source of water for incubation of eggs and larva.

- Fertilized eggs from each female are initially incubated separately in isolation buckets until ELISA results for BKD risk are available.

- 6,000 eyed eggs are loaded per incubator tray (Heath incubators) after high BKD risk eggs have been culled.

- Water flow rates are set at 3 gpm at the eyed egg stage, and increased to 5 gpm at the first hatch of sac fry.

- Fry are ponded directly from the incubator trays into 14-18 raceways at 108,000 fry per ½ raceway, which results in a 0.08 initial density index (D.I.). The "reduced" ½ raceway area improves ease of feeding and cleaning of the raceways during the early stage of growth. When D.I. approaches 0.25, the fish are switched from belt feeders to hand-feeding, and the center screens are removed from the raceways, thus reducing D.I.s by 50%.

- There has been no prophylactic feeding of antibiotics since 1998. Before 1998, erythromycin was routinely fed prophylactically.

- Single pass water from Tyee Creek, 44-46^{o} F, is gravity-fed into the raceways at 380 gallons/minute/raceway from Tyee Creek.

- Subyearling fish are marked and tagged in May. At that time, the tagging crew marks, inventories and disperses the fry from each raceway throughout three banks of raceways (a total of 46 raceways). Within each bank of raceways, a pair of raceways are each loaded with 25,000 fish with fish in one of these raceway receiving CWTs that designate their final rearing vessel (upper raceway, adult pond or lower earthen pond). The remaining raceways in each bank are loaded with 35,000 fish. All fish are 100% adipose fin-clipped. The 75,000 coded wire tagged fish (1 raceway of 25,000 fish per bank) serve as a lower Columbia River control group for assessing survival of Snake River spring Chinook.

- In late October through early November, the yearling fish are transferred from the raceways to their final rearing ponds to accommodate ponding of subyearling fish of the subsequent brood year. From the middle bank of raceways, the two raceways of 25,000 fish (includes the CWT fish) are moved into an adult pond. ~~From the lower bank of 18 raceways, twelve raceways of fish (including the two raceways with 25,000 fish and CWTs) are moved to the lower earthen pond.~~ From the upper bank, the raceways with 35,000 fish are lightened to 25,000 fish/raceway, and 10,000 fish/raceway, or a total of 160,000 fish, are moved to the upper earthen pond. The flow in earthen ponds = 3500 to 4,000 gallons/minute and the density indices are <0.1. (April 9, 2006; lower earth pond DI=0.06; upper pond was DI=0.09). The lower earthen dirt pond receives second use water from the upper earthen pond. [Note: Tagging protocols were recently changed after preparation of this draft report].

- In December before release, 5000 fish per each of three raceways in the upper bank are crowded and PIT tagged. A total of 15,000 PIT tags are put in the non-CWT-fish from the raceways (#6, 8, and 10) least subject to predation. Mortalities in these three raceways are carefully monitored for PIT tags to ascertain the actual number of tagged fish at release.

- Carson NFH could potentially resume assisting the Umatilla Tribe with the Walla Walla River spring Chinook reintroduction program. The presence of brook trout in Tyee Creek precluded transfers of spring Chinook from Carson NFH to watersheds with ESA listed bull trout. Recent replacement of the water intake screen in 2007 will allow Carson NFH to resume spring Chinook

transfers for reintroduction to the Walla Walla River. A biological opinion examining the effects upon bull trout in the Walla Walla River is expected in the summer of 2007.

Release and Outmigration

- Up through 1998, Carson NFH released up to 2.0 million smolts per year. Beginning with BY1997, rearing densities and on-station release numbers were reduced to 1.42 million smolts in response to the study of Banks (1994).

- Smolts are force-released directly into the Wind River during the third week of April to coincide with natural spring migrations and spill at Bonneville Dam.

- The actual number of smolts released from the earthen ponds is unknown. The last inventory occurs in November during their transfer from the raceways. Mortalities collected from the earthen pond screens are tracked, but losses from predators are unknown.

- In 1999, the average travel time from release at Carson NFH to Bonneville Dam was 10.2 days, with a range from less than 24 hours to 94 days. Most PIT tagged fish released from Carson NFH are presumed to go undetected at Bonneville Dam because releases from the hatchery with scheduled spills, and most fish use the spillway.

- Mean size of released smolts is 16 to 18 fish per pound.

- Predation on native Wind River steelhead juveniles by released spring Chinook smolts is considered to negligible. Fully-smolted hatchery fish outmigrate rapidly from the Wind River into the Columbia River, and available information indicates that hatchery-origin juveniles do not residualize. In addition, the primary spawning and rearing areas for steelhead are upstream of the hatchery in the mainstem Wind River and tributaries. Steelhead fry emerge from gravel after smolts have emigrated from the Wind River.

Facilities and Operations

- Brook trout are present in Tyee Creek, the main water source for the hatchery. New screens installed in 2007 preclude brook trout juveniles from hatchery inflow.

- Two earthen ponds are present at Carson NFH. The lower earthen pond receives second pass water from the upper earthen pond. There have been no studies to assess fish health effects of second pass water.

- The hatchery has a 40 cfs water right for Wind River water. Regular use of this water supply was discontinued to avoid disease transmission to hatchery fish from anadromous salmonids in the river with the expectation that the water right will be used only under emergency conditions. In the past, the Wind River withdrawal pipe did not meet NOAA Fisheries screening criteria and had not been flushed in several years. To avoid the screening issues and maintain the hatchery's water right, a screened pump has been installed, and periodic water withdrawals can be made without affecting fish on station.

- Bacteria additives are used in the earthen ponds to assist with digestion of organics. After release of fish, the ponds are emptied and left to dry over the summer. This has reduced problems with the *flag tail syndrome*.

- Carson NFH does not have a back-up generator for the mechanical screen intake and pumps.
- Water temperature averages 44-47^{o} F.
- The lower half of the 46 raceways are covered, the upper half are not; and fish reared in the two earthen ponds are each given different CWT codes.
- Otter predation is significant, particularly in the *(number to be entered)* raceways and earthen ponds, and creates errors in the station fish inventory. No immediate solutions are apparent other than hiring a trapper to remove live otters for relocation. Some modification to the fences, such as flashing at the top, might be useful.
- Uncovered raceways could be fenced and covered to reduce bird predation (e.g. herons).
- The pollution abatement pond receives all raceway cleaning effluent water. Normal outflow is discharged into the Wind River. Cleaning effluent and total discharge (normal operation) effluent are monitored weekly for suspended and settled solids. The facility has been in compliance with NPDES standards since the early 1980's.
- Raceway alarms are needed on each raceway to detect high water levels from clogged screens. Low water alarms are present and functional.
- Security alarms to discourage poaching are not present on the adult holding ponds. Fences keep vehicles out, but will not exclude people.
- Domestic drinking water is irradiated with ultra-violet light (UV) prior to pumping to a storage tank that holds 10,000 gallons with a turnover rate of approximately 2-3 days (summer use is greater). Monthly coliform testing is ongoing, but positive tests have occurred in the past. Modifications are needed to UV-disinfect the water on the feed line from the storage tank to the on-station residences.
- Tanks in the nursery building have lead paint. Some lead paint is also present in the residences and on the adult fish crowder.
- Radon is high in the nursery building, and a circulation fan needed. The radon problem has been addressed in the residences but not in the hatchery building.
- Similar to other stations, Mitchell Act funding does not pay for facility renovations or maintenance. Program improvements may not occur because reimbursable funding to cover those costs is lacking.

Research, Education, and Outreach

- [Review Team Note: HET needs to summarize ongoing tagging studies, research, and M&E at Carson?
- The hatchery manager would like to construct an education/outreach visitor center at the entrance to the hatchery.

- In cooperation with the USGS Columbia River Research Lab, a three year study on steelhead and Chinook salmon juvenile interactions shows that highly variable numbers (0 to 99 fish/100 meters) of spring Chinook fry are produced each year by hatchery-origin spring Chinook spawning in the upper Wind River and its tributaries (between river kilometer 29.7 to 42.5). The abundance and distribution of natural-origin spring Chinook juveniles in the Wind River seems to depend on river flows which appear to reduce survival to the yearling stage. A few natural-origin spring Chinook smolts with PIT tags have been detected at Bonneville Dam (5 PIT tag detections out of 538 tagged fish, between 2004-2006).

- Carson NFH is participating in Mitchell Act funding outreach team.

- Carson NFH hosts a volunteer program from April to end of September. The hatchery usually has two retired couples who "meet and greet" on weekends, other couple does gardening, landscaping. The hatchery is equipped with two RV pads, including a guest service area between the two RV pads with laundry facilities, showers, baths, etc.

- The hatchery receives approximately 2000 visitors/year. Offsite outreach contacts over 10,000 additional people. The hatchery has an open house, a kids' fishing day, and a disabled-handicapped persons fishing day, with ≈500-600 kids (2004 and 2005) participating each year in Kid's Fishing Day

- The hatchery has a cooperative agreement with Mt. Hood Community College for student volunteers enrolled in the Fish Technology Program. Students conduct studies, feed fish, and take water quality samples, etc., on weekends as partial fulfillment of their fish technology curriculum.

- Carson NFH is starting a lecture series during the summer in Stevenson as a public outreach activity.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[33] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- Program confers significant sport and tribal harvest benefits. 10-year average for BY1990-1999 which includes all return years for each BY: 5,473 in Columbia River harvest (range = 92-12,812). For example, in CY 2001, sport catch in Wind River was 11,516, tribal catch was 1,840, and escapement of 12,075 back to the hatchery. Mean sport and tribal catch in CY 1989-1998 was 2615 and 868 adults, respectively.

- Carson NFH spring Chinook provided over 32,000 angler-days in 2001.

[33] *See Components of This Report for a description of these potential benefits and risks.*

- Mass marking of Carson NFH spring Chinook allow selective fisheries in mainstem Columbia River while managing risks to ESA-listed natural-origin spring Chinook, as specified in NOAA Fisheries biological opinions.

- Excess adults trapped at the hatchery are provided to the Yakama Nation (mean = 2,575/year) for subsistence and ceremonial purposes and to food banks.

Conservation Benefits

- Spring Chinook are not native to the Wind River, and a naturalized population has not been established. Consequently, the hatchery program confers no direct conservation benefit in the Wind River.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest and surplus adults trapped at hatchery provide a cultural benefit to Columbia River tribes.

- Carson NFH has been involved directly in BKD transmission and survival studies in light of new technologies and methods.[34]

- Location of Carson NFH upstream from only one mainstem dam facilitates survival studies on spring Chinook for multiple tag groups.

- Carson NFH has provided many opportunities for research on spring Chinook: interaction studies between steelhead and spring Chinook, starter feed studies on spring Chinook.

- Geographic location of hatchery is on scenic byway access to Mt. St. Helens National Monument from the Columbia River Gorge.

- Fish are used to assess hydro impacts and fish passage.

- Hatchery staff are providing increasing outreach activities in the local community.

- Carson NFH supports educational activities of Hood River Community College.

Benefits Conferred to Other Stocks, Species, and Communities

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[35] the Review Team identified the following benefits of this program:

Harvest Benefits

[34] *For example: Hard et al. 2006. Genetic effects of ELISA-based segregation for control of bacterial kidney disease in Chinook salmon (Oncorhynchus tshawytscha). Canandian Journal of Fisheries and Aquatic Sciences 63: 2793-2808 (and references therein).*

[35] *Ibid.*

- Harvest benefits are minimal outside the Columbia River Basin. Less than 1% of total harvest occurs in ocean fisheries.

- Carson NFH spring Chinook were the principal source of the current broodstock at Leavenworth and Little White Salmon NFH, and previously at Winthrop and Entiat NFHs.

Conservation Benefits

- Carson NFH spring Chinook have been an important source of fish for reintroduction programs in the Umatilla and Walla Walla rivers. One long-term goal of these reintroduction programs is to provide harvest benefits to the Umatilla Tribe.

Research, Education, Outreach and Cultural Benefits

- Hatchery staff provide educational opportunities offsite to other communities, including the Wenatchee Salmon Festival at Leavenworth NFH.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[36] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- No genetic risks identified.

Demographic Risks

- Potential failure of the water screen mechanism and lack of a back-up generator poses a demographic risk to fish on station.

- Predation losses pose a demographic risk to fish in uncovered ponds and raceways.

- Lack of shade covers over some of the raceways concentrates fish in shaded areas along raceway walls during summer months, increasing densities, potential stress,, and disease risks.

Ecological Risks

- Low ecological risk from antibiotic resistance in bacterial flora from erythromycin injections of adults held for broodstock.

- Brook trout population in Tyee Creek may pose a disease risk that needs to be monitored and controlled.

Research, Education, Outreach and Cultural Risks

- None identified.

[36] *Ibid.*

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[37] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Straying of fish from Carson NFH has not been identified as significant nor a risk, but deliberate transfers of Carson NFH spring Chinook could pose a genetic and/or ecological risk to populations in other non-target watersheds. Additionally, transferring and releasing fish outside the Wind River to upriver locations in the Columbia and Snake rivers increases the potential for straying, although straying from transfers has not been evaluated.

Demographic Risks

- Since construction of the hatchery, Tyee Creek has been blocked from access by migratory fish within the Wind River Basin.

- Potential use of Wind River water would pose demographic risks to other fish species via entrainment and lack of screening that complies with NOAA Fisheries requirements.

Ecological Risks

- Straying of fish from Carson NFH has not been identified as significant nor a risk, but deliberate transfers of Carson NFH spring Chinook could pose a genetic and/or ecological risk to populations in other watersheds (e.g. strays of Carson spring Chinook from the Walla Walla River into the Tucannon River). Additionally, transferring and releasing fish upriver increases the potential for straying. Straying from transfers has not been evaluated.

- Presence of brook trout in Tyee Creek water posed demographic risk to fish stocks in other watersheds, particularly bull trout, when Carson NFH spring Chinook were transferred to other watersheds. This risk has been removed by installation of new water intake screens during the summer of 2007.

- Introducing a non-native stock into the Wind River poses ecological risks to native species, although recent research suggest that the actual effects are not significant.

- Disease risk to native species in the Wind River.

Research, Education, Outreach and Cultural Risks

- Attraction of large numbers of anglers to the Wind River and limited access leads to refuse in habitat and social conflicts.

[37] *Ibid.*

Recommendations for Current Program

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue CA1: Present program goals for spring Chinook are not expressed in terms of numeric outcomes that quantify intended benefits or goals. *Harvest contributions vary widely in response to post-release survivals, marine conditions, and harvest regimes in the Columbia River. Like most other Mitchell Act funded programs, this hatchery program lacks specific numeric goals for contribution to harvest or other benefits.*

Recommendation CA1: Restate program goals to identify the number of harvestable adult spring Chinook desired from this program in the ocean, lower Columbia River, and Wind River. For example, the current program size and desired post-release survivals leads to a mean harvest goal of 5,700 adult spring Chinook per year. A stated harvest goal of 5,000 spring Chinook per year in the Wind River would be consistent with the size of the current program and expected smolt-to-adult return rates.

Issue CA2: Excess spring Chinook adults return to the Carson NFH in most years with very large surpluses (>10,000 fish) in some years. *Opportunities may exist for increased sport and tribal harvests in high return years. Federal lands along the Wind River may provide the potential for increased access by fishermen for harvest. Carson NFH is currently working with the Wind River Watershed Council to improve fish access (John Hitron, Manager, Carson NFH).*

Recommendation CA2: The Service, WDFW, and the Wind River Watershed Council should investigate additional or improved fishing access sites to the Wind River.

Broodstock Choice and Collection

Issue CA3: The escapement goal is currently cited as the broodstock retention goal and is not consistent between planning documents (e.g. 1,400, 1,200, 1,000 have been noted) and may exceed the number of adults required for the current program (yield 1.17 million smolts for onsite release and transfer of 250,000 yearlings to the Walla Walla River for reintroduction).

Recommendation CA3: Clarify the broodstock collection/retention goal so that no more than the number of adults required for broodstock needs are injected and held single specific number of adults is established as the annual broodstock goal for the program.

Issue CA4: Adult fish returning to the facility are not automatically enumerated. *The adult fish are visually estimated as they enter the facility. The first accurate count occurs when fish are given their first immunization injection of erythromycin. .An accurate count of adult fish at the time of entry to the facility would help with ladder operations, broodstock collection, and surplusing.*

Recommendation CA4: Install an electronic fish counter as the fish pass from the ladder to the adult holding pond.

Hatchery and Natural Spawning, Adult Returns

Issue CA5: In the past, the ladder into the facility was closed in some years during adult returns to encourage natural spawning and establishment of a naturalized population of spring Chinook in the Wind River. *The deliberate exclusion of returning adults from entering the hatchery increases ecological risks to native fish species in the Wind River. This is a particular concern to native steelhead. Spring Chinook are not native to the Wind River and establishment of naturalized population would potentially pose significant ecological risks to other species with little potential benefits that are not already conferred by the existing segregated hatchery program.*

Recommendation CA5a: Leave the ladder open during the entire adult return season (May-August) in all years, and surplus excess adults to the tribes and food banks. Adult spring Chinook returning to the Carson NFH should not be excluded from entering the hatchery ladder regardless of their numbers (see also Recommendation CA2).

Recommendation CA5b: Investigate the feasibility and benefit of a temporary weir in the Wind River to divert as many hatchery-origin spring Chinook back into the hatchery. The benefits and risks (e.g. to steelhead) of a temporary weir would need to be assessed.

Recommendation CA5c: Investigate the feasibility of installing a one-way weir or trap within the ladder to make sure fish cannot exit. PIT tag data has shown that fish sometimes leave the ladder after entering.

Incubation and Rearing

Issue CA6: Lack of shade covers for many of the raceways increases crowding of fish, particularly during the summer months, potentially increasing stress and disease risks to spring Chinook juveniles.

Recommendation CA6: Construct covers over raceways that are currently uncovered.

Issue CA7: Fencing around raceways and ponds is inadequate for controlling predation from birds (e.g., herons) and small mammals (e.g., otters).

Recommendation CA7: Install improved fencing and other exclusion methods to reduce predation by birds and mammals.

Issue CA8: Lack of high water alarms poses flooding and risk of fish loss. Blockage of water flow from the upper to the lower earthen pond can cause flooding and fish loss.

Recommendation CA8: Install a high water alarm on the upper earthen pond to detect blockage of screening between the two earthen ponds that could cause fish loss in the lower pond with insufficient water flow and flooding in the upper pond.

Release and Outmigration

Issue CA9: Fish released from earthen ponds are not enumerated prior to release. *The last inventory occurs when fish are transferred to earthen ponds from raceways, five to six months prior to release. Actual release numbers are unknown. Losses due to predation in earthen ponds could be significant but are not currently quantified.*

Recommendation CA9: Install a fish counting device at the outlet of the lower earthen pond to quantify total release numbers and the number of fish lost to predation.

Facilities/Operations

Issue CA10: Carson NFH is under funded for operations, maintenance, and M&E, and has insufficient funding for major maintenance and infrastructure improvements. *This is caused by lack of Mitchell Act funding to cover all program and facility costs, thus resulting increasing gaps between facility needs and fund availability. These gaps are related to both inflation and increased aging of hatchery facilities. Fishery comanagers and partners have developed a Mitchell Act outreach team to address Mitchell Act facility and funding needs.*

Recommendation CA10: Adopt or advocate the funding levels developed by the outreach team, including the development of a major maintenance budget and funding of the infrastructure improvements identified here in this report.

Issue CA11: The mechanical cleaning mechanism for the intake water screen is antiquated, requiring frequent maintenance by personnel, particularly during periods of rain and run-off. In addition, mechanical portions of the mechanism are exposed, posing a potential human health and safety risk to hatchery staff working in the area to service the mechanism. Although security fencing and safety rails have been installed, additional modifications may be desired.

Recommendation CA11: The Service should have appropriate safety and engineering personnel inspect the water intake mechanism to determine if (a) an improved mechanism requiring less human maintenance can be installed and (b) whether a safety problem exists.

Issue CA12: Facility and on-site living currently use a UV treatment system for their domestic water supply. *The domestic water supply is currently treated prior to entering storage. Unused water can become contaminated based on occasional positive testing for Coliform bacteria. Additionally, if there is a loss of power and the water in storage is depleted, no treated water is available.*

Recommendation CA12: Treatment system should be evaluated, and upgrades or alternatives considered.

Issue CA13: Radon is a potential problem in the hatchery incubation room, and lead paint is present in various rearing areas within the facility. *A 1994 radon testing report identified two locations that had readings of Radon in indoor air above recommended levels (4.0 Pico Curies per Liter): Residence quarters #1 and the nursery building - break room had levels of 5.3 and 26.7 Pico Curies, respectively Follow up testing in 1996 recorded 7.8 and 14.5 Pico Curies, respectively. .Corrections measures have already been implemented in residence quarters #1, but not in the nursery building.*

Recommendation CA13: Retest radon levels in the nursery building and take corrective action as warranted. Contact the Regional Environmental Coordinator and develop a *lead paint survey and corrective action plan* to address lead paint issues at the facility.

Issue CA14: Carson NFH has a water right granted in 1950 for 40 cfs from the Wind River. *However, the facility has relied predominantly on Tyee Creek and has rarely used water from the Wind River. The Wind River is considered a secondary or back-up water supply.*

Recommendation CA14: Develop a contingency operational plan for using Wind River water and ensure that the intake fish screen complies with NOAA Fisheries' ESA criteria. If Wind River water is no longer needed for fish culture or domestic use at Carson NFH, the Service should pursue options for reserving that water for maintaining instream flows. The Team considers the water right as a way to preserve flows and water quality in the Wind River and recommends that the right be reserved for maintaining instream flows if no longer needed at Carson NFH.

Research, Monitoring, and Accountability

Issue CA15: Coded wire tagged fish may not accurately represent all progeny groups released from Carson NFH. Currently,, three groups of 25,000 fish each are tagged in each of three different types of rearing vessels used at the facility. At times there may be multiple rearing vessels from which only one contains tagged fish (e.g. 1 of 18 raceways). *Since the populations between vessels can be different (age and size) and the pond environments can differ slightly (flow and flow pattern), the practice of tagging fish in one vessel does not represent the entire population. In most NFH programs, salmon are spawned throughout the adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes". The fry are ponded by take/hatch date into a series of vessels that, when fully populated, differ in age and size of fish, at least initially, between vessels. Accurate estimation of fishery contributions and stray rates requires that fish carrying CWTs represent the entire brood year statistically (e.g., stratified sampling and tagging of fish from each spawn group.*

Recommendation CA15: Consult with the Columbia River Fisheries Program Office to develop a new tagging strategy that accurately represents the entire population of progeny from all spawn groups. For example, all spawn groups should be proportionately represented among tag groups and raceways.

Issue CA16: There is no in-basin monitoring of PIT tag returns to the Wind River. *Adult returns are monitored at Bonneville Dam, but no in-stream monitoring occurs. In-stream monitoring would help with in-season harvest management on the Wind River.*

Recommendation CA16: Install a PIT tag detector at Shipherd Falls to detect returning adults, including wild steelhead carrying CWTs and hatchery spring Chinook.

Issue CA17: The Service currently electrofishes and removes brook trout in Tyee Creek on an annual basis in excess of the standard needed to collect for fish health or other stated management purpose. *In the past, reducing the abundance of brook trout was considered a way to control disease risks and reduce the potential for brook trout entering Carson NFH via the water intake. However, fish health believes the disease risk is minimal, and an upgraded screen was installed in 2007 that prevents brook trout from entering the facility.*

Recommendation CA17: Develop an annual monitoring plan for brook trout, including collection of samples for fish health and removal for other purposes,, that accounts for the current level of concern regarding the disease risk from the brook trout population and the physical risk they may pose after installation of an upgraded intake screen.

Issue CA18: The hatchery collects and records standard fish culture data and participates in management & research projects; however the hatchery would benefit from a clearly defined monitoring and evaluation plan, including an annual review to specifically address marking protocols and other components.

Recommendation CA18: Develop a consistent and clearly defined M&E program and review on an annual basis (prior to ponding and coded-wire tagging of a broodyear).

Issue CA19: *Current studies by USGS to understand ecological interactions between introduced spring Chinook and native steelhead in the Wind River have been ongoing for only a short period of time (less than one salmon generation). More data are needed to fully understand those ecological interactions.*

Recommendation CA19: The Service should support continued interaction studies to assess the effects of Carson NFH spring Chinook on natural populations of steelhead in the Wind River.

Issue CA20: The "visioned" function, purpose, and membership of Hatchery Evaluation Teams (HET) as originally described during the "Fisheries: A Future Legacy"(USFWS, 1991) planning process have been applied inconsistently among NFHs throughout the Pacific region, particularly regarding hatchery evaluations and fish production contingencies. *HET meetings and communications among Service offices regarding the Carson NFH fish program and evaluations are irregular and often include "external partners." While external partner or coordination meetings are valuable and necessary, the HRT believes that internal Service meetings and communications regarding Service hatchery programs are valuable and necessary as well. The HRT recommendations below are based on the 1993 USFWS "Hatchery Evaluation Action Plan" with modifications by the HRT.*

Recommendation CA20: (a) Establish an internal hatchery evaluation team (HET) consisting of staff from the hatchery, the servicing fish health center, the servicing fisheries program office, and the fish technology center when appropriate (e.g., contingency spawning protocols, feed monitoring, etc.); (b) the HET should meet twice annually - after smolts are released and before adults return - to discuss the fish program and evaluations. Discussion points of HET meetings should include results of on-going evaluations, evaluation plans and ideas, tagging/marking protocol and plans, adult and juvenile sampling, data management and reporting, fish program modifications, fish ponding, ponding densities, production numbers, spawn numbers, disposition of excess juveniles, fish health, and implementation of Hatchery Review Team recommendations, etc. The HET can meet more often as necessary to discuss specific fish program or evaluation issues. The HET shall record meeting minutes and distribute to the HET and the appropriate line manager in the Regional Office. The hatchery staff and HET should continue coordination meetings which involve comanagers and interested parties.

Education and Outreach

Issue CA21: The facility has limited infrastructure to accommodate the public and the number of people that visit the facility. *Given its location along a scenic byway, improved outreach facilities could be very beneficial for public education and conveying the mission of the Carson NFH and fisheries program.*

Recommendation CA21: The Team recommends that facilities be improved to expand visitation and education opportunities.

Alternatives to Current Program[38]

The Review Team considered the benefits and risks of the existing spring Chinook program at the Carson NFH and developed seven possible alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified a recommended alternative (or alternatives).

Alternative 1: Current program with recommendations

Pros

- Provides significant sport and tribal harvest benefits within the Columbia and Wind rivers. Spring Chinook are a highly valuable recreational and commercial species, particularly among sport fishers.

- Surplus adults contribute to tribal subsistence and ceremonial purposes.

[38] *Alternatives with asterisks (*) were favored by the Review Team over alternatives without asterisks.*

- Composite genetic stock successfully used for reintroductions in the mid-Columbia region. Broodstock source for reintroductions in the Umatilla and Walla Walla rivers.

- Successfully used to establish segregated hatchery programs in support of valuable fisheries in the mid-Columbia region (e.g., Leavenworth NFH).

- Carson NFH spring Chinook have a high homing fidelity back to the Wind River from on-station releases

- Results of ecological interaction studies with steelhead suggest little negative impact to natural populations of steelhead in the Wind River. Although some spring Chinook spawn in the Wind River, no naturalized population has been established.

Cons

- Spring Chinook are not native to the Wind River above Shipherd Falls.

- Risk of disease transfer from spring Chinook to the natural steelhead population and other species in the basin.

- Transfers of Carson NFH spring Chinook to other watersheds poses some genetic and ecological risks to natural populations due to potential straying to non-target watersheds.

- Presence of brook trout in Tyee Creek water poses demographic risk to fish stocks in other watersheds when Carson NFH spring Chinook are transferred to other facilities. With the screen replacement on the water intake in 2007, Carson NFH is expected to have the capability for brook trout-free transfers. A biological opinion examining the effects of transfers from Carson NFH to bull trout in other watersheds is expected in the summer of 2007.

Alternative 2: Expand the facility or reduce the size of the current spring Chinook program and develop an integrated harvest summer steelhead program

Expand the facility or reduce the existing spring Chinook program and implement an integrated harvest summer steelhead program (proposed size to be determined by comanagers) derived from ESA-listed, natural-origin summer steelhead trapped at Shipherd Falls. The sport fishery would be expected to occur primarily in the area above Shipherd Falls.

Pros

- Provides additional sport fishing opportunity for steelhead on the Wind River.

- Serves as a genetic repository for the ESA-listed Wind River summer steelhead population.

Cons

- May reduce a high valued sport and tribal fishery for Spring Chinook in the Wind River.

- Fewer surplus spring Chinook adults may be available for tribal subsistence and ceremonial purposes.

- Due to the current abundance of steelhead in the Wind River (near carrying capacity, Dan Rawding, WDFW, pers. comm.), the presence of a steelhead program in the Wind River would be expected to reduce the productivity of the natural steelhead population due to competition and potential natural spawning of hatchery-origin fish.

- A hatchery program for steelhead in the Wind River would be inconsistent with WDFW's current management strategy for the Wind River.

- Inclusion of wild steelhead in a genetically integrated broodstock would reduce the number of natural-origin steelhead spawning naturally in the Wind River (broodstock mining risk).

- Increased disease risk to the hatchery populations if Wind River water is used for rearing steelhead.

- If Wind River water is used, it may reduce homing fidelity of hatchery-origin fish back into the facility, thus increasing risks to natural populations .

- Attempts to control or exclude hatchery-origin steelhead upstream of Shipherd Falls would reduce the number of hatchery-origin steelhead available for harvest in the Wind River.

Alternative 3: Expand the facility or reduce the size of the current spring Chinook program and develop an integrated conservation winter steelhead program

Expand the facility or reduce the existing spring Chinook program and implement an integrated conservation winter steelhead program (proposed size to be determined by comanagers) derived from ESA-listed, natural-origin winter steelhead trapped at Shipherd Falls.

Pros

- Increases a listed winter steelhead spawning population in the Wind River.

- Serves as a genetic repository for the ESA-listed upper Columbia River Gorge winter steelhead population.

Cons

- Same as the cons for Alternative 2 except the broodstock mining risk would be to the natural winter steelhead population in the Wind River.

- Low abundance of winter steelhead may require a captive broodstock program to begin a hatchery program.

- Rearing winter steelhead at Carson NFH above Shipherd Falls may change the distribution of winter steelhead, which was historically restricted to downstream of Shipherd Falls.

Alternative 4: Expand the facility or reduce the current spring Chinook program and implement the F2 component of the White River (Wenatchee) spring Chinook program

The Service has recently accepted responsibility for rearing the F2 hatchery-produced progeny from F1 captively-reared spring Chinook parents obtained as eyed eggs from the endangered White River population, Wenatchee River drainage. That F2 rearing program is currently conducted at Willard National Fish Hatchery. This alternative would rear 150,000 F2 White River Spring Chinook received as eyed eggs from the F1 captive broodstock and is coupled to alternatives at Little White and Willard NFHs. The Service is also considering responsibility for the F1 captive rearing and breeding portion of the program at Little White Salmon NFH.

Pros

- Supports recovery of an ESA-listed, "endangered" stock. This stock has been identified with distinct biological attributes.
- Considered a biologically significant stock in the mid-Columbia river region.
- White River spring Chinook program has strong co-manager support.
- Reduces the risk of catastrophic loss by separating captively-bred broodstock and their F2 generation progeny.

Cons

- May reduce a high valued sport and tribal fishery for spring Chinook in the Wind River.
- Fewer surplus spring Chinook adults may be available for tribal subsistence and ceremonial purposes.
- Increases disease risk and the potential for increased drug use at Carson NFH if medicated feeds are necessary to prevent bacterial kidney disease outbreaks among White River spring Chinook.
- Requires extensive rearing space for the relatively small size of the program.
- Does not provide direct mitigation for Bonneville Dam as prescribed in the Mitchell Act.
- Presence of brook trout in Tyee Creek may increase risks to White River spring Chinook and other fish stocks, both at Carson NFH and after transfer to other watersheds. However, recent installation of a new water intake screen at Carson NFH during the summer of 2007 has reduced these risks significantly. A biological opinion on these risks is expected in the summer of 2007.
- Requires significant infrastructural changes to Carson NFH (e.g. effluent treatment).

Alternative 5: Hatchery production for restoration of naturally spawning populations in the Big White Salmon River (emphasis on

spring Chinook), depending on availability of space (could be combined with other alternatives)

Adjust the size of the current spring Chinook program and use a portion of the Carson NFH to rear fish for reintroduction of native species into the Big White Salmon River after removal of Condit Dam. This could include spring Chinook, tule fall Chinook, coho salmon, chum salmon, bull trout and steelhead, although spring Chinook is the only species demonstrated to be successful at Carson NFH. This would include potential rehabilitation of Big White Ponds and a reconstruction of a conservation weir for broodstock collection and management of naturally spawning populations in the Big White salmon River (see Spring Creek NFH tule fall Chinook current program recommendations).

Carson NFH may be especially suited for rearing spring Chinook for reintroduction into the Big White Salmon. Due to its close geographic proximity, spring Chinook from the Klickitat have been chosen by WDFW as the stock of choice for reintroduction of spring Chinook into the Big White Salmon River. This would likely be a small program (up to 250,000) that would a have minimal effect on facility rearing space and could be combined with other alternatives.

Pros

- Documented success of raising Spring Chinook salmon.
- The number of facilities with a diverse array of rearing environments in relative close proximity to the Big White Salmon River makes Carson NFH, Little White Salmon NFH, Willard NFH and Spring Creek NFH attractive sites for rearing fish for reintroduction.
- The removal of Condit Dam offers a unique opportunity in the Columbia River Basin to test a large-scale reintroduction project of an entire river system.
- Offers the opportunity to initiate populations in the Big White Salmon River that were depleted by the construction of Condit Dam and, later, Bonneville Dam.
- Reduces the risk of straying to the Big White Salmon River that the currently reared out-of-basin populations have.

Cons

- Reduces the amount of rearing space available for the current production of fish for Columbia River and Wind River harvest, including valuable sport and tribal fisheries.
- May increase the risk of disease transfer within the hatchery.

Alternative 6: Terminate the existing program and decommission the facility

Pros

- Removes an out-of-basin species, not native to the Wind River above Shipherd Falls.

- Eliminates the risk of disease transfer from spring Chinook to natural steelhead populations and other species within the Wind River basin.

Cons

- Eliminates a high valued sport and tribal fishery for spring Chinook in the Wind River.
- Surplus spring Chinook adults would not be available for tribal subsistence and ceremonial purposes.
- Terminates an important hatchery population that has been used successfully for reintroduction of spring Chinook into the Umatilla River and Walla Walla River, and used also to establish valuable hatchery-supported harvest programs in the mid-Columbia region (e.g., Leavenworth NFH).
- Reduces the Service's outreach capabilities for the Gorge region.

Recommended Alternatives

Short-term Goal (up to 15 years): Implement Alternative 1 but at reduced release levels to allow the implementation of Alternative 5 as desired by comanagers. The current Carson spring Chinook salmon program would be retained, with implementation of all recommendations, but with a reduction of up to 250,000 fish to accommodate the rearing of another stock deemed suitable for restoration of a naturally spawning population in the Big White Salmon River. The reduction of Carson production would allow the rearing of up to 250,000 smolts (such as an integrated Klickitat spring Chinook salmon stock) for release into the Big White Salmon River. This reintroduction program would be limited to three generations (up to 15 years). In addition, the Review Team supports the spring Chinook reintroduction program in the Walla Walla River and assumes that Carson NFH would resume former responsibility of rearing and delivery of approximately 250,000 yearlings for that program. Implementation of both reintroduction programs (Walla Walla and Big White Salmon rivers) at full capacity (250,000 juveniles each) would result in a temporary reduction of on-station releases to 900,000 smolts to retain current rearing densities and a maximum of 1.4 million smolts or pre-smolts reared on-station.

Long-term Goal (15+ years): Resume current program (Alternative 1) of a 1.4 million smolt release into the Wind River, contingent upon the successes of the spring Chinook reintroduction efforts in the Big White Salmon River (potentially the Klickitat stock), reintroduction efforts elsewhere (e.g., Walla Walla River), and potential program changes at Little White Salmon, Willard, and Spring Creek NFHs (see following sections on those programs).

V. Big White Salmon River Watershed[39, 40]

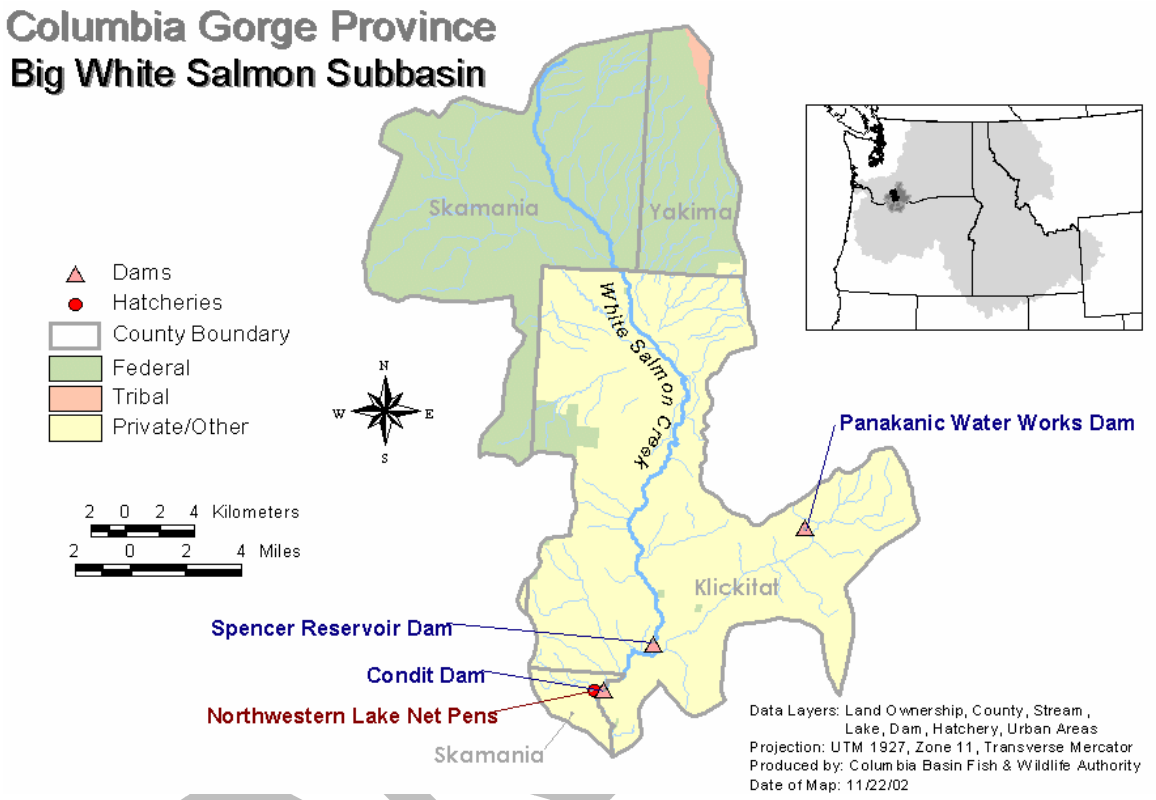

Figure 4. Big White Salmon River Watershed[41]

[39] *Primary source documents for information in this section include:.*
[40] *Includes Bonneville Pool*
[41] *APRE Columbia Gorge Province Report - http://www.nwcouncil.org/fw/apre/provincereports/Columbia%20Gorge%20Province%20Report.doc*

Big White Salmon River Overview

Watershed Description[42]

The Big White Salmon River originates in the Gifford Pinchot National Forest in south central Washington along the south slope of Mount Adams in Skamania and Yakima counties. It flows south for 45 miles before entering the Bonneville Pool in Underwood, Washington at Columbia River Mile (RM) 167. The Big White Salmon River drains approximately 386 mi² (250,459 acres) of Skamania, Yakima, and Klickitat counties. Principal tributaries include Trout Lake, Buck, Mill, Dry, Gilmer, and Rattlesnake Creeks. The basin is oriented north to south with elevations ranging from 80 feet to 7,500 feet. Topography varies within the watershed from rugged mountains to rolling hills to river valleys. Consolidated sediments are overlain with basaltic lava flows. Subsequent erosion, mud flows, and glaciation have resulted in precipitous cliffs, deeply incised canyons, and relatively flat valley floors.

The mainstem of the Big White Salmon River has an average gradient of 3.2% over its length of 45 miles. Anadromous fish passage is currently blocked at RM 3 by Condit Dam. A 20-foot falls at Husum (RM 16) is likely a partial barrier to some anadromous fish; however, some historical evidence exists of anadromous fish reaching the Trout Lake Valley upstream of the falls. Stream flows fluctuate from low flows in summer to peak flows in winter. Some streams only flow during high flow events and are dry the remainder of the year (ephemeral streams). Mean flows in the mainstem increase from an average daily flow of 644 cubic feet per second (cfs) in the fall to 1,538 cfs in the spring. The largest stream flows typically occur in response to rain-on-snow events, when heavy rains combine with high air temperatures and high winds to cause widespread snowmelt. Low flows are maintained on the mainstem by late season snowmelt and areas of water retention or recharge.

Fisheries[43]

Fisheries on salmon and steelhead are restricted to the lower 3.3 miles of the Big White Salmon River downstream from Condit Dam. Size of historical spawning populations is not well documented.

The lower mile of the Big White Salmon River supports a significant steelhead fishery. Skamania stock summer steelhead and winter steelhead have been released into the Big White Salmon River watershed to mitigate for the losses of anadromous fish caused by Condit Dam and to provide local recreational and tribal fishing opportunities. All hatchery steelhead are adipose fin clipped, and the river has been managed under catch-and-release sport fishing regulations for wild steelhead since 1986. As upriver summer steelhead migrate up the Columbia River, they seek refuge in the cooler waters of the lower Big White Salmon River. These fish will hold in the cooler water before continuing their upstream migration. This area provides a thermal refuge for summer steelhead.

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[42] *from – Wind River Subbasin Summary, November 15, 2000 Draft D. Rawding Subbasin Team Leader; prepared for The Northwest Power Planning Council unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report)*

[43] *from – Wind River Subbasin Summary, November 15, 2000 Draft D. Rawding Subbasin Team Leader; prepared for The Northwest Power Planning Council (Posted as document number ## on the Review Team's web site. See also Appendix B of this report)*

Conservation

Natural populations of salmon and steelhead in the Big White Salmon River have been severely impacted by hydropower development. The closure of Condit Dam in 1913 at RM 3.1 blocked all upstream migration of salmon and steelhead, resulting in extirpation of all anadromous populations upstream of the dam. Resident populations of rainbow trout and cutthroat trout persisted upstream of the dam and are present as self-sustaining natural populations. Construction of Bonneville Dam in 1938 flooded natural spawning habitat for fall Chinook and chum salmon in the lower reaches of the Big White Salmon River at its confluence with the Columbia River.

Bull trout are present and are the only ESA listed salmonid species upstream of Condit Dam. Introduced brook trout are present also. Conservation measure are focused on preserving riparian habitat in the upper watershed and promoting natural spawning of salmon and steelhead downstream from the dam.

The owner and operator of Condit Dam, PacifiCorp, is scheduled to begin removing Condit Dam in October, 2008 in lieu of maintaining the dam and providing fish passage. Removal of Condit Dam will provide access to fall Chinook of approximately 8 river miles

Habitat[44]

The Big White Salmon River only supports 1.2 miles of anadromous spawning and rearing habitat downstream from the Condit Dam powerhouse and another 1.8 miles between the powerhouse and the dam. This is compared to approximately 40 miles of potential anadromous fish habitat upstream of the dam.

In 1992-93, the U.S. Forest Service (USFS) and Underwood Conservation District (UCD) jointly surveyed fish habitat and associated riparian vegetation along 86 miles of private and state managed stream corridor within the Big White Salmon River. The survey covered the main branches of the lower and upper Big White Salmon River, Trout Lake Creek, Gilmer Creek, Rattlesnake Creek, Buck Creek, Indian Creek, Mill Creek and Spring Creek. The surveys mapped and described various features related to water quality, vegetation, streambed structure, bank stability, water withdrawals, erosion, grazing, culverts, and other land-use and natural features (Hennelly 1994[45]).

The USFS manages 50% of the land within the Big White Salmon River subbasin. The President's Forest Plan (ROD) categorizes the basin as a Tier 2 Key Watershed.

Federal land management decisions in the watershed will significantly influence the quality of habitat in the Big White Salmon River subbasin. Currently, national forest habitat is considered fair to excellent depending on the location. Habitat in the lower mainstem and tributaries (state and private ownership) is judged to be poor to excellent. Most habitat in the subbasin is degraded compared to historic conditions. Habitat problems noted by the USFS and others are mainly related to timber harvesting practices, roads, agriculture, water withdrawals, and rural development. This is evidenced by increased peak water flows, increased sedimentation, lack of large woody debris, increased width-to-depth ratios, lack of riparian vegetation, and increased water temperature (Champion Pacific

[44] *from – Wind River Subbasin Summary, November 15, 2000 Draft D. Rawding Subbasin Team Leader; prepared for The Northwest Power Planning Council (Posted as document number ## on the Review Team's web site. See also Appendix B of this report)*
[45] ***Citation required.***

Timberlands 1997, USFS 1995, 1997, and 1998[46]). Habitat improvements for salmon and steelhead upstream of Condit Dam will need to restore riparian conifer vegetation, reduce sediment delivery to streams, slow runoff rates, increase water storage capacity of the watershed, reduce stream energies, eliminate barriers, enhance channel complexity, and ensure adequate recruitment of large woody debris into the system.

Current Status of Salmonid Stocks

The co-managers have identified 12 principal salmonid stocks in the Big White Salmon River watershed, one of which (spring Chinook salmon) considered extirpated, two may also be extirpated (coho salmon and bull trout), and another two severely depressed (steelhead trout and chum salmon).

- Spring Creek NFH tule fall Chinook salmon (segregated hatchery)
- Tule fall Chinook salmon (natural)
- Upriver bright fall Chinook (segregated hatchery strays)
- Spring Chinook salmon (natural, extirpated)
- Chum salmon (natural, extirpated)
- Coho salmon (natural, extirpated)
- Summer steelhead (natural, extirpated)
- Summer steelhead (segregated hatchery)
- Winter steelhead (segregated hatchery)
- Rainbow trout (natural, upstream of Condit Dam)
- Cutthroat trout (natural, upstream of Condit Dam)
- Bull trout (extirpated?)
- Brook trout (introduced, upstream of Condit Dam)

The following tables summarize the current status and management premises of those stocks, as identified by the co-managers. Habitat assessments were obtained from: Northwest Power and Conservation Council. 2004. White Salmon River Subbasin Plan. Available at: www.nwcouncil.org/fw/subbasinplanning.

Population viability from Technical Recovery Team, July 2004 report. Status evaluation of salmon and steelhead populations in the Willamette and Lower Columbia River Available at:www.nwr.noaa.gov/salmon-recovery-planning.

[Note: The following stock tables are still under development.]

[46] *Cited references need to be inserted.*

Table 8. Columbia River Gorge hatchery tule fall Chinook (Spring Creek NFH)

Management Premises and Goals	
ESA Status	*Threatened. Hatchery population is included in Lower Columbia River ESU.*
Biological Significance	Medium to High. Spring Creek NFH tules included in diversity evaluation as potential source for re-establishing native run. The Spring Creek NFH brood stock originated from Big White Salmon River.
Population Viability	High. A 10-year average of 8 recruits per spawner for brood year 1990-99.
Habitat	Low. There are few intact spawning areas remaining for the Columbia River Gorge populations.
Harvest	*High.* For every fish returning to the hatchery another 1.9 was harvested. An average 18,994 fish were harvested in the Columbia River and 18,098 fish were harvested in the ocean, brood year 1990-99 10-year average.
Hatchery Program	
Facilities	Spring Creek NFH.
Type	Segregated.
Authorization and Funding	Mitchell Act and John Day Dam Mitigation.
Primary Purpose	Harvest.
Secondary Purposes	Potential source for re-establishing native runs.
Broodstock Origin(s)	Wild fish from Big White Salmon River.

Table 9. Big White Salmon River tule fall Chinook

Management Premises and Goals	
ESA Status	Threatened. Lower Columbia River ESU.
Biological Significance	Medium to High. Big White Salmon River population is included in the Gorge Tributaries Fall Run strata, which also includes the lower and upper Columbia River Gorge and Hood River populations (TRT 2006). There are few intact spawning areas remaining for the Columbia River Gorge populations. Spring Creek NFH tules included in diversity evaluation as potential source for re-establishing native run.
Population Viability	Low. TRT viability score ranged from 0.6 to 1.4, with the weighted average score of 0.86 (high risk of extinction). Heavily influenced by spawning of hatchery fish from Spring Creek NFH (tules), Bonneville hatchery (upriver bright) and Little White Salmon NFH (upriver bright). Natural spawning of tule fall Chinook in the Big White Salmon River occurs below the barrier. Completion of Bonneville Dam inundated the primary habitat in the lower river. Natural production is likely composed of hatchery strays. Historic distribution of fall Chinook salmon is believed to extend to Husum Falls, located at River Mile 8. Abundance surveys since 1964 indicate a significant population decline. Upriver bright fall Chinook salmon originated from the Columbia River above McNary Dam. These fish have been reared at Bonneville and Little White Salmon hatcheries to mitigate for Chinook salmon lost due to the construction and operation of mainstem Columbia River dams. Stray upriver brights from these facilities have been observed in the Big White Salmon River and natural production of bright fall Chinook occurs in the Big White Salmon River. Upriver bright fall Chinook salmon tend to spawn later than tule fall Chinook and the abundance of upriver bright fall Chinook salmon has been monitored since 1988.
Habitat	Low. TRT habitat score ranged from 0.2 to 1.2. Habitat impacted by Condit and Bonneville dams. Estimated escapement of wild fish has averaged 319 for 1992-2003 (Big White Salmon River Subbasin Plan 2004).
Harvest	Moderately High. Harvested at similar rate as tule fall Chinook salmon from Spring Creek NFH.

Table 10. Big White Salmon River spring Chinook

Management Premises and Goals	
ESA Status	*Threatened*. Lower Columbia River ESU
Biological Significance	*Unknown*. The TRT consensus was that extirpation of this population eliminated all its genetic resources (TRT 2004). Klickitat spring Chinook salmon are being considered as potential source for re-establishing a spring Chinook run once Condit Dam is removed.
Population Viability	*Extirpated*. The native population of spring Chinook in the Big White Salmon River was most likely extirpated after failure of the Condit Dam fish ladder shortly after dam construction in 1913.
Habitat	TRT habitat score of 0. Habitat eliminated by Condit Dam. Estimated historic capacity approximately 1,000 escapement of wild fish, which can be restored after planned removal of Condit Dam (Big White Salmon River Subbasin Plan 2004).
Harvest	

Table 11. Big White Salmon River coho

Management Premises and Goals	
ESA Status	Threatened. Lower Columbia River ESU
Biological Significance	Hatchery introductions, the near absence of accessible spawning habitat, and the low probability of any successful natural reproduction suggest that much of the genetic diversity native to the Big White Salmon River is extirpated (TRT 2004). Removal of Condit Dam provides an opportunity for re-colonization into historic habitat by this ESU.
Population Viability	Very Low to Extinct. Big White Salmon River population may be extirpated because of Condit Dam (TRT 2004). A small spawning population of coho persists in the Big White Salmon River. The WDFW believes upstream adult coho distribution is limited to the area below Condit Dam. Hatchery coho are released in the basin and hatchery strays are a likely source of any natural production.
Habitat	Very Low. Most of the habitat eliminated by Condit Dam. Current distribution limited to area downstream of Condit Dam (river mile 3.4). Current habitat below the dam has been modeled to support 200 or more adult fish. Historical distribution totaled 21.1 miles. Estimated historic capacity approximately 1,694 escapement of wild fish, which can be restored after planned removal of Condit Dam (Big White Salmon River Subbasin Plan 2004).
Harvest	

Table 12. Big White Salmon River chum

Management Premises and Goals	
ESA Status	Threatened. Lower Columbia River ESU
Biological Significance	*High.* **(**Extirpated). There are no known spawning aggregations for upper Gorge chum salmon populations, upstream of Bonneville Dam (TRT 2004). Bonneville Dam pool eliminated much of this populations spawning habitat.
Population Viability	Very Low to Extinct. For the upper Gorge Chum salmon (Washington), the TRT weighted average score was 0.18 (very high risk of extinction or extinct). There are no known spawning aggregations.
Habitat	Very Low. Big White Salmon River population may be extirpated because of Bonneville pool and Condit dam.
Harvest	

Table 13. Big White Salmon River hatchery summer steelhead (Skamania Hatchery)

Management Premises and Goals	
ESA Status	*Not listed.*
Biological Significance	*Low.*
Population Viability	High. Smolt to adult survival rate for Kalama River hatchery summer steelhead ranges from 1.6 to 18% (Big White Salmon River Subbasin Plan 2004).
Habitat	Reproductive success of Skamania steelhead in the Kalama was 16% of that for wild (Big White Salmon River Subbasin Plan 2004).
Harvest	*High ?*
Hatchery Program	
Facilities	Washington Department of Fish and Wildlife.
Type	Segregated. 20,000 smolt release (Big White Salmon River Subbasin Plan 2004).
Authorization and Funding	Mitchell Act.
Primary Purpose	Harvest.
Secondary Purposes	
Broodstock Origin(s)	Skamania stock (Klickitat and Washougal rivers)

Table 14. Big White Salmon River steelhead (winter and summer combined)

Management Premises and Goals	
ESA Status	Threatened. Included in Middle Columbia River ESU.
Biological Significance	High. Local population of O. mykiss upstream of Condit Dam may have genetic structure found in historic steelhead populations (Big White Salmon River Subbasin Plan 2004).
Population Viability	Low. Natural spawning runs of winter and summer steelhead currently are limited to the lower 3.3 miles of river below Condit Dam Historic abundance of 1,100 adults to currently less than 20, based on EDT (Big White Salmon River Subbasin Plan 2004).
Habitat	Low. Removal of Condit Dam may restore anadromy of existing O. mykiss population upstream of Condit Dam. Current distribution limited to area downstream of Condit Dam (river mile 3.4). Historical distribution was up to River mile 16 and tributaries, totaling 32.9 miles (Big White Salmon River Subbasin Plan 2004).
Harvest	Low.

Table 15. Big White Salmon River hatchery winter steelhead (Skamania Hatchery)

Management Premises and Goals	
ESA Status	*Not listed.*
Biological Significance	*Low.*
Population Viability	High. Smolt to adult survival rate for Kalama River hatchery summer steelhead ranges from 1.6 to 18% (Big White Salmon River Subbasin Plan 2004).
Habitat	Reproductive success of Chambers Creek steelhead in the Kalama was 12% of that for wild (Big White Salmon River Subbasin Plan 2004).
Harvest	*High ?*
Hatchery Program	
Facilities	Washington Department of Fish and Wildlife.
Type	Segregated. 20,000 smolt release (Big White Salmon River Subbasin Plan 2004).
Authorization and Funding	Mitchell Act.
Primary Purpose	Harvest.
Secondary Purposes	
Broodstock Origin(s)	Chambers Creek stock (Puget Sound).

Table 16. Big White Salmon River rainbow trout

Management Premises and Goals	
ESA Status	*Not listed*. .
Biological Significance	*Medium.* Resident rainbow trout are native to the Big White Salmon River drainage and inhabit the Big White Salmon River up to RM 42.5 where the stream becomes a barrier due to steep gradient and low flow. Stocking of rainbow trout began in the Big White Salmon River as early as 1934, and in Cascade Creek in 1942. These are the USFS and WDFW's earliest records found, yet stocking may have occurred before these dates. Hatchery rainbow trout have been stocked into this watershed, but these releases were terminated in the 1990's except for 10-40,000 fingerling rainbow trout that are stocked annually in Northwestern Lake for recreational angling opportunities. In 1990, the WDFW conducted a genetic study of rainbow trout in the Big White Salmon River drainage (Phelps, 1990). Samples were collected from five locations throughout the drainage. The analysis indicated the wild rainbow trout populations to be genetically distinct from each other and from Washington State hatchery rainbow trout strains. The study concluded that hatchery supplementation of rainbow trout in the drainage has not caused a loss of distinct wild populations. Rainbow trout in Big White Salmon River are listed as one of the outstanding remarkable resources in the wild and scenic portion of the river. This designation affords a high level of protection for these fish. The status of the rainbow trout population is unknown.
Population Viability	*Unknown.*
Habitat	.
Harvest	

Table 17. Big White Salmon River cutthroat trout

Management Premises and Goals	
ESA Status	*Not listed*. .
Biological Significance	*Medium.*
Population Viability	*Unknown.* Coastal cutthroat trout occur in the watershed, but the historic and recent distribution and status of this species are unknown. Hatchery cutthroat releases occurred as early as the 1930s, but were discontinued at least 30 years ago. Personnel from WDFW have observed these fish in the lower tributaries. In 1999, a sample of 50 coastal cutthroat trout were collected by WDFW and forwarded to National Marine Fisheries Service (NMFS) for genetic analysis. Because of the limited information and the lack of sampling that specifically targeted cutthroat trout, the status of coastal cutthroat trout in the watershed is unknown; however, the distribution appears to be limited and the sea-run form may be extirpated.
Habitat	.
Harvest	

Table 18. Big White Salmon River bull trout

Management Premises and Goals	
ESA Status	*Threatened*. .
Biological Significance	*Medium.*
Population Viability	*Extirpated (Unknown)?.* The status of bull trout in the Big White Salmon River is unknown. Bull trout have been observed in the mainstem below Condit Dam and managers believe these fish are part of an adfluvial population, which uses the Bonneville Reservoir. In 1993, bull trout presence/ absence surveys were conducted in the watershed as a cooperative project between the U.S. Forest Service (USFS) and WDFW. No bull trout were found in any stream during this limited sampling effort. The WDFW has initiated a bull trout-sampling project in the Columbia Gorge Province to more accurately determine the distribution of bull trout in the Big White Salmon River and other Washington tributaries. In the Big White Salmon River, surveys will focus on cold water habitats that can support bull trout. Until this project is completed, there is insufficient information to determine distribution, assess population status, or develop a recovery plan for these fish.

Habitat	.
Harvest	

Table 19. Big White Salmon River brook trout

Management Premises and Goals	
ESA Status	*Not listed*. An introduced, exotic species.
Biological Significance	*Low*. Brook trout are not native to the western United States.
Population Viability	*Unknown.* Hatchery releases have been discontinued, but naturally reproducing populations have been established within this watershed. The status and viability of brook trout in the Big White Salmon River are unknown at this time.
Habitat	.
Harvest	

Other Species of Concern

Table 20. Additional salmonid and non-salmonid native fish species present in the Big White Salmon River[47]

Common name	Scientific Name
Salmonid	
Mountain whitefish	*Prosopium williamsoni*
Sea-run Cutthroat Trout	*Oncorhynchus clarki clarki*
Bull Trout	*Salvelinus confluentus*
Non-Salmonid	
Pacific lamprey	*Lampetra Tridenata*
White Sturgeon	*Acipenser transmontanus*
Speckled dace	*Rhinichthys osculus*
Longnose dace	*Rhinichthys cataractae*
Redside shiner	*Richardsonius balteatus*
Sculpins	*Cottus* sp.
Three-spine stickleback	*Gasterosteus aculeatus*

Fish assemblages in the Big White Salmon River are divided into the areas upstream and downstream of Condit Dam. Species found downstream from the dam include spring and fall Chinook, coho salmon, winter and summer steelhead, large-scale and bridgelip suckers, pacific and brook lamprey, threespine stickleback, sculpins, white sturgeon, redside shiners, peamouth, and northern pikeminnow rainbow trout, and bull trout. Sea-run cutthroat trout, pink salmon, and chum salmon most likely used this area historically but are now considered extirpated. Species found upstream of the dam include cutthroat trout, rainbow trout, sculpin, and brook trout (introduced). Pacific lampreys were historically, and are currently, important to the Yakama Indian Nation. The status of this species is unknown.

Salmon and Steelhead Hatcheries in the Watershed[48]

Spring Creek National Fish Hatchery (U.S. Fish and Wildlife Service)[49]

Spring Creek NFH is located 20 miles upstream from Bonneville Dam on the Columbia River, at river mile 167, on 60.21 acres. The hatchery is on the north side of the Columbia River near Highway 14 in Skamania County, Washington (Figure 1). The hatchery is bounded by the Columbia River on the south and by the highway and 500ft high basalt cliffs to the north.

[47] *Cite*
[48] *See Figure 3.*
[49] *Spring Creek National Fish Hatchery is located on the mainstem Columbia River, approximately XXX miles from the mouth of the Big White Salmon River. Due to its close proximity to Big White Salmon River and…. the Hatchery Review Team assessed the hatchery as if it were within the Big White Salmon River watershed proper.*

Spring Creek National Fish Hatchery (NFH) was authorized by Special Act 24 Stat. 523, March 03, 1887 and Special Act 30 Stat. 612, July 01, 1898 and placed into operation in September 1901 to support the commercial fishing industry in the Columbia River. The hatchery was reauthorized by the Mitchell Act (16 USC 755-757; 52 Stat. 345) May 11, 1938 and amended on August 8, 1946, (60 Stat. 932) for mitigation of Bonneville Dam and conservation of fishery resources in the Columbia River Basin. The hatchery was remodeled in 1948 to prevent inundation by the pool behind Bonneville Dam. The hatchery was again remodeled in 1970 to expand operations to meet commitments under the John Day Mitigation Act. The hatchery is currently propagating tule fall Chinook salmon and includes adult broodstock collection, egg incubation, rearing, and on-station release of 15.1M subyearling smolts. The tule fall Chinook stock was developed from wild fish native to the White Salmon River. The hatchery has reared this stock since 1901.

Spring Creek NFH also operates a sub-station on the Big White Salmon River. Known as the *Big White Salmon Ponds*, this facility is located on 42 acres approximately 1-1/4 miles upstream from the mouth of the White Salmon River. The two ponds have been used to rear spring Chinook, but the facility has not been used recently and will not be used until ESA screening concerns are met and Condit Dam is removed

The majority of funding for Spring Creek National Fish Hatchery was reimbursable provided by the Army Corps of Engineers, COE, under the John Day Mitigation, and NOAA Fisheries, National Oceanic Atmospheric Administration, through Mitchell Act and FWS Maintenance Management funds for a total of $943,871. M & E costs for 2006 was approximately $1,196,178 and included $803,509 for tagging, marking, and adult biosampling.

Funding Source	**Amount**
Corps of Engineers	$559,141
NOAA-Fisheries(Mitchell Act)	$353,007
FWS – Hatchery Cyclical Maintenance	$31,723
Total	$943,871

Capital Improvements to the Spring Creek NFH have total $1,114,396 for the period 1998 - 2006

Spring Creek NFH Tule Fall Chinook

Operator: U.S. Fish and Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal***: Support commercial, tribal, and recreational fisheries in the ocean, lower Columbia River, and Bonneville pool. Although not specifically stated as a program goal, the desired harvest goal is to achieve a mean overall harvest of 37,000 adult Chinook per year based on the current size of the program and a 10-year average smolt-to-adult survival of 0.379% (harvest plus escapement back to the hatchery). John Day Dam mitigation has an escapement goal of 30,000 adults, 15,000 of which are to come from Spring Creek NFH. However, current controversy exists regarding whether tule fall Chinook is the appropriate stock to mitigate for fish losses associated with John Day Dam (see discussion of *upriver bright fall Chinook* at Little White Salmon NFH).

- ***Broodstock escapement goal***: Provide an escapement back to the hatchery of at least 10,000 hatchery-origin adult Chinook for a segregated broodstock program to support lower Columbia River fisheries. Achieve a 0.07 survival from smolt release to adult recovery at the hatchery to maintain brood stock.

- ***Conservation goal***: Spring Creek NFH Tule NFH fall Chinook are included with the Lower Columbia River Chinook ESU which is currently listed as *threatened* under the ESA. The conservation goal is to maintain a genetic repository for tule fall Chinook native to the lower Columbia River. The draft White Salmon Recovery Plan (p. 44) states, "When Condit Dam is removed, fall Chinook salmon from the program [Spring Creek NFH] will be used to reintroduce fall Chinook into the basin." A comprehensive lower Columbia River ESA recovery plan is under development.

- ***Escapement goal for natural-origin adults***: None. The hatchery does not intercept natural-origin tule fall Chinook.

- ***Research, education, and outreach goals***: Provide visitation opportunities at the Spring Creek NFH, but no specific long-range goals currently exist.

Objectives

- Trap 10,000 adults and spawn 8,000 adults (min. 4,000 females) tule fall Chinook to yield a minimum of 20 million green eggs (4,675 = approx. avg. fecundity, 1986-2005).

- Release 15.1 M subyearling smolts directly from the hatchery into the Columbia River (Bonneville Pool) (U.S. v. Oregon agreement). 8.55M for John Day mitigation, 6.55M funded by Mitchell Act.

Program Description

The Spring Creek tule fall Chinook brood stock originated from the White Salmon River, a mile from the location of the hatchery, and is the stock of choice for reintroduction in the White Salmon River pending Condit Dam removal scheduled in 2008. The tule fall Chinook stock is indigenous to the White Salmon River and the hatchery has reared this stock since 1901.

Spring Creek NFH is a single species facility rearing only tule fall Chinook salmon. Brood stock collection at the hatchery is managed to maintain the genetic integrity of the stock. The Service ensures that adult brood stock is randomly collected across the spawning run in proportion to the rate at which they return. The hatchery escapement goal is 10,000 adults of which 4,000 need to be females, but all fish returning are allowed to enter the hatchery.

Adult tule fall Chinook return to the hatchery from late August through September with 70% of the return entering the hatchery between September 4th and September 20th. Traditionally, the hatchery starts the spawning process around the 15th of September and is generally finished by the 5th of October. Spawning takes place daily with an average daily egg take of 1.75 million although it's possible to have daily takes of over 5 million eggs. Fish exceeding hatchery needs are distributed to the Yakama Nation for Ceremonial and Subsistence (C&S) and other tribes as requested. Additional fish are transferred to the State Food Bank Program.

Production goals are to release 15.1M tule fall Chinook smolts. The Spring Creek facility is operated under a strategy that releases smolts (fingerlings) during three time periods: March, April, and May. This release strategy maximizes production from available rearing space.

Spring Creek NFH also operates a sub-station on the White Salmon River. Known as the Big White Salmon Ponds this facility was used to collect adult tule fall Chinook up until the late 1960's once the number of the Chinook returning directly to the hatchery were able to fulfill broodstock needs.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- Derived from Big White Salmon river, propagated for over 100 years with little influence from other stocks.
- Stock represents the ancestral population native to the Big White Salmon River and the population that spawned in areas now flooded by the Bonneville pool.
- Included with the Lower Columbia Chinook ESU; hatchery fish are included with the current *threatened* listing under the ESA.

- Adults return to the facility from the last week of August through first week of October.
- Fish enter the hatchery daily, via a fish ladder directly from the Columbia River, are visually counted and sexed, and guided to one of 17 Burrows ponds. One Burrows pond is filled at a time before another pond is opened, with each pond receiving between 400 and 1,000 fish, depending on the size of the run.

Hatchery and Natural Spawning, Adult Returns

- Fish spawning occurs between September 15 and October 1
- 13-16 egg takes, every day except for weekends during spawn season.
- The egg take goal is 20 million fertilized eggs.
- In most years, surplus fish are available and given to a food bank;
- Some natural spawning of tule fall Chinook from Spring Creek NFH occurs in the Big White Salmon River. For BY 1990-1999 average 1,156 Spring Creek tule fall Chinook returned to spawning grounds (primarily to the Big White Salmon River). This is about 2% of all fish based on recovery of coded wire tags (?). The Ladder pulsing strategy resulted in increased numbers of fish straying into the Big White Salmon River. Very few adults stray from the vicinity of Spring Creek NFH and the Big White Salmon River. (Pastor 2004[50]).
- Jacks (2-year old males) compose 2-3% of the total number of spawners, 1987-2001, with 4% of the spawned males composed of jacks.
- Spawning is generally pairwise. Three females and three males are first pair-spawned in three separate color-coded pans. Saline water is added to each pan the eggs allowed to fertilize for 30 seconds to one minute. The egg-milt mixtures from each pairwise spawning are then combined into a single bucket for transport to the hatchery and loading into the incubation trays (see below).
- Spring Creek NFH fall Chinook are taken in fisheries in US, Canada and Southeast Alaska as part of the negotiated U.S Canada Treaty harvest allocation.
- Average recoveries of Spring Creek NFH Chinook for broodyears 1990-1999 were 30-34% (19,295) at the hatchery, 33% in Columbia River harvests (18,994), 31% in ocean harvests (18,098), and 2% to spawning grounds in the Big White Salmon River (1,156).
- SARs back to the hatchery have averaged 0.138% (BY1980-BY2001).
- Survival rates (harvest + escapement) have been over 1% (BY1998-2000)
- Since 1980, less than 30% of returning adults were recovered at the hatchery (remainder in fisheries).

Incubation and Rearing

[50] *Cited reference needed here.*

- Incubation takes place in Heath trays, two trays are initially loaded with the eggs from three females (7,500/tray).

- At the eyed stage, eggs are shocked and reloaded at 5,000 eggs/tray.

- Excess eggs are buried on site

- Fry button up in trays, and are then ponded in 44 outdoor Burroughs Ponds after approximately 1,600 Temperature Units (TUs)., during the first few weeks of December. 350,000 swim up fry are placed in each of the ponds

- Water source is 50% well, 50% spring water to achieve an incubation temperature of 50-52 degrees F. (warmer well water mixed with spring water-brings temperature up to desired incubation temperature).

- At present time, there is not a soft-shell problem. Hasn't existed since the new well came on line in 1992. Hydrogen sulfide in the well water may reduce the soft shell problems at SCNFH. Additional changes may have also reduced the soft-shell problem (e.g. changing to an iodine flow-through treatment 3 times/week, and improved handling techniques of adult fish); Fungus is not a problem so formalin treatments are not necessary. .

- Hatchery water source is 46 degree F spring water, 2,500-3,000 gpm. The hatchery operates a 90% biological reuse water system for the outdoor ponds.

- Green egg to eye-up survival is 93.7%

- Fry to Smolt survival is 97.5%.

- Average Density index for the last 10 years has been .28 and flow index has been 1.44

- Enteric Redmouth and bacterial gill disease are the two primary fish health concerns.

- Hatchery production records are maintained in the CRIS database program.

- Predation and possible disease transmittance within the facility is a possibility caused by Great Blue Herons (Ardea herodias) and to a lesser extent otters (Lontra canadensis).

Release and Outmigration

- Fish are 100% mass-marked with an AD clip prior to release. 450,000 fish receive a cwt and an equal number, 450,000 receive a cwt but no ad clip (DIT no-mark group).

- Proposed Spring Creek reprogramming would reduce on station releases to 10.5 M smolts from the current release goal of 15.1M smolts.

- Smolts are forced released in three release groups (March 7.6M, April 4.2M, May 3.5 M)

- Carrying capacity of rearing ponds is approximately 100,000 pounds, requiring an early March release of 7.6M to achieve a total release of 15.1 M .

- Fish out-migrate to Bonneville within 24-48 hours of release with full passage within 96 hours. The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions as they should quickly migrate from the release site.

- Spring Creek NFH fish are released directly into the mainstem Columbia River migration corridor rather than into tributary spawning or rearing areas. The available information is consistent with the hypothesis that predation by hatchery-origin fish is, most likely, not a major source of mortality to naturally reproducing populations, at least in freshwater environments of the Columbia River basin.

Facilities and Operations

- Biological filter utilizes oyster shells as the media source. Operation of a biological reuse system is a risk factor for disease since there are limited options for treatment of fish pathogens without harming the beneficial bacteria in the reuse system.

- Bacterial consortiums are added to the reuse system for breaking down solids and maintaining desired levels of nitrosomonas and nitrobacter bacteria.

- Weir used on Big White Salmon River at Big White Salmon Ponds for adult collection but is no longer functional. The weir was last used in 1987. Only 595 adults returned to the Spring Creek National Fish Hatchery that year. Trapping at the Big White Ponds produced 186 adults, the North Shore trap at Bonneville Dam provided 1,487 fish, 1473 fish, excess to the needs of the Bonneville State Hatchery were transported to Spring Creek and 303 adults came from Abernathy NFH. The total egg take that year was 11.6 million, approximately 7 million short from meeting its mitigation commitment.

- The Big White Ponds is a facility which could potentially play a roll in restoration and recovery of native stocks in the White Salmon River after Condit Dam is removed, but is currently inoperable since the water intake screens are not compliant with NOAA Fisheries screening requirements and is susceptible to flooding.

- Spring water collection facility access and security is a potential problem. Increased security would be desired.

- Need to upgrade flow alarms. Incubation building doesn't have alarms. Need oxygen and ammonia, nitrates, nitrites, pH continuous meters on reuse system to monitor water chemistry.

- Limited security for the broodstock ponds. Currently, hatchery staff checks the adult holding ponds during broodstock season once per night and it is monitored during normal working hours.

- Individual flow meters are needed on each pond. At present time, flows are estimated by percent that valves are opened.

- All production water used in the outdoor ponds is discharged through the settling pond. The hatchery operates on a 90% recirculated water system. Cleaning of the biological reuse system involves back flushing the oyster shell media filter beds which is discharged into the settling pond. Settling pond outflow is sampled weekly; outflow is sampled 2-3 hours after back flushing the filter beds. All effluent water is discharged into the settling pond prior to discharge from the

facility into the Columbia River. Settled solids were removed approximately six years ago; n both petroleum compounds and PCBs were identified and material were disposed of at the Waster Management Landfill in Arlington, OR.

- Aquamats used in Burroughs ponds (n=44 ponds); precludes need to brush ponds. Aquamats work especially well in Burroughs ponds because of circular nature (as compared to rectangular raceways).

- Fish were reared in the settling pond in one year with qualitative conclusions that the fish did well.

- No ability to automatically count adult fish as they enter the facility. An automatic counter would facilitate operations.

- Do not have a major bird predation problem, Great Blue Herons and mallard ducks are occasionally seen on the hatchery

- The hatchery is located within the Columbia Gorge Scenic Area. Any new construction needs to be coordinated with the Columbia Gorge Scenic Area Commission.

- The hatchery is considering electro-anesthesia so that carcasses and surplused adults could be used for consumptive purposes. Initial findings suggest major facility modifications would be necessary to convert to an electro-anesthesia system.

- Mitchell Act does not pay for facility renovations or maintenance. Program improvements may not occur because of lack of reimbursable funding to cover those costs.

Research, Education, and Outreach

- Joint project with USGS evaluating out-migrants from the BWSR. The following questions are being addressed: Is there a natural population of tule fall Chinook in the BWSR? If so, are they genetically distinct from the SCNFH stock?

- Condit Dam is scheduled to be breached (removed) in October 2008.

- A full parental genotyping feasibility study is currently underway.

- A fry release study (January release) was conducted; paper currently is being developed. Very poor survival and adult returns.

- ERM (Enteric Red Mouth) has been a serious issue for Spring Creek NFH in the past and remains a constant concern. An ERM disease study is currently being conducted by the lower Columbia River Fish Health Center.

- Spring Creek NFH houses the lower Columbia River Information and Education Office. This office also serves Carson NFH and the Lower Columbia Fish Health Center

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[51] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- The program confers significant sport, tribal and commercial harvest benefits. The 10-year average (broodyear 1990-1999 which includes all return years for each broodyear): Columbia River harvest is 18,994, or 33% of the returning population, and ocean harvest is 18,098, or 31% of the returning population, including the continental US (Washington and Oregon coastlines), British Columbia and Southeast Alaska. Text.

- Mass marking began at Spring Creek NFH in 2005; therefore, selective fisheries will be an option in the near future.

- Excess adults trapped at the hatchery are provided to food banks and are used for tribal subsistence and ceremonial purposes.

Conservation Benefits

- Mass marking began at Spring Creek NFH in 2005 and will allow for quantifying the number and proportion of hatchery fish on the spawning grounds.

- Hatchery program reduces extinction risks to tule fall Chinook in the lower Columbia River ESU.

- Spring Creek NFH tule fall Chinook are considered the genetic repository for restoring fall Chinook to the Big White Salmon River after removal of Condit Dam.

- Confers planned recovery benefits for Big White Salmon River restoration.

Research, Education, Outreach and Cultural Benefits

- The hatchery is home to the Lower Columbia Information and Outreach Office and provides support from this office to fisheries offices within the region.

- The visitor facilities adequately support the number of visitors (5,000 per year) that pass through the hatchery.

- Spring Creek NFH provides significant outreach activities, including an open house, salmon-in-the-classroom programs and fishing derby support.

- The land which the facility is on provides recreational access (e.g. sturgeon fishing and windsurfing) to the waters of the Columbia River mainstem.

[51] *See Components of This Report for a description of these potential benefits and risks.*

- Tribal harvest and surplus adults trapped at the hatchery provide a cultural benefit to Columbia River tribes.

- Participating in a Mitchell Act funding outreach team.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[52] the Review Team identified the following benefits of this program:

Harvest Benefits

- Substantial harvest of Spring Creek NFH occurs along the coast of Oregon and Washington, and into British Columbia and southeast Alaska (ocean harvest is 18,098, or 31% of the returning population), thus conferring a significant harvest and economic benefit to commercial fishers and citizens of Alaska and British Columbia.

- Spring Creek NFH tule fall Chinook is an intended source for fall Chinook broodstock at Bonneville Hatchery.

Conservation Benefits

- None identified at the present time, but this stock could be used to help restore naturally spawning populations in other watersheds of the lower Columbia River.

Research, Education, Outreach and Cultural Benefits

- Spring Creek NFH tule fall Chinook are a Pacific Salmon Treaty indicator stock.

- Hatchery staff provide educational opportunities offsite to other communities and the education program addresses other stocks in the region.

- Double index tagging provides harvest exploitation rates on wild stocks in the Columbia River. This may be useful for evaluating selective fisheries.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[53] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- There is a domestication risk for Spring Creek NFH tule fall Chinook due to their intended conservation role as a genetic resource for reintroductions in the lower Columbia River and their sustained propagation as a *segregated* hatchery stock propagated with hatchery-origin adults.

[52] *Ibid.*
[53] *Ibid.*

- Significant proportions of tule fall Chinook in the Big White Salmon River are Spring Creek NFH origin. This precludes the establishment of a viable self-sustaining natural population as long as the number of natural spawners is dominated by hatchery-origin fish. The long-term goal is to reverse this situation after removal of Condit Dam and nearly eight additional stream miles of fall Chinook habitat will be accessible.

Demographic Risks

- The use of 90% reuse water poses a demographic risk to the stock because of difficulties to control fish pathogens.
- The biological filter (oyster beds) for the reuse system is a risk factor for disease.
- The large numbers of hatchery strays from Spring Creek NFH into Big White Salmon River may pose a demographic risk (e.g. competition for spawning habitat) to the establishment of a viable self-sustaining population.
- Spring water collection facility access and security is a potential problem because it is adjacent to a major state highway.
- Inadequate alarms at the hatchery pose demographic risks to fish on station. Incubation building doesn't have alarms. The facility does not have continuous electronic meters to monitor oxygen, ammonia, nitrates, nitrites, pH, or other water chemistry parameters of the reuse system .
- Limited security for the broodstock ponds.
- Bonneville Dam provides a significant risk to the early Spring Creek NFH tule fall Chinook release as the release is prior to the present spill window listed NOAA's mainstem biological opinion.

Ecological Risks

- Concentration of northern pike minnow at the outflow of the hatchery ladder may pose a significant risk at time of release.

Research, Education, Outreach and Cultural Risks

- Raceways at Spring Creek NFH are not fenced, posing a public safety risk.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[54] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- None identified.

[54] *Ibid.*

Demographic Risks

- None identified.

Ecological Risks

- Risk to chum redds through nitrogen gas supersaturation and potential predation in the lower Columbia mainstem when spill is increased at Bonneville Dam to accommodate release of Spring Creek NFH tule fall Chinook.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue SC1: Present program goals for Spring Creek NFH tule fall Chinook are not fully expressed in terms of numeric outcomes that quantify intended benefits or goals. *Harvest contributions vary widely in response to post-release survivals, marine conditions, and harvest regimes in the Columbia River. Like most other Mitchell Act funded programs, this hatchery program lacks specific goals for numeric accountability with respect to harvest, conservation, or other benefits. John Day Dam mitigation harvest numbers for tule fall Chinook from Spring Creek NFH are identified (15,000 adults). However, there are tribal concerns regarding the appropriate stock and point of release for John Day Dam mitigation.*

Recommendation SC 1: Restate program goals to identify the number of harvestable adult tule fall Chinook desired from the Mitchell Act proportion of this program in the ocean and lower Columbia River. For example, the current program size and desired post-release survivals leads to a mean harvest goal of 19,000 fish per year for Columbia River harvest and 18,000 for ocean harvest.

Broodstock Choice and Collection

Issue SC2: Spring Creek NFH tule fall Chinook does not represent the same stock composition as the one impacted by John Day Dam. *John Day Dam mitigation funds are received by Spring*

Creek NFH for the tule fall Chinook program when the stock is not an in-kind contribution to mitigation for the dam.

Recommendation SC2: Continue to work through US v. Oregon to resolve broodstock composition and point of release issues regarding John Day mitigation (see also discussion and recommendations for *upriver bright fall Chinook at Little White Salmon NFH)*.

Issue SC3: Adult fish returning to the facility are not automatically enumerated. *The adult fish are visually estimated as they enter the facility and one pond is hand counted and the number is extrapolated to the other ponds. The size of the return makes this process extremely labor intensive and reduces the accuracy of this method.*

Recommendation SC3: Install a fish counter on each pond where broodstock are held.

Hatchery and Natural Spawning, Adult Returns

Issue SC4: Large numbers of Spring Creek NFH tule fall Chinook currently stray into the Big White Salmon River. Removal of Condit Dam will provide the opportunity to restore fall Chinook salmon in the Big White Salmon River. *Restoration of fall Chinook in the upper Big White Salmon River may require control of hatchery fish escapement to allow colonization and natural population adaptations.*

Recommendation SC4a: The Service should continue to collect adult and juvenile tissue samples and conduct genetic analyses to determine stock composition of naturally spawning adults and contribution to juvenile production. This would require continuing the estimation of adult spawning and juvenile production abundance.

Recommendation SC4b: Investigate the opportunity for installing a weir to control the number of hatchery-origin fish passed upstream as part of the restoration process. As the number of natural-origin fall Chinook increase over time, the number of hatchery-origin fish allowed to spawn naturally would need to be reduced to allow a self-sustaining natural population to develop. A weir would also allow monitoring of the recolonization success and future opportunity to collect broodstock for a potential integrated hatchery program if desired in the future.

Issue SC5: MS-222 is currently used to anesthetize adults during spawning. This precludes the use of carcasses for nutrient enhancement of streams and other beneficial uses for potential human use. *At the present time, the hatchery must render the carcasses at a cost of approximately $10,000/year. MS-222 is also a human health hazard.*

Recommendation SC5: Develop an alternative method of anesthetizing broodstock at the time of spawning. Use of electro-anesthesia is currently being investigated.

Incubation and Rearing

Issue SC6: Iodine treatment of fertilized eggs overlaps with the time that adults are held for broodstock. As a result, treated water from the hatchery building is discharged directly into

the Columbia River to avoid recirculating iodine through the re-use system and into the adult holding ponds .

Recommendation SC6: Re-plumb the hatchery building so that water can be discharged directly into the settling pond rather than the re-use system or river.

Release and Outmigration

Issue SC7: The current program size of 15.1 M smolts pushes the capacity of the hatchery to rear all fish within recommended density guidelines for fall Chinook. In addition, the water re-use system for the hatchery increases disease and water quality risks to fish on station.

Recommendation SC7: Reduce program size to 10.5M subyearling smolts in accordance with the proposed Spring Creek reprogramming. Maintain density indexes below 0.3 (Banks and LaMotte 2002[55]).

Issue SC8: Operation of Bonneville Dam strictly for power generation in March inhibits downstream passage and survival of Spring Creek NFH Chinook subyearlings.

Recommendation SC8: Continue to work with COE/BPA to establish a March spill to facilitate downstream passage of fall Chinook subyearlings from Spring Creek NFH and other populations.

Facilities/Operations

Issue SC9: Water source for the hatchery is an unsecured spring collection point adjacent to a state highway. There is a risk to the hatchery's water supply from highway accidents and vandalism. . *Text.*

Recommendation SC9: Work with engineering to design a cover and physical barrier that would protect the water supply from highway spills, vehicle intrusions, and potential vandalism.

Issue SC10: Water re-use system is not equipped with alarms that respond to water chemistry parameters for oxygen, ammonia, nitrates, nitrites, and pH levels. *Current system is over 20 years old and only measures water levels.*

Recommendation SC10: Upgrade water monitoring system to include electronic metering of critical water quality parameters with alarms to notify hatchery staff when levels exceed fish safety guidelines.

Issue SC11: Water flows into individual ponds cannot be currently measured.

Recommendation SC11: Install water flow meters on each pond. These new flow meters could be integrated into the upgraded monitoring system for the water re-use system.

[55] *Cited reference needed here.*

Issue SC12: Adult broodstock ponds are not fenced or equipped with intruder alarms. *Text.*

Recommendation SC12: Install security fence around broodstock ponds and intruder security alarms.

Research, Monitoring, and Accountability

Issue SC13: Spring Creek NFH is under funded for operations, maintenance, and M&E, and has insufficient funding for major maintenance and infrastructure improvements. There is currently a maintenance backlog of $1,259,470. The figure does not include rehab of the Big White Ponds with an estimated cost of $328,500.[56] *Spring Creek NFH is funded by 43% Mitchell Act and 57% John Day Dam mitigation/ACOE funding. This issue is primarily caused by a lack of Mitchell Act funding to cover program and facility costs, thus resulting in increasing gaps between funding needs and availability related to both inflation and increased aging of hatchery facilities. Fishery comanagers and partners have developed a Mitchell Act outreach team to address Mitchell Act facility and funding needs. John Day Dam mitigation funding levels are current for operations and maintenance; however, there is a lack of John Day Dam mitigation funds to cover M&E activities.*

Recommendation SC13: Adopt the funding levels developed by the outreach team including the development of a major maintenance budget that includes funding of the infrastructure improvements identified here in this report.

Issue SC14: Currently, at the Spring Creek NFH, 150,000 fish in a few raceways for each of the raceway series representing the three release groups of Chinook are tagged (e.g., three or four of 20 raceways). *Since the populations between raceways can be different (age and size) and the pond environments can differ slightly (flow and flow pattern) the practice of tagging fish in one raceway does not represent the entire population. In most NFH production programs salmon are spawned throughout the adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes" The fry are ponded by take/hatch date into a series of raceways that when fully populated differ in age of fish and size of fish (initially) between raceways. Production monitoring using coded-wire tags requires that the tags represent the entire population.*

Recommendation SC14: Consult with Columbia River Fisheries Program Office to develop a consistent tagging strategy that accurately represents the entire population of progeny from all spawn groups. For example, one approach could be to apply tags to 15,000 fish each in 10 of the 20 raceways.

Issue SC15: At Spring Creek NFH, DIT tag groups are not always applied to the same raceways. *Therefore, it is highly unlikely that the fish in the two groups are identical as required for the underlying statistical assumptions. "Double Index Tagged (DIT)" groups are paired coded-wire tagged groups that are reared and released in a similar manner and are identical with the exception that one of the groups in the pair is adipose clipped (marked) and the second is not clipped (unmarked)." (Joint Coho DIT Analysis Workgroup). DIT is used as a method to*

[56] *Data from SAMMS database.*

analyze the effects of selective fisheries. Different tag groups in different raceways violates the statistical assumptions.

Recommendation SC15: Consult with Columbia River Fisheries Program Office to develop a new DIT application strategy that ensures that the paired groups are identical fish (other than the fin clip). The paired groups should come from and reside in the same raceway(s).

Issue SC16: Peaks and troughs in return numbers make it difficult for Spring Creek NFH to collect broodstock representative of the returning population. *The current practice is to collect and fill enough fish for a minimum of one pond per day (one of 17 ponds) after the fish begin returning.*

Recommendation SC16: Implement PIT tag program to determine travel time of adults from Bonneville Dam to Spring Creek NFH. PIT tags could also provide information regarding the survival of outmigrating juveniles through the corner collector, juvenile bypass or turbines.

Issue SC17: The facility has no clearly defined M&E program.

Recommendation SC17: Develop a consistent and clearly defined M&E program and review on an annual basis (prior to ponding and coded-wire tagging of a broodyear).

Issue SC18: The "visioned" function, purpose, and membership of Hatchery Evaluation Teams (HET) as originally described during the "Fisheries: A Future Legacy"(USFWS, 1991) planning process have been inconsistently applied regarding hatchery evaluations and fish production modifications. *Meetings and communications between Service offices regarding the Spring Creek NFH fish program and evaluations are infrequent and often include "external partners." While external partner meetings (coordination meetings) are valuable and necessary, the HRT believes that internal Service meetings and communications regarding Service hatchery programs are valuable and necessary as well. The HRT recommendations below are based on the 1993 USFWS "Hatchery Evaluation Action Plan" with modifications by the HRT.*

Recommendation SC18: (a) Establish an internal hatchery evaluation team (HET) consisting of staff from the hatchery, the servicing fish health center, and the servicing fisheries program office; (b) the HET should meet twice annually - after smolts are released and before adults return, to discuss the fish program and evaluations. Discussion points of HET meetings should include results of on-going evaluations, evaluation plans and ideas, tagging/marking protocol and plans, adult and juvenile sampling, data management and reporting, fish program modifications, fish ponding, ponding densities, production numbers, spawn numbers, disposition of excess juveniles, fish health, and implementation of Hatchery Review Team recommendations, etc. The HET can meet more often as necessary to discuss specific fish program or evaluation issues. The HET shall record meeting minutes and distribute to the HET and the appropriate line manager in the Regional Office. The hatchery staff and HET should continue coordination meetings which involve comanagers and interested parties.

Education and Outreach

Issue SC19: The demands of the education and outreach program for the Lower Columbia I&E office located at Spring Creek NFH have increased. *This includes: a proposed visitors facility at Warm Springs NFH, new support needs for Eagle Creek NFH, continuing support for the Columbia Gorge NFHs and the fish health center, and additional regional outreach responsibilities.*

Recommendation SC19: Evaluate the future needs of the program in terms of both infrastructure support and personnel.

Alternatives to Current Program[57]

The Review Team considered the benefits and risks of the existing tule fall Chinook program at Spring Creek NFH and developed three alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted including reduction of the annual release size to 10.5 million. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified a recommended alternative (or alternatives).

Alternative 1: Current program with recommendations, including reduction of program to 10.5 million smolts

Continue production with on-station releases. This may or may not include other aspects of the Spring Creek reprogramming proposal.

Pros

- Contributes significantly to sport, tribal and commercial fisheries in the Columbia River and ocean harvest, including continental US (Washington and Oregon coastlines), British Columbia and Southeast Alaska.
- Indicator stock for the US/Canada Treaty and is a significant contributor to fisheries in Canadian waters.
- Program has relatively high productivity with a recruit per spawner rate of 8 recruits per spawner (BY 1990-1999).
- Program is largely a disease free stock and poses little disease risk to hatchery and wild stocks.
- Provides surplus adults for food banks and tribal subsistence and ceremonial purposes.

[57] *Alternatives with asterisks (*) were favored by the Review Team over alternatives without asterisks.*

- Use of local broodstock reduces demographic extinction risks to ESA-listed tule fall Chinook in the lower Columbia River Chinook ESU.

- Broodstock source for reestablishing upper Gorge and Big White Salmon (tule) fall Chinook populations.

- Reduction in program size will eliminate the need for an early release in March. This early release currently requires coordination with the COE and BPA to spill water at Bonneville Dam to facilitate juvenile downstream passage. That March spill poses risks to chum salmon redds downstream through nitrogen gas supersaturation and potential predation.

Cons

- Incidental take on other listed species in the intensive ocean and lower Columbia fisheries that target the Spring Creek NFH tule fall Chinook and other hatchery fall Chinook stocks.

- The large numbers of hatchery strays from Spring Creek NFH into Big White Salmon River and possible strays into other production areas in the Bonneville Pool may pose genetic and demographics risk to natural populations.

- Does not fully meet in-kind mitigation for John Day Dam.

Alternative 2: Replace Spring Creek NFH tule fall Chinook program with an upriver bright fall Chinook harvest program

Terminate the existing Spring Creek NFH tule fall Chinook program and implement an upriver bright fall Chinook program (10.5 M subyearling smolts).

Pros

- Better meets in-kind mitigation for John Day Dam.

- Contributes to sport and tribal fisheries in Columbia River and ocean harvest. Upriver bright fall Chinook are sought after for harvest, particularly by tribal fishers, because they return at a time and condition that makes the salmon very valuable.

- Contributes more harvest to southeast Alaska compared to tule fall Chinook.

- Program has relatively high productivity with a recruit per spawner rate of 7.6 recruits per spawner (BY 1990-1999).

Cons

- Greater disease risk with upriver bright fall Chinook, especially since Spring Creek NFH relies on reuse water.

- Eliminates the only remaining tule fall Chinook (ESA-listed) hatchery stock above Bonneville Dam.

- Increased risk of straying of out-of-basin stock into listed lower Columbia populations.
- Contribute less to the ocean fishery off of the coast of Washington and Oregon compared to Spring Creek NFH tule fall Chinook.
- Tag recovery efforts are diluted due to lack of cooperation by Alaska and Canada compared to recovery efforts along the Washington and Oregon coast

Alternative 3: Continue tule fall Chinook production as described in Alternative 1 and accommodate hatchery production for restoration of naturally spawning populations in the Big White Salmon River (emphasis on tule fall Chinook reintroduction)

Use the facility to rear fish for reintroduction of native species in the Big White Salmon River after the removal of Condit Dam. This could include spring Chinook, tule fall Chinook, coho, chum, bull trout and steelhead, although tule fall Chinook would most likely be the species of choice based on culture history at Spring Creek NFH. This would also include the recommendations for rehabilitation of Big White Ponds and the reconstruction of a conservation weir for broodstock collection and management of the naturally spawning population on the Big White Salmon River (see Spring Creek NFH tule fall Chinook current program recommendations).

Spring Creek NFH has egg incubation and early rearing capabilities, and offsite incubation/rearing capabilities at Big White Ponds. Given the current water reuse system at Spring Creek NFH, only tule fall Chinook should be considered for full-term rearing on station.

Program size would be up to 350,000 subyearlings to return 1,000 adults based on an average survival rate of 0.3%

Pros

- The number of facilities with a diverse array of rearing environments in relative close proximity to the Big White Salmon River makes Carson NFH, Spring Creek NFH, Big White Ponds, Little White Salmon NFH and Willard NFH attractive sites for rearing fish for reintroduction.
- The removal of Condit Dam offers a unique opportunity in the Columbia River Basin to test a large-scale reintroduction project of an entire river system.
- Offers the opportunity to jump-start populations in the Big White Salmon River that were depleted or extirpated by the construction of Condit Dam and later, of Bonneville Dam.
- Provides a broodstock collection and acclimation site at Big White Ponds on the Big White Salmon River and allows for the control of hatchery influence on the natural populations in the Big White Salmon River.
- Spring Creek NFH hatchery tule fall Chinook have been identified by the Lower Columbia TRT as a potential broodstock source for reintroduction of tule fall Chinook in the Big White Salmon River.

Cons

- Spring Creek NFH is limited as not all species are suitable for rearing on a water reuse system, and the use of water reuse systems are less desirable for rearing multiple species at once.
- May reduce the amount of rearing space available for the current production of fish for ocean treaty harvest and Columbia River harvest.
- The cost of the construction, operation and maintenance of a conservation weir, the rehabilitation of Big White Ponds and other facility improvements is high.
- May increase the risk of disease transfer within the hatchery.

Alternative 4: Terminate the program and decommission the facility

Pros

- Reduces incidental take on other listed species in the intensive ocean and lower Columbia fisheries that target the Spring Creek NFH tule fall Chinook.
- Eliminates hatchery strays from Spring Creek NFH into Big White Salmon River and possible strays into other production areas in the Bonneville Pool.
- Eliminates the need for coordination with COE/BPA to have spills and favorable juvenile passage conditions through Bonneville Dam in March.
- Eliminates the March spill that poses a potential risk to chum redds through nitrogen gas supersaturation and potential predation in the lower Columbia mainstem caused by the flow increased at Bonneville Dam to accommodate for the release of Spring Creek NFH tule fall Chinook.

Cons

- Significantly reduces contribution to sport, tribal and commercial fisheries in the Columbia River and ocean harvest, including continental US (Washington and Oregon coastlines), British Columbia and Southeast Alaska.
- Surplus tule fall Chinook adults would not be available for food banks and tribal subsistence and ceremonial purposes.
- Eliminates a mitigation hatchery program with high productivity.
- Increases the demographic extinction risks to ESA-listed tule fall Chinook in the lower Columbia River Chinook ESU by eliminating this broodstock.
- Eliminates an important broodstock source for reestablishing upper Gorge and Big White Salmon tule fall Chinook populations.
- Reduces the Service's outreach capabilities for the Gorge region.

Recommended Alternatives

Short-term goal (up to 15 years): Continue tule fall Chinook production as described in alternative 1 and accommodate hatchery production for restoration of naturally spawning fall Chinook in the Big White Salmon River as described in alternative 3.

This alternative would include a mitigation program reduction to 10.5 million fall Chinook smolts for on-station release. This would be compatible with the current Spring Creek reprogramming proposal but would also be compatible with proposals for modification to current John Day mitigation strategies which would call for all upriver bright fall Chinook hatchery releases to be moved further upriver.

The conservation element of this proposal is linked to restoration strategies for the Big White Salmon watershed following the planned removal of Condit Dam. Design of this program would be based on ongoing genetic studies to determine level of potential divergence between Spring Creek NFH broodstock and natural origin tule fall Chinook in the Big White Salmon River. The initial stage of implementation could incorporate a rescue program, taking naturally spawning adults from the Big White Salmon prior to Condit Dam removal. The broodstock would be collected on the Big White Salmon, offspring would be differentially marked and released back into the Big White Salmon to bridge the period of adverse effects of high sediment load following dam removal. Alternately, tule fall Chinook returns to Spring Creek NFH could be used as initial broodstock for outplanting in the Big White Salmon. Over time, a conservation weir on Big White Salmon would then be used to collect broodstock as well as exclude hatchery strays from the natural production area.

The fall Chinook conservation program would be of limited duration: It would likely last for approximately 3 generations (up to 12 years). Optimally, the outplanting program would decrease in size over time as the size of the naturally spawning population increases. Initial program size would be up to 350,000 subyearlings intended to return 1,000 adults based on an average survival rate of .3%

Alternative management operations of the ladder at Spring Creek NFH should be considered as a means of further reducing possible effects of fall Chinook hatchery strays on natural production areas within Bonneville Pool.

Big White Salmon ponds have the capability to assist with restoration of other species including spring Chinook, winter steelhead, coho, and chum salmon. Present steelhead and coho populations in the Big White Salmon are most likely to increase in numbers without use of hatchery supplementation. Spring Chinook and chum will require reintroduction methods requiring the use of incubation, rearing, and acclimation capabilities. Continued discussion and coordination with co-managers will be required to determine such possible conservation roles for Service facilities.

Long-term goal (15+ years): Continue recommended mitigation hatchery program (Alternative 1), including a revaluation of regional management priorities, and continued implementation of methods for managing tule fall Chinook strays in the Bonneville Pool so that the program is consistent with conservation and recovery objectives of the region.

VI. Little White Salmon River Watershed[58]

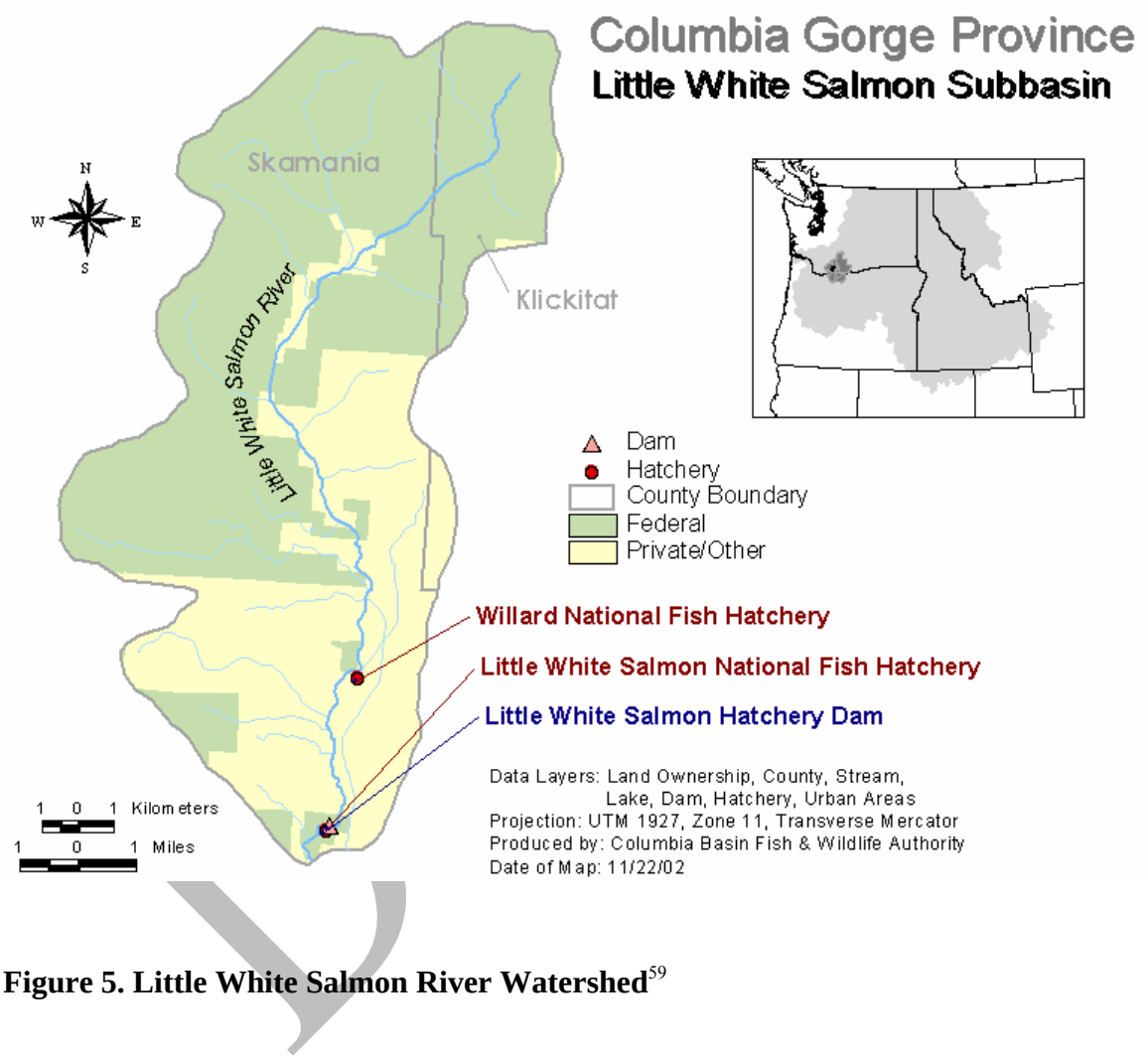


Figure 5. Little White Salmon River Watershed[59]

[58] *Primary source documents for information in this section include:*
[59] *APRE Columbia Gorge Province Report - http://www.nwcouncil.org/fw/apre/provincereports/Columbia%20Gorge%20Province%20Report.doc*

Little White Salmon River Overview

Watershed Description[60]

The headwaters of the Little White Salmon River originate *just east of the Cascade crest* in south central Washington. The basin encompasses approximately 136 square miles and enters the Columbia River at Drano Lake at RM 162. Anadromous fish use is limited in this basin, with only about 500 meters of available habitat in the lower river. Basin topography varies from gentle slopes formed by l*ava flows and volcanic cones to* steep, rugged landforms (WDFW 1990). The basin drains the Indian Heaven Wilderness and the Monte Cristo Range, which lie in the northwest and northeast portions of the basin, respectively. A major feature is the Big Lava Bed, comprising a large area in the western portion of the subbasin. The geology of this area, and the Indian Heaven Wilderness to the north, consists of relatively young quaternary basalt/andesite flows, of which the Big Lava Bed is a recent (8,000 years ago) example. The area in and around the Monte Cristo Range, on the other hand, is made up of older, tertiary deposits of volcanic tuff and pyroclastic flows. This area makes up much of the mainstem of the Little White Salmon and is susceptible to large, deep seated landslides due to decomposition of the older deposits into silts and clays (USFS 1995). Deep soils of glacial origin are present in alluvial deposits in valley bottoms. These soils also tend to be susceptible to deep-seated landslides. Elevation in the basin ranges from 5,300 feet to 50 feet at the mouth. The major tributaries to the Little White Salmon are Rock Creek, Lava Creek, Moss Creek, Wilson Creek, Cabbage Creek, Berry Creek, Homes Creek, Lusk Creek, and Beetle Creek.

Fisheries[61]

Spring Chinook Harvest

- Spring Chinook are harvested in ocean commercial and recreational fisheries from Oregon to Alaska, in addition to Columbia River commercial and sport fisheries.
- CWT analysis indicated that upriver spring Chinook are impacted less by ocean fisheries than lower Columbia River Chinook stocks.
- From 1938-1973, about 55% of upriver spring Chinook runs were harvested in directed Columbia River commercial and sport fisheries; from 1975-2000 (excluding 1977), no lower river fisheries have targeted upriver stocks and the combined Indian and non-Indian harvest rate was limited to 11% or less.
- Beginning in 2001, selective fisheries and abundance based management agreement through US v. Oregon, has enabled an increase in Columbia harvest of hatchery spring Chinook. WDFW and the Yakama Indian Nation negotiate an annual harvest plan for sharing the Little White Salmon

[60] *from - Vol. II , Chapter K – Little White Salmon; Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plans, Dec., 2004 unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report).*

[61] *from - Vol. II , Chapter K – Little White Salmon; Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plans, Dec., 2004 unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report).*

Hatchery surplus between the sport fishery and tribal commercial and subsistence fisheries in Drano Lake.

- Sport harvest in Drano Lake from 1993-2002 averaged 1,847, with a record 6,495 harvested in 2002.

- Tribal harvest and hatchery subsistence distributions have averaged 3,175 during 1993-2002.

Fall Chinook Harvest

- Fall Chinook are harvested in ocean commercial and recreational fisheries from Oregon to Alaska, in addition to Columbia River commercial gill net and sport fisheries.

- URB fall Chinook migrate farther North in the ocean than lower Columbia Chinook, with most ocean harvest occurring in Alaska and Canada.

- URB fall Chinook are also an important sport fish in the mainstem Columbia from the mouth upstream to the Hanford Reach, and an important commercial fish from August-early October.

- Fall Chinook originating upstream of Bonneville Dam are subject to Federal Court Agreements regarding Indian and non-Indian harvest sharing.

- CWT data analysis of the 1989-1994 brood years suggests that the majority of the URB fall Chinook harvest occurred in Alaska (24%), British Columbia (23%), and mainstem Columbia River (42%) fisheries.

- Columbia River harvest of URB fall Chinook is limited to 31.29% (23.04% Indian/ 8.25% non-Indian) based on ESA limits for Snake River wild Chinook.

- Fall Chinook that pass Bonneville Dam are also harvested in Treaty Indian commercial and subsistence fisheries in August and September.

- Sport harvest in the Little White Salmon River averaged 45 fall Chinook annually from 1985-1987.

Conservation[62]

Focal salmonid species in Little White Salmon River watersheds include fall Chinook and chum. When considering biological objectives for recovery, The fall Chinook are combined with Wind River fall Chinook to form the upper Gorge fall Chinook population and the chum are combined with the Wind and upper Gorge tributary chum to form the upper Gorge chum population. Bull trout do not occur in the subbasin. Salmon numbers have declined to only a fraction of historical levels (Table 1). Extinction risks are significant for the focal species – the current health or viability is very low for chum and low for fall Chinook.

[62] *from - Vol. II , Chapter K – Little White Salmon; Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plans, Dec., 2004 unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report).*

Focal Species	ESA Status	Hatchery Component[1]	Historical numbers[2]	Recent numbers[3]	Current viability[4]	Extinction risk[5]
Fall Chinook	Threatened	Yes	4,000 – 5,000	100-200	Low	~50%
Chum	Threatened	No	Unknown	<100	Very Low	~70%

[1] *Significant numbers of hatchery fish are released in the subbasin.*
[2] *Historical population size inferred from presumed habitat conditions using Ecosystem Diagnosis and Treatment Model and NOAA back-of-envelope calculations.*
[3] *Approximate current annual range in number of naturally-produced fish returning to the subbasin.*
[4] *Prospects for long term persistence based on criteria developed by the NOAA Technical Recovery Team.*
[5] *Probability of extinction within 100 years corresponding to estimated viability*

Habitat[63]

Decades of human activity have significantly altered watershed processes and reduced both the quality and quantity of habitat needed to sustain viable populations of salmon and steelhead. There is currently very little habitat available to anadromous fish in the Little White Salmon Subbasin. Historically, anadromous fish could ascend only as far as RM 2, where a barrier falls (Spirit Falls) blocked upstream passage. Approximately 1 mile of this historically available habitat was impounded by Bonneville Dam and is now Drano Lake. The remaining two miles are currently blocked by the barrier dam at the Little White Salmon National Fish Hatchery. No fish are passed above the barrier dam due to limited available habitat and a concern of the effects of naturally-spawning fish introducing pathogens to the hatchery.

Anadromous fish passage is naturally blocked on the mainstem by a falls at river mile (RM) 2; however, a few fish are believed to ascend to a larger falls at RM 2.5 – 3. Most natural anadromous spawning occurs in only approximately 400-500 meters of river habitat that is available downstream of the falls and above Drano Lake. High temperatures and other conditions in Drano Lake might affect passage. Two dams restrict passage in the basin. One is located near the mouth of the Little White Salmon, at the Little White Salmon Fish Hatchery, and the other is located on Lost Creek (north) adjacent to a diversion intake. A culvert survey in 1995 revealed that 15 of 26 culverts presented barriers to resident fish, though more information is needed (USFS 1995).

Current Status of Salmonid Stocks

The co-managers have identified 9 principal salmonid stocks in the Little White Salmon River and at the hatchery, one of which (tule fall Chinook salmon) considered severely depressed or extirpated and another considered extirpated (chum salmon).

- Tule fall Chinook salmon (natural, severely depressed or extirpated)
- Upriver bright fall Chinook (segregated hatchery)

[63] *from - Vol. II , Chapter K – Little White Salmon; Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plans, Dec., 2004 unless otherwise noted (Posted as document number ## on the Review Team's web site. See also Appendix B of this report).*

- Chum salmon (natural, extirpated?)
- Coho salmon (segregated hatchery)
- Spring Chinook salmon (segregated hatchery)
- White River Spring Chinook salmon (captive broodstock for Wenatchee River, WA)
- Cutthroat trout (natural)
- Rainbow trout (natural)
- Rainbow trout (segregated hatchery; WDFW plants 3,500 upstream of the hatchery in June)

The following tables summarize the current status and management premises of those stocks, as identified by the co-managers. Habitat assessments were obtained from: Northwest Power and Conservation Council. 2004. Little White Salmon River Subbasin Plan. Available at: www.nwcouncil.org/fw/subbasinplanning.

Population viability from Technical Recovery Team, July 2004 report. Status evaluation of salmon and steelhead populations in the Willamette and Lower Columbia River Available at:www.nwr.noaa.gov/salmon-recovery-planning.

Note: The following tables are still being developed.

Table 21. Little White Salmon River tule fall Chinook

Management Premises and Goals	
ESA Status	*Threatened. Lower Columbia River ESU.*
Biological Significance	*Low*. There are few intact spawning areas remaining for the Columbia River Gorge populations (TRT 2004). Primary spawner counts are from the Wind River. Heavily influenced by spawning of out of ESU hatchery fish (upriver bright) from Bonneville hatchery and Little White Salmon NFH and tules from Spring Creek NFH.
Population Viability	*Very Low.* TRT score for the upper Gorge Fall-run (Washington) strata is 0.85 (either extinct or high risk of extinction).
Habitat	*Very Low.* Historical abundance estimated at 4,000 to 5,000 adult fish, with current natural production estimated at 100 to 200 adult fish, heavily influenced by spawning of hatchery fish. Bonneville Dam inundated the primary habitat in the river (lower 2 miles). Spawning now restricted to ¼ mile stretch just downstream of the hatchery. Smolt capacity now estimated at 73,652 smolts (Little White Salmon River Subbasin Plan 2004).
Harvest	*Moderately High.* Harvested at similar rate as tule fall Chinook from Spring Creek NFH.

Table 22. Little White Salmon River hatchery spring Chinook (Little White Salmon NFH)

Management Premises and Goals	
ESA Status	*Not Listed.*
Biological Significance	*Low to medium.* This is an introduced hatchery stock. Spring Chinook salmon were either not native or very limited distribution in the Little White Salmon River. This hatchery stock has been and is used for reintroducing spring Chinook salmon into watersheds where the native population was extirpated, for example Umatilla and Walla Walla rivers in eastern Oregon.
Population Viability	*Moderately High.* A 10-year average of > 3 recruits per spawner for brood years 1990-99.
Habitat	*No spawning habitat. Rearing habitat in hatchery and Drano Lake.*
Harvest	*High.* Based on coded-wire tag recoveries, an average 1,289 fish were harvested, broodyear 1990-99 10-year average. It appears that coded-wire tag recoveries are under-reported for the Drano Lake fishery, where the average sport catch was estimated at 1,861 and the average tribal catch was estimated at 2,026 for return years 1994-2003 (Joe Hymer, WDFW, written communication). Over this same 10-year period, an average 1,276 were also surplus hatchery returns distributed to the Yakama Nation for food.
Hatchery Program	
Facilities	Little White Salmon NFH.
Type	Segregated.
Authorization and Funding	Mitchell Act.
Primary Purpose	Harvest.
Secondary Purposes	Re-introduction to areas upstream of Bonneville Dam.
Broodstock Origin(s)	Wild Spring Chinook salmon passing Bonneville Dam, 1955-64 (Carson stock).

Table 23. Little White Salmon River hatchery upriver bright fall Chinook (Little White Salmon NFH)

Management Premises and Goals	
ESA Status	*Not Listed.*
Biological Significance	*Low.* This is an introduced hatchery stock. Upriver bright fall Chinook salmon were not native in the Little White Salmon River. This hatchery population has been and is used for stocking Chinook salmon into watersheds where the native population was extirpated or depressed, for example Umatilla and Yakima rivers in eastern Oregon and Washington, respectively.
Population Viability	*High.* A 10-year average of approximately 8 recruits per spawner for broodyears 1990-99.
Habitat	*Very Low.* Bonneville Dam inundated the primary habitat for tule fall Chinook in the river (lower 2 miles). Spawning now restricted to ¼ mile stretch just downstream of the hatchery. Chinook smolt capacity now estimated at 73,652 smolts (Little White Salmon River Subbasin Plan 2004).
Harvest	*High.* Based on coded-wire tag recoveries, an average 1,227 fish were harvested in the Columbia River and 1,973 were harvested in the ocean, broodyear 1990-99 10-year average. Coded-wire tag recoveries may be under-reported for the Drano Lake fishery, where the average sport catch was estimated at 467 for return years 1994-2003 (Joe Hymer, WDFW, written communication). A tribal fishery is relatively new for fall Chinook salmon in Drano Lake, with 3,571 harvested in 2004 and 3,866 harvested in 2005 (Roger Dick Jr., Yakama Nation, communication).
Hatchery Program	
Facilities	Little White Salmon NFH.
Type	Segregated.
Authorization and Funding	Mitchell Act and John Day Dam mitigation.
Primary Purpose	Harvest.
Secondary Purposes	Stocking into areas upstream of John Day Dam (Yakima River, Washington).
Broodstock Origin(s)	Bonneville Hatchery in 1988 (upriver bright stock (wild) initially trapped & spawned at Bonneville Dam in 1977).

Table 24. Little White Salmon River hatchery coho (Willard NFH)

Management Premises and Goals	
ESA Status	*Not Listed.*
Biological Significance	*Low:* Returns to Little White Salmon NFH – discontinued in 2004. *Moderate to High:* Re-establishing runs to Yakima River (transferred to Eagle Creek NFH in 2004) and Wenatchee River (started in 2001 and now using adult returns to the Wenatchee River for broodstock).
Population Viability	*Moderate.* Smolt to adult survival rates for the on-station release from Little White Salmon NFH ranged from 0.1% to 1.1%, broodyears 1992-2001.
Habitat	*Very Low* (Little White Salmon River). *Moderate to High* (Upper Columbia River (Yakima, Wenatchee, and Methow))
Harvest	*Moderate.* 35% of the coded-wire tag recoveries were from fisheries in the ocean and Columbia River, broodyear 1981 to 2001 (65% of recoveries were at the hatchery).
Hatchery Program	
Facilities	Willard NFH.
Type	Segregated.
Authorization and Funding	Mitchell Act.
Primary Purpose	Harvest.
Secondary Purposes	Re-introduction for Yakima Nation program. Formerly Yakima River, now Wenatchee River, Washington.
Broodstock Origin(s)	Toutle River stock, established 1956.

Table 25. White River hatchery spring Chinook – juvenile rearing (Willard NFH)

Management Premises and Goals	
ESA Status	*Endangered.*
Biological Significance	*High.*
Population Viability	Low.
Habitat	Low.
Harvest	*Low.*
Hatchery Program	
Facilities	Willard NFH, Little White Salmon NFH, Carson Depot Springs, Entiat NFH, Aquaseed Inc. private hatchery
Type	Captive (F1). 150,000 smolts from F2 generation.
Authorization and Funding	ESA. Grant County PUD.
Primary Purpose	Conservation.
Secondary Purposes	
Broodstock Origin(s)	White River eggs (redd pumping) through 2009, upper tributary to the Wenatchee River, upstream of Lake Wenatchee, Washington.

Other Species of Concern

Table 26. Additional salmon and non-salmonid native fish species present in the Little White Salmon River[64]

Common name	Scientific Name
Salmonid	
Mountain whitefish	*Prosopium williamsoni*
Cutthroat trout	*Oncorhynchus clarki*
Non-Salmonid	
White Sturgeon	*Acipenser transmontanus*
Pacific lamprey	*Lampetra Tridenata*
Longnose dace	*Rhinichthys cataractae*
Speckled dace	*Rhinichthys osculus*
Redside shiner	*Richardsonius balteatus*
Sculpins	*Cottus* sp.
Three-spine stickleback	*Gasterosteus aculeatus*

There are no known ESA listed natural populations in the Little White Salmon River.

Salmon and Steelhead Hatcheries in the Watershed[65]

Little White Salmon and Willard National Fish Hatchery Complex (U.S. Fish and Wildlife Service)

Little White Salmon NFH is located in south-central Washington one mile upstream of the mouth of the Little White Salmon River. The Little White Salmon River joins the Columbia River at river mile 162. Drano Lake, a natural impoundment at the mouth of the river, is a popular sport and tribal fishing area. The hatchery encompasses 433 acres of land including easements. A natural barrier falls immediately upstream of the hatchery precludes upstream migration of salmon and steelhead.

The Little White Salmon NFH was placed in operation following official Congressional authorization in 1898 with the intent to supplement the commercial fishing industry. The hatchery's role expanded during the 1930's under the Mitchell Act to one of mitigation for the loss of habitat due to the completion of Bonneville Dam in 1938.

The Little White Salmon NFH propagates of two stocks of Chinook salmon for on-station release and off-site transfers to provide harvest or conservation benefits as mitigation for hydropower dams on the Columbia River: "*upriver bright*" (URB) fall Chinook and *Carson-strain* spring Chinook.

[64] *Cite*
[65] *See Figure 3.*

Willard NFH is located on the Little White Salmon River approximately five miles upstream of the Little White Salmon NFH. A barrier falls immediately upstream of the Little White Salmon NFH precludes upstream migration of salmon and steelhead to the Willard NFH. However, Willard NFH can release juvenile salmonids which migrate downstream over the falls to the Columbia River. In the past, adult broodstock were collected and spawned at Little White Salmon NFH, and the fertilized were eggs transported to Willard NFH for incubation, hatch, and rearing prior to release. The Columbia River Research Laboratory, a satellite research station of the Western Fisheries Research Center, U.S. Geological Survey (USGS), Seattle, WA, is co-located adjacent to Willard NFH (Cook, WA). Willard NFH was authorized by an amendment to the Mitchell Act to mitigate for fisheries lost due to the construction and operation of hydroelectric dams on the Columbia River. The earliest reports available indicate that the Willard was initially planned and constructed as a fall Chinook facility. However, the very cold water temperatures at Willard NFH inhibited the rearing of fall Chinook, but those temperatures were adequate for rearing coho salmon and spring Chinook.

For many years, 1.0 million yearling coho salmon were released on site annually, with brood stock collection at Little White Salmon NFH. Also 500,000 coho salmon had been released annually in the Yakima River as part of the Yakama Nation's coho reintroduction program, but responsibility for that program was transferred to Eagle Creek NFH, OR in 2004 due to funding shortfalls in the Mitchell Act, shifting priorities, and termination of on-station releases in 2004. Since 2004, no fish have been released into the Little White Salmon River from Willard NFH.

The hatchery currently rears coho salmon, in support of the Yakama Nation's coho reintroduction program in the Wenatchee River, and White River spring Chinook in support of a captive breeding program to recover an endangered natural population in the Wenatchee River basin. This latter program is not reviewed here because it was transferred to Willard NFH only recently (2006).

In 1975, the Little White Salmon NFH and Willard NFH were administratively combined to form the Little White Salmon/Willard NFH Complex (Complex). Administration of the Complex occurs at the Little White Salmon facility. Complex facilities are managed, staffed, and budgeted as a single entity. The Complex has 12 full-time employees, three of which are stationed at Willard NFH. The staff includes the Complex Manager, Deputy Complex Manager, Hatchery Manager at Willard NFH, two Fishery Biologists, a Maintenance Worker, and five Animal Caretakers.

Operational budget for the complex in 2006 was $1,211,424. M & E costs for 2006 was approximately $422,227 (includes $274,966 and $122,261 for tagging at Little White Salmon NFH and Willard NFH, respectively).

Funding Source	**Amount**
NOAA- Fisheries(Mitchell Act)	$774,376
Bonneville Power Administration	$207,389
Corps of Engineers	$63,699
FWS Quarters	$90,213
FWS Hatchery Cyclical Maintenance	$75,747
Total	$1,211,424

Capital Improvements to the Little White Salmon NFH Complex have totaled $7,055,475 during the period 2000- 2006.

Little White Salmon NFH Upriver Bright (URB) Fall Chinook

Operator: U.S. Fish and Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal***: Support commercial, tribal, and recreational fisheries in marine waters, the lower Columbia River, Drano Lake, and the Yakima River. Achieve a 10-year average of 0.4% smolt-to-adult survival that includes harvest plus escapement back to the hatchery. Although not specifically stated as a program goal, the desired survival would lead to a mean harvest goal of approximately 3,200 adult URB fall Chinook annually based on the current size of the program.

- ***Broodstock escapement goal***: Provide an escapement back to the hatchery of at least 930 hatchery-origin adult female fall Chinook (1,937 adults total). Achieve a 0.1% smolt-to-adult return rate back to the hatchery to provide sufficient numbers of adult fish for brood stock.

- ***Conservation goal***: The hatchery program has no direct conservation goals within the Little White Salmon River. Upriver bright fall Chinook are not native to the Little White Salmon River and are not part of the lower Columbia River Chinook ESU. However, releases of URB fall Chinook in the Yakima River are intended to help restore a natural population via supplementation natural spawning.

- ***Escapement goal for natural-origin adults***: Not applicable in the Little White Salmon River. A natural population of upriver bright fall Chinook salmon does not exist in the Little White Salmon River.

- ***Research, education, and outreach goals***: No specific short or long term goals, plans, or programs currently exist.

Objectives

- Trap and spawn a minimum of 1,937 adult URB fall Chinook.(minimum 930 spawned females) to yield a minimum of 4.46 million green eggs.

- Release 2.0 million subyearling smolts directly from the hatchery into the Little White Salmon River (U.S. v. Oregon agreement).

- Transfer 1.7 million subyearlings to the Yakama Nation's Prosser Hatchery acclimation ponds between February and the first week of April for release into the Yakima River

Program Description

Development of the "mid-Columbia" or Columbia Gorge URB fall Chinook brood stock was initiated in 1977 when adult URB fall Chinook migrating upstream were trapped from the Bonneville Dam fish ladder and spawned at Bonneville Hatchery. An upriver bright fall Chinook program was established at Little White Salmon/Willard complex in 1988. However, in 1998, eyed eggs were imported from Klickitat, Lyons Ferry, Bonneville, Priest Rapids, and Umatilla hatcheries to make up for eggs lost to mechanical failures. Returning adults are spawned in the fall, and their progeny are released (into the Little White Salmon River) or transferred (to the Yakima River) the following spring as subyearlings.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- A barrier dam/weir on the Little White Salmon River diverts adults into an access ladder and adult holding pond. The ladder is pulsed until about October 20 so that excess adults to program needs are available to the terminal fishery in Drano Lake. After that time, the ladder is left open 24 hours throughout the return to reduce straying to the Big White Salmon River. This latter protocol began in 2006

- Stock is excluded from the Lower Columbia River Chinook Salmon ESU.

Hatchery and Natural Spawning, Adult Returns

- Avg. egg take = 5.5M/year (1990-2001) Avg. number of adults spawned 1990-2001 = 2,320 (avg. no. of females 1, 204). Avg. No. of males = 1, 116. 3.5% of the males are jacks (2-years old). (4,800 – 5,000 eggs/female). Approx. 48% females. From 1990 to 2001 an average of 5,429,289 eggs (range 4,192,595 – 6,675,395) have been taken from fish returning to the hatchery

- Harvest and returns from this release average (for broodyears 1990-1999): hatchery recoveries 38% (3,131), Columbia River harvest 15% (1,227), ocean harvest 24% (1,973), spawning ground 22% (1,827).

- 5.5 M eggs = avg. egg take (1990-2001)

- 4,800 eggs/female = fecundity

- Adults are randomly spawned pairwise (1:1); up to 5% of the males are jacks (2-year old males).

- Spawning occurs from mid-Sept. to late October.

- 10% of the reported tag recoveries occurred upstream (Columbia River) of the hatchery. Nearly 80% of upstream recoveries occurred in the Big White Salmon River.

- Avg. SAR to the hatchery = 0.22%, BY1982-2001.
- Less than 40% of CWT recoveries occur at the hatchery.
- Need to understand genetic risks of straying and natural spawning of stray URB within the historic range of tule fall Chinook. This is of particular interest in the Big White Salmon River where post Condit dam removal and identification/selection of the appropriate tule stock for restoration in the river is yet to be decided. Genetic analyses is currently being pursued; however, M&E funding is limited.
- Contribute to U.S. Canada treaty numbers.
- Average for broodyears 1990-1999: hatchery recoveries 38% (3,131), Columbia River harvest 15% (1,227), ocean harvest 24% (1,973), spawning ground 22% (1,827).
- *For Prosser Hatchery component:* Average for broodyears 1990-1999 (excluding BY 1991-1993): hatchery recoveries 0.1% (8), Columbia River harvest 32% (1,605), ocean harvest 33% (1,677), spawning ground 35%% (1,750).

Incubation and Rearing

- Excess eggs are buried on station.
- Trays are initially loaded at 1 female per tray (average of 4,800 eggs per tray). Then after shocking and enumeration, 5000 eggs are loaded per tray.
- Eggs are incubated with single pass spring and well water and then supplemented with river water as needed to control temperature. Incubation temperature is 42-48 degrees. Flows are 3 gpm initially and 5gpm after first hatch.
- After hatch and yolk-sac absorption, fry are transferred directly to outdoor ponds (1,750 TUs required).
- Transfers of fish to Yakama Nation occurs during the first week of April right after they are marked. (200,000 AD + CWT).
- Predation and possible disease transmittance within the facility is a possibility from otters (Lontra canadensis) and to a lesser extent mink (Mustela vison) and American Water Dipper (Cinclus mexicanus).

Release and Outmigration

- 400k of the 2.0 M Chinook released on station are CWT (200k AD + CWT, 200k CWT only). The remainder are ad-fin clipped only. 100% Ad-fin clipping began in 2005. 200k of the 1.7M Chinook transferred to Yakima River also have Ad-fin clips and CWTs.
- Release size objective = 90 fish/lb. This release size objective is based on other Chinook programs and has not been evaluated specific to little White Salmon NFH.

- The screens are pulled 24 hours before the fish are force released.

Facilities and Operations

- There are twenty-two 110' x 10' wide raceways with baffles that have catwalks several feet above the raceways which are approximately three feet deep with water. OSHA has approved the raceways as they are currently operated.

- Remote incubation facility (Carson Depot Springs) does not meet effluent standards for an isolation facility. Approximately three years ago, security alarm systems at Carson Depot were upgraded; however, given its location away from the main facility, security remains an issue. There are also human health and safety issues. The water alarms are okay.

- Carson Depot springs incubation facility is on leased property with no security fence. The building has been broken into with no damage inside. Intruder alarm on building but has no water alarms.

- Pollution abatement vault is currently insufficient for larger volumes of water and restricts cleaning procedures; however, effluent water has always complied with NPDES standards.

- Reliance on reimbursable funding, funding shortfalls have resulted in program reductions (i.e. Willard coho harvest program). Mitchell Act does not pay for facility renovations or maintenance. Program improvements may not occur because of lack of reimbursable funding to cover those costs.

- Spawning area would need to be increased if reprogramming of Spring Creek occurs and increased production of URB at LWS occurs Reprogramming would require the handling of twice the adults currently processed. Also, returning mass marked adults will require electronic sampling devices that will not fit into the current spawning area.

- Electro-anesthesia proposed for increased program size of URB due to Spring Creek reprogramming.

- Inline flow meters would allow spring water use to be monitored.

- Washington Department of Fish and Wildlife plants trout upstream of the anadromous barrier. The screen on the water intake for LWS is inadequate for avoiding entrainment of juvenile fish and may be a source of disease transmission to the hatchery.

- USGS research facility (Cook Lab) located just downstream of the Willard NFH and upstream of LWS NFH brings in foreign fish for research, but effluent water goes through an ozonator and is chlorinated before the water enters an abatement pond. Constant import of fish for on-station research poses fish health risks.

Research, Education, and Outreach

- M&E support from reimbursable sources is inadequate. Funding is inadequate. For example, funds for PIT tags is not available.

- Visitors area is a plus but it could use enhancements. Also, on-station outreach programs/plans are a low priority relative to proposed program changes.

- Participating in a Mitchell Act funding outreach team.
- Mitchell Act does not fund M&E activities. Needed for understanding genetic risks of releasing URB in Bonneville pool areas.
- Hatchery personnel maintain limited contact with the public and outside groups.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[66] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- Upriver brights are sought after for harvest, particularly by tribal fishers, because they return at a time and condition that makes the salmon very valuable.
- Terminal tribal fishery in Drano Lake provided 3,571 (2004) and 3,866 (2005). The tribal portion of this fishery has been going on since ???? (fill in year)….. In 2006, 600 fish were harvested in the sport fishery in Drano Lake.
- Provides harvest benefits of: Columbia River harvest 15% (1,227), ocean harvest 24% (1,973) (data from BY 1990-1999). Ocean harvest predominantly occurs in Alaska and British Columbia.

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest and surplus adults trapped at the hatchery provide a cultural benefit to Columbia River tribes. Excess adults provided to tribes for ceremonial and subsistence purposes.
- The visitor facilities support 5,000 visitors per year that pass through the hatchery.
- Little White Salmon NFH staff make presentations about the facility to local clubs and organizations.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[67] the Review Team identified the following benefits of this program:

[66] *See Components of This Report for a description of these potential benefits and risks.*
[67] *Ibid.*

Harvest Benefits

- Provides harvest benefits of: Columbia River harvest 15% (1,227), ocean harvest 24% (1,973) (data from BY 1990-1999). Ocean harvest predominantly occurs in Alaska and British Columbia.

- *For Prosser Hatchery component:* Average for broodyears 1990-1999 (excluding BY 1991-1993): hatchery recoveries 0.1% (8), Columbia River harvest 32% (1,605), ocean harvest 33% (1,677), spawning ground 35%% (1,750).

Conservation Benefits

- None identified.

Research, Education, Outreach and Cultural Benefits

- Double index tagging provides harvest exploitation rates on wild stocks in the Columbia River. This may be useful for evaluating selective fisheries.

- Little White Salmon River and Drano Lake are considered a wildlife viewing area. Wildlife is attracted to the area to take advantage of adult carcasses.

- Tribal harvest of fish released at Prosser provide a cultural benefit to Columbia River tribes.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[68] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- Adults are not randomly collected throughout the entire run.

Demographic Risks

- None identified.

Ecological Risks

- None identified.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

[68] *Ibid.*

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[69] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Straying risk to the lower Columbia fall Chinook ESU (i.e. natural populations of tule fall Chinook). Significant levels of straying into the Big White Salmon River have been documented.

- Straying risk to upriver bright Chinook natural production upstream of the Dalles Dam, including Snake River populations.

- The Prosser program is classified as integrated; however, it is unclear whether it is managed as such. Improper management of integrated programs may pose a genetic risk to the establishment of a natural population in the Yakima River. At the present time, URB fall Chinook from the Little White Salmon NFH represent a segregated hatchery stock that poses a genetic risk to natural populations upstream of the pool behind McNary Dam.

Demographic Risks

- Carrying out mainstem fisheries to harvest upriver bright fall Chinook is resulting in high incidental catch of several listed salmonid species, including Snake River B-run steelhead.

- Incidental catch of some listed tule fall Chinook occurs in the ladder during adult collection. However, there are very few steelhead caught and they are returned to the river live.

Ecological Risks

- Upriver bright fall Chinook spawning in the Big White Salmon River pose an ecological risk to naturally spawning populations (i.e. superimposition of redds, competition for prey, etc.). Stocks of particular concern are naturally spawning tule fall Chinook and coho, both of which are listed.

Research, Education, Outreach and Cultural Risks

- None identified.

[69] *Ibid.*

Recommendations for Current Program

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue LW1: Transferring and releasing Little White Salmon upriver bright fall Chinook into the Yakima River may not be consistent with conservation goals for natural populations upstream of the pool behind McNary Dam*. URB fall Chinook from the Little White Salmon River represent a genetically-segregated, introduced stock derived from upstream-migrating fish initially trapped at Bonneville Dam in the 1970's. Among fish released into the Yakima River, 35% of the CWT recoveries for returning adults are from the spawning grounds in the Yakima River. Another broodstock that is managed as a native mid-Columbia integrated population, for example Priest Rapids fall Chinook, may be a more appropriate stock for meeting the 1.7 million release into the Yakima River.*

Recommendation LW1: The Service should review the broodstock management and natural populations restoration goals for URB fall Chinook in the Yakima River with the Yakama Nation and other comanagers.

Issue LW2: Present program goals for upriver bright fall Chinook are not expressed in terms of numeric outcomes that quantify intended benefits or goals. *Harvest contributions vary widely in response to post-release survivals, marine conditions, and harvest regimes in the Columbia River. Like most other Mitchell Act funded programs, this hatchery program lacks specific goals for numeric accountability with respect to harvest, conservation, or other benefits.*

Recommendation LW2: Restate program goals to identify the number of harvestable adult upriver bright fall Chinook desired from this program in the ocean and lower Columbia River. For example, the current program size and desired post-release survivals leads to a mean harvest goal of 3,200 adult upriver bright fall Chinook per year.

Broodstock Choice and Collection

Issue LW3: The current hatchery stock is not genetically integrated with natural populations in the Yakima River. Also, the present fall Chinook stock at Little White Salmon NFH may not be compatible with conservation and restoration goals for fall Chinook in the Yakima River (see issue LW1).

Recommendation LW3: Work with the Yakama Nation to identify alternative broodstock sources for the Yakima River if a genetically integrated hatchery stock for assisting with recovery of naturally spawning populations in the Yakima River is desired.

Issue LW4: Adult fish returning to the facility are not automatically enumerated. *The adult fish are visually estimated as they enter the facility. An accurate count would help with ladder operations, broodstock collection, and surplusing.*

Recommendation LW4: Install an electronic fish counter as the fish pass from the ladder to the broodstock pond.

Hatchery and Natural Spawning, Adult Returns

Issue LW5: The upriver bright fall Chinook from Little White Salmon NFH stray and spawn in the Big White Salmon River. *Adults straying and spawning in the Big White Salmon River pose genetic and ecological risks ESA listed Lower Columbia River fall Chinook and other salmon species (e.g., coho salmon).*

Recommendation LW5a: Assess the feasibility of creating additional terminal fisheries in the Lower Columbia River for URB fall Chinook returning to Little White Salmon NFH to reduce the number of strays and surplus fish returning to the facility or

Recommendation LW5b: Alternatively, reduce the size of the program to reduce surplus adults returning to the hatchery and strays in the Big White Salmon River.

Issue LW6#: MS-222 is currently used to anesthetize adults during spawning. This precludes the use of carcasses for nutrient enhancement of streams and other beneficial uses for potential human use. *MS-222 is also a human health hazard.*

Recommendation LW6: Develop an alternative method of anesthetizing broodstock at the time of spawning. Use of electro anesthesia is currently being proposed. This has been identified as priority, especially if spring creek reprogramming occurs given increased number of fish that will be spawned.

Incubation and Rearing

No issues identified

Release and Outmigration

No issues identified.

Facilities/Operations

Issue LW7 Little White Salmon NFH is under funded for operations, maintenance, and M&E, and has insufficient funding for major maintenance and infrastructure improvements. There is currently a maintenance backlog of $(number to be entered) at the hatchery[70] *Little White Salmon NFH is funded by Mitchell Act, Grant County PUD, and BPA. This issue is primarily caused by a lack of Mitchell Act funding to cover program and facility costs, thus resulting increasing gaps between funding needs and availability related to both inflation and increased aging of hatchery facilities. Fishery comanagers and partners have developed a Mitchell Act outreach team to address Mitchell Act facility and funding needs. Funding levels are current for operations and maintenance; however, there is a lack of funds to cover M&E activities.*

Recommendation LW7: Adopt or advocate the funding levels developed by the outreach team including the development of a major maintenance budget, including funding of the infrastructure improvements identified here in this report.

Issue LW8: The current placement of the coded-wire tag detector impedes efficient processing of adults during spawning*. The current size of the spawning building does not allow for the detector to be installed in its appropriate place.*

Recommendation LW8: Expand the spawning area of the adult holding and spawning building. This has been identified as priority, especially if spring creek reprogramming occurs given the increased number of fish that will be spawned at Little White Salmon NFH.

Issue LW9: Intake screen should meet state and federal fish screen standards. *Inadequate screening could result in injury or mortality to upstream fish populations and/or result in possible disease transmission to hatchery populations. Although this is not a priority as there are no listed anadromous fish or bull trout present in the upper Little White Salmon Watershed, meeting current state and federal fish screen standards should be a standard for all facilities.*

Recommendation LW9: Upgrade the intake screen.

Issue LW10: Spring water availability fluctuates throughout the rearing season. *Currently, spring water contribution to the water supply is visually estimated, then adjusted manually.*

Recommendation LW10: Install inline flow meters on the spring water intake.

Research, Monitoring, and Accountability

Issue LW11: Not much information exists on Drano lake terminal fisheries. *Lack of coded-wire tag recovery data. Creel surveys are not as intense as for other stocks such as spring Chinook (pers com Jim R.).*

Recommendation LW11: Improve data collection on sport and tribal harvest in Drano Lake. This will improve the hatcheries ability to accurately assess the harvest benefits it provides. This information could also improve broodstock management.

[70] *Data from SAMMS database.*

Issue LW12: Upriver bright fall Chinook from Little White Salmon NFH are spawning in the Big White Salmon River after listed tule fall Chinook and coho have spawned. Not much is known about the ecological impact of Little White Salmon NFH upriver bright fall Chinook spawning on tule fall Chinook and coho production in the Big White Salmon River. *Currently, redd counts are performed, tissue samples are collected to identify genetic contribution to juvenile production in the Big White Salmon River. However, funding is limited and genetic analysis still have yet to be performed. This will be of increasing concern when Condit Dam is removed and efforts to recover natural populations in the Big White Salmon River are increased.*

Recommendation LW12a: Continue to supplement redd count information with genetic and ecological interaction studies. Fund and conduct genetic analysis.

Recommendation LW12b: Investigate the possibility of creating a terminal fishery on URB fall Chinook at the mouth of the Big White Salmon River.

Recommendation LW12c: Develop a PIT tag program so that adult returns can be assessed at Bonneville Dam. Fisheries can be targeted on URB fall Chinook from Little White Salmon NFH when they are detected at Bonneville Dam (see also Recommendation LW13).

Recommendation LW12d: Consider installation of a conservation weir in the Big White Salmon River to intercept and sort fish as they enter the Big White Salmon River.

Issue LW13: Downstream migration timing to Bonneville Dam is not well known . *Text.*

Recommendation LW13: PIT tag 15,000 fish to establish migration timing

Issue LW14: The facility has no clearly defined M&E program.

Recommendation LW14: Develop a consistent and clearly defined M&E program and review on an annual basis (prior to ponding and coded-wire tagging of a broodyear).

Issue LW15: The "visioned" function, purpose, and membership of Hatchery Evaluation Teams (HET) as originally described during the "Fisheries: A Future Legacy"(USFWS, 1991) planning process have been inconsistently applied regarding hatchery evaluations and fish production modifications. *Meetings and communications between Service offices regarding the Little White/Willard NFH Complex fish programs and evaluations are infrequent and often include "external partners." While external partner meetings (coordination meetings) are valuable and necessary, the HRT believes that internal Service meetings and communications regarding Service hatchery programs are valuable and necessary as well. The HRT recommendations below are based on the 1993 USFWS "Hatchery Evaluation Action Plan" with modifications by the HRT.*

Recommendation LW15: (a) Establish an internal hatchery evaluation team (HET) consisting of staff from the hatchery, the servicing fish health center, and the servicing fisheries program office; (b) the HET should meet twice annually - after smolts are released and before adults return, to discuss the fish program and evaluations. Discussion points of

HET meetings should include results of on-going evaluations, evaluation plans and ideas, tagging/marking protocol and plans, adult and juvenile sampling, data management and reporting, fish program modifications, fish ponding, ponding densities, production numbers, spawn numbers, disposition of excess juveniles, fish health, and implementation of Hatchery Review Team recommendations, etc. The HET can meet more often as necessary to discuss specific fish program or evaluation issues. The HET shall record meeting minutes and distribute to the HET and the appropriate line manager in the Regional Office. The hatchery staff and HET should continue coordination meetings which involve comanagers and interested parties.

Education and Outreach

Issue LW16: On-station outreach programs/plans are a low priority relative to proposed program changes. *The visitors' areas could be enhanced. Outreach efforts are limited and not coordinated with the Information and Education Columbia Gorge Program.*

Recommendation LW16: Update the visitors' areas and incorporate Little White Salmon NFH into Columbia River outreach program.

Alternatives to Current Program[71]

The Review Team considered the benefits and risks of the existing Upriver Bright Fall Chinook program at Little White Salmon NFH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified a recommended alternative (or alternatives).

Alternative 1: Current program with recommendations

Pros

- Provides a sport and tribal terminal fisheries in Drano Lake, a fisheries in Columbia River and ocean harvest. Upriver bright fall Chinook are sought after for harvest, particularly by tribal fishers, because they return at a time and condition that makes the salmon very valuable.
- Program is largely a disease free stock and poses little disease risk to hatchery and wild stocks.
- Program has relatively high productivity with a recruit per spawner rate of 7.6 recruits per spawner for the on-station release and 6.5 recruits per spawner for the fish released at Prosser (BY 1990-1999).

[71] *Alternatives with asterisks (*) were favored by the Review Team over alternatives without asterisks.*

Cons

- The program continues to propagate a non-native, out-of-basin, out of ESU stock that poses genetic and ecological risks to naturally spawning populations within the Columbia Gorge region.

- Straying risk to the lower Columbia fall Chinook ESU (i.e. natural populations of tule fall Chinook). Significant levels of straying into the Big White Salmon River have been documented which pose an ecological and/or genetic risk.

- Straying risk to upriver bright fall Chinook natural production upstream of the Dalles Dam, including Snake River populations.

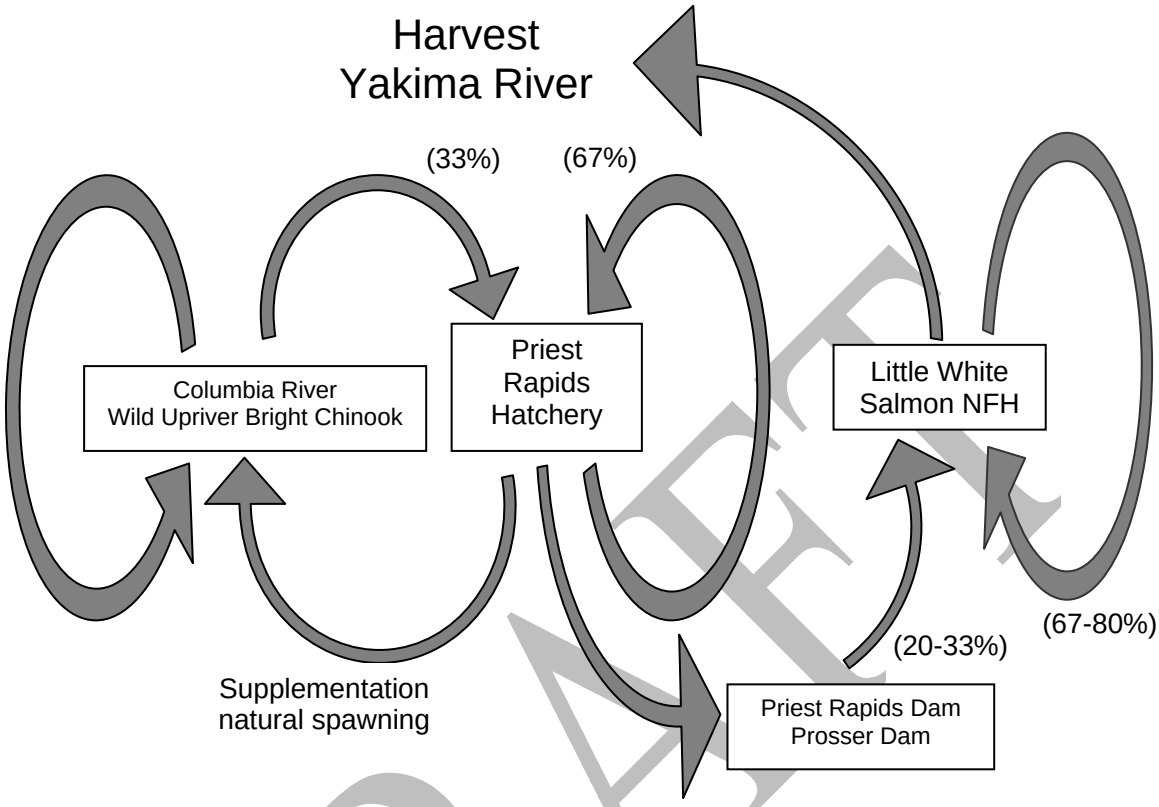
- URB fall Chinook at Little White Salmon NFH represent a segregated, hatchery-propagated stock for which the natural population origins are unknown. Continued transfer and stocking of URB fall Chinook from Little White Salmon NFH into the Yakima River poses genetic risk to the establishment of a natural population in the Yakima River.

- Carrying out mainstem fisheries to harvest upriver bright fall Chinook is resulting in high incidental catch of several listed salmonid species, including Snake River B-run steelhead.

- The program continues to propagate a non-native, out-of- ESU stock that does not contribute to conservation objectives within the Columbia Gorge region.

Alternative 2: Convert current segregated program to an integrated harvest "stepping stone" upriver bright fall Chinook program (Priest Rapids stock) in support of upriver fisheries and restoration efforts

Convert the Little White Salmon upriver bright fall Chinook program from a segregated to an integrated program by: (a) incorporating gametes from adults trapped at Priest Rapids state hatchery, or (b) replacing the current broodstock with Priest Rapids stock. Supplementation releases into the Yakima River would be genetically linked to the Priest Rapids, Hanford Reach stock, not the Bonneville pool harvest mitigation stock. This alternative would justify reducing on-site releases at Little White Salmon NFH and increasing releases upriver in support of John Day mitigation (see figure below).



Pros

- This action would be consistent with tribal interests to increase upriver fishing opportunities.
- This creates the opportunity to utilize the stock for upriver fisheries and restoration purposes.
- Reduces the risk of releases into the Yakima River.
- Reduces the risk of straying into the Big White Salmon River and Wind River by reducing on-station releases at Little White Salmon NFH.

Cons

- Straying risks into the Big White Salmon River and Wind River will continue to exist.
- Reduces the terminal fishery in Drano Lake.
- Requires continued annual importation of gametes or eyed eggs from Priest Rapids or Prosser Hatcheries to Little White Salmon NFH.

Alternative 3: Terminate the current upriver bright fall Chinook program and replace with tule fall Chinook

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Pros

- This would involve the rearing of a stock included in the ESU.
- Reduces the risk of straying by eliminating the rearing of an out-of basin stock and replacing it with an in-basin stock. This reduces straying risks to the Big White Salmon River.
- This would change the distribution of the ocean fishery from an Alaska and British Columbia to an ocean fishery in British Columbia, Washington and Oregon.
- Provides a backup facility for maintaining the Spring Creek NFH stock of tule fall Chinook.
- This would reduce the incidental take on B-run steelhead and naturally spawning upriver bright fall Chinook from the Snake River.

Cons

- The risk of the impacts of straying from a hatchery stock on a natural population still exists.
- The program does not provide in-kind mitigation for the primary stocks lost by the construction of John Day Dam.
- Tule fall Chinook are not as valuable to the tribal and sport fisheries as the upriver bright fall Chinook reared currently.
- Duplicates a program that already exists at Spring Creek NFH.

Alternative 4: Terminate the current upriver bright fall Chinook program and increase the spring Chinook program

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Pros

- Reduces the risk of straying to the Big White Salmon River. Spring Chinook salmon have a lower stray rate than upriver bright fall Chinook. Additionally, spring Chinook return at a different time than the naturally spawning tule fall Chinook in the Big White Salmon River.
- Spring Chinook are valuable to the sport fisheries in the lower Columbia.
- This would reduce the incidental take on B-run steelhead and naturally spawning upriver bright fall Chinook from the Snake River.
- Potentially increases the spring Chinook program at Little White Salmon NFH by an additional 150,000 smolts.

Cons

- Depending on the size of the spring Chinook program, this alternative may require additional rearing space.

- This will eliminate ocean harvest and tribal commercial harvest of upriver bright fall Chinook.

- Spring Chinook are more difficult to rear from a disease perspective.

- The program does not provide in-kind mitigation for the primary stocks lost by the construction of John Day Dam.

- Replaces a program that produces 3.7 million upriver bright fall Chinook that result in an average return of 8,000 fall Chinook adults (BY 1990-1999. Includes both Prosser and on-station releases) with a small addition of 150,000 spring Chinook (at .3% SAR, increases the current return 450 adults).

Alternative 5: Expand the current upriver bright fall Chinook program at Little White Salmon/Willard NFH complex as part of John Day Dam mitigation (Spring Creek Reprogramming)

The rearing of 4.5 million upriver bright fall Chinook will be moved from Bonneville State Hatchery to Little White Salmon River, increasing the number of upriver bright fall Chinook reared at Little White Salmon River to 8.2 million. The on-station release would increase from 2 million to 5 million and a transfer of 1.5 million to Ringold Springs Rearing Facility for upriver release would be added. The transfer of 1.7 million to Prosser Hatchery for release into the Yakima River would be maintained.

The rearing of 4.5 million tule fall Chinook would be moved from Spring Creek NFH to Bonneville State Hatchery. This would reduce the number of tule fall Chinook reared at Spring Creek NFH to 10.5 million.

Pros

- Maximizes the economic value of the tribes fall season fisheries, by creating a different balance of stocks in their fisheries by increasing available URBs and decreasing tule fall Chinook abundance.

- Improves in-place and in-kind mitigation responsibility for John Day Dam.

- Provides a backup facility for maintaining the Spring Creek NFH stock of tule fall Chinook.

- Negates the need to negotiate a March spill at Bonneville Dam.

- Eliminating the March spill reduces the risk to chum redds through nitrogen gas supersaturation and potential predation in the lower Columbia mainstem caused by the flow increased at Bonneville Dam to accommodate for the release of Spring Creek NFH tule fall Chinook.

- Eliminates the need for a portion of the tule fall Chinook to go through Bonneville Dam. This will likely increase survival for that portion.

- Reduces rearing densities of tule fall Chinook at Spring Creek NFH. This reduces physiological stress which may improve fish health at Spring Creek NFH.

- Expands the sport and tribal terminal fishery at Drano Lake.

Cons

- Increase in production cost. Operation costs do not decrease significantly at Spring Creek NFH in conjunction with the production reduction of tule fall Chinook, and; therefore, do not compensate for the increase in cost for rearing the additional upriver bright fall Chinook at Little White Salmon NFH.

- Decreases the smolt-to-adult survival benefits of the three-stage release at Spring Creek NFH, where survival rates have been shown to vary between the releases and, on average, the March release has had the second best survival rates of the three (1st April, 2nd March, 3rd May). In some years, each survival rate has been shown to be better than the other two.

- May increase the risk of straying of out-of-basin, out-of-ESU upriver bright fall Chinook from Little White Salmon NFH into the Big White Salmon River and other watersheds in the region.

Alternative 6: Terminate the program and decommission the facility

Decommission hatchery in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site

Pros

- Reduces the risk of straying to the Big White Salmon River that the currently reared out-of-basin populations have.

- Eliminates all risks associated with the current program.

Cons

- Eliminates the program's contribution to ocean treaty harvest, Columbia River harvest, and terminal harvest in Drano Lake, including valuable sport and tribal fisheries.

- Eliminates the program's in-kind mitigation for John Day Dam.

- Substantially reduces or eliminates social and economic benefits of Little White Salmon NFH fish programs to the Gorge community at large.

- Reduces the Service's outreach capabilities for the Gorge region.

Recommended Alternatives

<u>Immediate recommendation</u>: Alternative 1. Current program with implementation of all recommendations and concurrently begin discussions with co-managers to implement the short term goal described below.

The current program includes an on-station release of 2 million sub-yearling smolts and a transfer of 1.7 million sub-yearling pre-smolts to the Yakama Nation's Prosser acclimation ponds on the Yakima River. The on-station production supports multiples fisheries and the Yakima River program is a harvest and supplementation program. Some of the Team's recommendations related to implementation of Alternative 1 include: (a) review, with the Yakama Nation and other co-managers, the broodstock management goals for URB fall Chinook at Little White Salmon NFH; (b) install an electronic fish counter from the hatchery ladder to the broodstock pond so that adult fish can be enumerated as they enter the facility; (c) create additional terminal fisheries and/or reduce the number of fish released on station to reduce surplus adults returning to the hatchery or straying to the Big White Salmon River; (d) replace the current method of anesthetizing adults (current method uses MS-222) with an alternate means; (e) update water intake screen; (f) PIT tag 15,000 smolts that are released on station; (g) establish a Service *Hatchery Evaluation Team* (HET); and (h) update the visitor's center and include Little White NFH into the Service's Columbia River fisheries outreach program.

<u>Short-term goal (up to 15 years)</u>: Implement Alternative 2 by converting the current segregated program at Little White Salmon NFH to an integrated harvest "stepping stone" upriver bright fall Chinook program using Priest Rapids Hatchery stock as a brood source in support of upriver fisheries and restoration/supplementation efforts in the Yakima River.

The Priest Rapids URB fall Chinook program is identified as an integrated/harvest program in the HGMP. Wild fish, presumably from the Hanford Reach region, are routinely included in the broodstock. Because a significant proportion of the fish reared at Little White Salmon NFH are released into the Yakima River to help support or restore a naturally spawning population via supplementation, the Review Team believes that the Priest Rapids stock would be more appropriate for that purpose than the current segregated harvest mitigation stock at Little White Salmon NFH. Several options are possible for achieving this latter objective. For example, one option would be to replace the current broodstock completely, as illustrated in the figure associated with the description of Alternative 2. Another option would be to rear 2.0 million fish of the current stock for on-station release only and rear 1.7 million Priest Rapids stock (or progeny of Prosser Hatchery adult returns of Priest Rapids stock) for release into the Yakima River. Implementation of Alternative 2 may justify reducing on station releases below 2.0 million smolts while maintaining fisheries in the Bonneville pool and Drano Lake. Before Alternative 2 could be implemented, a detailed plan and agreement with comanagers would need to be developed

<u>Long-term goal (15+ years)</u>: Continue with the "stepping stone" upriver bright fall Chinook program using Priest Rapids stock as the adult broodstock source, including reduced on-station releases into the Bonneville pool and increased upriver releases into the natural historic spawning and rearing areas of URB fall Chinook in the Columbia River basin.

The Review Team concluded that, as a long-term goal, releases of hatchery-origin URB fall Chinook should be transferred from Columbia Gorge release sites to upriver areas consistent with their natural historic distribution. Little White Salmon NFH could continue to rear URB fall Chinook for that purpose, but on-station releases would be reduced only to the level necessary to

support a terminal fishery in Drano Lake. This proposed long-term approach is expected to confer most of the benefits realized by the current URB fall Chinook segregated hatchery program while reducing risks to naturally spawning fall Chinook populations in the Big White Salmon River (via reduced on-station releases) and naturally spawning populations in the Yakima River and adjacent regions. This long-term approach will require: (a) development of long-term cooperative agreements between the co-managers detailing responsibilities and funding needs; (b) scheduled coordination meetings between the co-managers.

Little White Salmon NFH Spring Chinook

Operator: U.S. Fish and Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal:*** Support commercial, tribal, and recreational fisheries in the lower Columbia River and Drano Lake. Although no specific harvest goal is stated, the average smolt to adult survival (brood years 1979-2001) was 0.3%. Broodstock needs are about 1,170. Therefore on average about 1830 spring Chinook are available for harvest.

- ***Broodstock escapement goal*:** Provide escapement back to the hatchery of at least 1170 (760 females) to support the on-station release of 1,000,000 smolts.

- ***Conservation goa****l*: The hatchery program has no specific conservation goal within the Little White Salmon River. Little White Salmon spring Chinook were derived from Carson stock and are not part of either the lower Columbia River Chinook ESU, which is listed as threatened, or the mid-Columbia River spring Chinook ESU which is not listed. However, Little White Salmon spring Chinook have been an important component to the re-introduction into the Walla Walla Rivers.

- ***Escapement goal for natural-origin adult****s*: There is no available habitat in the Little White Salmon River adjacent the hatchery. The hatchery is situated at the confluence with Drano Lake and there is an impassible falls at RM 2. Consequently, there is no specific escapement goal for a naturalized population in the river itself.

- ***Research, education, and outreach goal****s*: No specific short or long term programs or plans currently exist.

Objectives

- Trap approximately 1,170 adults and spawn approximately 450 adult SCS (minimum of 290 females) to yield a minimum 1.16 M eggs for 1.0 M smolts for on-station release . Release 1.0M yearling smolts directly from the hatchery into LWS River (U.S. v. Oregon agreement).

- Transfer up to 250,000 yearling SCS to the Walla Walla River for direct release into the river. A Carson NFH program component that is temporary at LWS until the "brook trout in Tyee Creek issue" is resolved, expected in June 2007. Beginning in 2008, transfer from Carson NFH are expected to be resumed. Funded by Mitchell Act. (U.S. v. Oregon agreement). note)

Program Description

The Little White Salmon NFH was established in 1898, although production began in 1896 on an experimental basis. The hatchery was built to address the decline of tule fall Chinook, the native

salmon stock that returned to the Little White Salmon River. This site was selected since it was considered one of the principal spawning areas of the quinnat or Chinook salmon. Assistant U.S. Fish Commissioner William Ravenel, describing the significance of the hatchery site noted in 1898 that "During the season, the salmon appeared in such large numbers below the rack that the Indians often speared two and three at one cast of the spear."

The spawning of spring Chinook salmon at the Hatchery first occurred in 1967 when fish of unknown origin returned to the Little White Salmon River (Nelson and Bodle 1990). These fish could have been strays or descendants from previous attempts to rear spring Chinook from the McKenzie River (1916 brood), Salmon River (1925 brood), or Carson stock reared at Willard during the 1964 brood year. Since that time, fish were released into the Little White Salmon River from Willamette stock (Eagle Creek NFH), South Santiam State Fish Hatchery, Klickitat River stock, Ringold Springs stock, and Carson stock. The present stock is considered a derivative of the Carson stock. Part of the 1995 brood included adult fish trapped on the White Salmon River (progeny of Carson stock reared and released at Big White Salmon Ponds). Fish originating from White Salmon River adults (released in 1997) were the only fish released since 1985 that did not originate from adults returning to the Hatchery.

The Little White Salmon/Willard NFH Complex (Complex) currently operates as part of the Columbia River Fisheries Development Program and is funded through the Mitchell Act - a program to provide for the conservation of Columbia River fishery resources. This program is a part of the mitigation for habitat loss resulting from flooding, siltation, and fluctuating water levels caused by Bonneville Dam. The Columbia River Fish Management Plan is currently under renegotiation, however, current production goals are generally consistent with the production goals in the expired plan.

Spring Chinook enter the hatchery holding ponds from mid-April to mid-August. Spawning occurs from early August to early September. A summary of numbers spawned from 1991 through 2002 is found in Section 7.4.2 of HGMP. Total adult returns ranged from 615 to 8,243, averaging 2,982 per year for this period. The annual escapement goal is 900 adults returning to the hatchery (see Section 1.11.1 and Section 7.4.2 of HGMP).

From 1998 through 2007, 210K to 350K spring Chinook smolts were reared and transferred from Little White Salmon NFH to the Umatilla Tribe for acclimation and release in the Umatilla Basin. In the early years, eggs were from Little White Salmon NFH stock and Ringold stock. However, beginning in 1999, all eggs came from adults returning to the Umatilla Basin. Those eggs were transferred from the Tribe's Umatilla Hatchery to Little White Salmon NFH for hatch and rearing, prior to transfer back to the Umatilla Basin. In 2007, the program was discontinued after broodyear 2005 pre-smolts were transferred back to the Umatilla Basin for release in the spring of 2007.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- An introduced "Carson stock" developed initially at Little White Salmon NFH in 1987
- Trapping occurs mid-April to mid-August.; spawning occurs early August to early September. Hatchery ladder is closed at the end of spawning season to prevent stray Tule Fall Chinook from entering the hatchery.
- Do not belong to an ESU.
- Adults are held in two holding ponds prior to spawning and may be moved from pond to pond prior to spawning. (Pre-spawning mortality approx. 2.5%).

Hatchery and Natural Spawning, Adult Returns

- Copy mean numbers of adults trapped and spawned from objectives.
- Jacks used in proportion to their composition among trapped males up to 5% jacks of the males used for broodstock each year. 1991-2002, 2% of the males spawned were jacks.
- Spawning is pairwise 1:1 if returns to the hatchery meet broodstock objectives; if shortage males, some males spawned twice (2:1).
- Very little straying documented from on-station releases.
- BY79-2001, SARs back to the hatchery averaged 0.3%. Approx. 2/3 of adult recoveries occur at hatchery (Approx. 1/3 in fisheries).
- Excess eggs taken in some years to account for disease loss and to provide eggs to other programs if needed.
- Adults given formalin treatment every other day while in brood pond; and are injected with erythromycin (15 mg drug/kg body weight) at approximately 30 days (early July) prior to spawning. Adults returning after early July are not injected (fish arriving less than three weeks before spawning are not injected).
- Eggs from high BKD risk females are culled or segregated to control BKD in the hatchery.

Incubation and Rearing

- Eggs are initially loaded one female per tray (approx. 4,000 eggs per female) and reloaded at eye-up at 5,000 eggs per tray.
- Eggs on single pass spring or well water. Initial: 3 gpm, 5gpm after hatch. Temp. 43-50 degrees, average 47 degrees.
- Surplus eggs are buried on station.
- Using a 70 micron drum filter for incubation water (applies to all stocks); now has an alarm to monitor water flow.

- Formalin treatment on the incubated eggs 3-5 times per week (protocol: terminate 10 TU days before first hatch).

- Take 1700 TUs for hatch and yolk absorption to occur; transfer to nursery tanks for one week to initiate first feeding (December- January. Some are ponded outside directly.

- Ten nursery tanks at present. Additional nursery tanks would be useful, particularly under new White River spring Chinook constraints. Maximum rearing densities in nursery tanks is 0.3 in April.

- Raceways use river water with mean water temperature = 44 degrees. Spring source is 48 degrees and can be diverted into the lower bank raceways.

- Prophylactic feeding of antibiotics to juveniles. LWS release fish receive one treatment, Umatilla fish receive two treatments prior to transfer back to the Umatilla River.

Release and Outmigration

- Mass marked with AD clips but no DIT tag groups because are not intercepted in ocean fisheries.

- Are not PIT tagged now, but it could be useful for monitoring passage and marine survivals

- 75,000 CWT and ad-clip (funded by BPA) and 50,000 CWT + ad-clip (funded by Mitchell Act) at present for stock assessment and survival and tagged occasionally for hatchery evaluation studies.

- 0.35% SAR harvest + escapement back to the hatchery (1988-1998).

- Limited volitional release; screens pulled one day before. A saltwater challenge at 3% (30 ppt) to evaluate survival. Held for 24h in saltwater

- Released one raceway at a time sequentially.

Facilities and Operations

- See upriver bright fall Chinook at Little White Salmon NFH section.

Research, Education, and Outreach

- See upriver bright fall Chinook at Little White Salmon NFH section.

- A three-year assessment was performed on baffled vs. non-baffled raceways.

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[72] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- In 2006, approximately one-fourth of all spring Chinook mainstem sport harvest upstream of Bonneville Dam occurred in Drano Lake.
- From BY 1990-1999, of cwt recoveries, 53% hatchery (1,507), 45% Columbia River harvest, including the Drano Lake terminal fishery (1,289), 0% ocean harvest, 2% spawning grounds (74).
- Excess adults trapped at the hatchery are provided for tribal subsistence and ceremonial purposes and to food banks.

Conservation Benefits

- Hatchery program confers no direct conservation benefit.

Research, Education, Outreach and Cultural Benefits

- Tribal harvest and surplus adults trapped at the hatchery provide a cultural benefit to Columbia River tribes. Excess adults provided to tribes for ceremonial and subsistence purposes.
- The visitor facilities support 5,000 visitors per year that pass through the hatchery.
- Little White Salmon NFH staff make presentations about the facility to local clubs and organizations.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[73] the Review Team identified the following benefits of this program:

Harvest Benefits

- From BY 1990-1999, of cwt recoveries, 53% hatchery (1,507), 45% Columbia River harvest, including the Drano Lake terminal fishery (1,289), 0% ocean harvest, 2% spawning grounds (74).

Conservation Benefits

- Little White Salmon NFH spring Chinook is an important source of fish for the reintroduction program in the Walla Walla River. One long-term goal of these reintroduction programs is to provide harvest benefits to the Umatilla Tribe.

Research, Education, Outreach and Cultural Benefits

[72] *See Components of This Report for a description of these potential benefits and risks.*
[73] *Ibid.*

- Little White Salmon River and Drano Lake are considered a wildlife viewing area. Wildlife is attracted to the area to take advantage of adult carcasses.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[74] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- None identified.

Demographic Risks

- None identified.

Ecological Risks

- Ecological risk from antibiotic resistance in bacterial flora within the system from erythromycin injections and prophylactic use of medicated feeds for hatchery-reared fish, and antibiotics in effluent.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[75] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- Straying of spring Chinook from on-station releases at Little White Salmon NFH has not been identified as significant risk, but deliberate transfers of Little White Salmon NFH spring Chinook could pose a genetic and/or ecological risk to populations in other watersheds. Additionally, transferring and releasing fish upriver increases the potential for straying. Straying from transfers has not been evaluated.

Demographic Risks

- Incidental catch of some listed steelhead occurs in the ladder during adult collection. However, there are very few steelhead caught and they are returned to the river live.

Ecological Risks

[74] *Ibid.*
[75] *Ibid.*

- Straying of spring Chinook from Little White Salmon NFH has not been identified as significant risk, but deliberate transfers of Little White Salmon NFH spring Chinook could pose a genetic and/or ecological risk to populations in other watersheds. Additionally, transferring and releasing fish upriver increases the potential for straying. Straying from transfers has not been evaluated.

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue LW17: **Present program goals for spring Chinook released on-station are not expressed in terms of numeric outcomes that quantify intended benefits or goals.** Harvest contributions vary widely in response to post-release survivals, marine conditions, and harvest regimes in the Columbia River. Like most other Mitchell Act funded programs, this hatchery program lacks specific goals for numeric accountability with respect to harvest, conservation, or other benefits.

Recommendation LW17: Restate program goals to identify the number of harvestable adult spring Chinook desired from this program in the lower Columbia River and Drano Lake. For example, the current program size and desired post-release survivals leads to a mean harvest goal of *(number to be entered)* adult spring Chinook per year.

Broodstock Choice and Collection

None identified.

Hatchery and Natural Spawning, Adult Returns

Issue LW18: MS-222 is currently used to anesthetize adults during spawning. This precludes the use of carcasses for nutrient enhancement of streams and other beneficial uses for potential human use. *MS-222 is also a human health hazard.*

Recommendation LW18: Develop an alternative method of anesthetizing broodstock at the time of spawning. Use of electro anesthesia is currently being proposed. This has been identified as priority, especially if Spring Creek reprogramming occurs given increased number of fish that will be spawned.

Incubation and Rearing

Issue LW19: Prophylactic use of erythromycin-medicated feed for the on-station release. *Juvenile fish are each given one 21-day treatment of erythromycin-medicated feed, to help control BKD outbreaks. These treatments are given prophylactically (i.e. even when the fish do not show clinical signs of disease). The U.S. Department of Agriculture and other federal agencies have published warnings and advisories regarding the biological risks and potential overuse of antibiotics. The Review Team concluded that antibiotic use should only be used as a last resort to prevent disease and meet the minimal survival needs of hatchery-produced fish. Improved fish culture practices should be the first approach for preventing disease and maximizing survival.*

Recommendation LW19: Discontinue the use of erythromycin-medicated feed. After discontinued use, if there is an increase in BKD, revaluate the rearing densities and consider a density reduction. For additional guidance, the Review Team plans to draft a scientific white paper on the known benefits and risks of antibiotics in fish culture as a foundation for basin-wide recommendations governing their use in federal hatcheries, consistent with existing federal regulations and guidelines.

Release and Outmigration

Issues: None identified.

Facilities/Operations

Issues: See upriver bright fall Chinook at Little White Salmon NFH section.

Research, Monitoring, and Accountability

Issue LW20: For the twenty-two new baffled rearing raceways, the optimum rearing density for smolt to adult survival and adult contribution is unknown. *Baffled versus unbaffled studies have been performed; however, understanding the optimum rearing density for the baffled containers have not.*

Recommendation LW20: Perform a three-year paired baffled raceways test, comparing the current program's standard rearing density of ~.2 to a lower density of ~.1. This may temporarily reduce on-station production.

Issue LW21: Currently, at the Little White Salmon NFH, 75,000 in one raceway and 50,000 fish in another raceway in a series of multiple raceways of Chinook are tagged. *Since the populations between raceways can be different (age and size) and the pond environments can*

differ slightly (flow and flow pattern) the practice of tagging fish in one raceway does not represent the entire population. In most NFH production programs salmon are spawned throughout the adult return to ensure that most segments of the run are represented in the resulting progeny. This procedure usually results in many different spawn "takes" The fry are ponded by take/hatch date into a series of raceways that when fully populated differ in age of fish and size of fish (initially) between raceways. Production monitoring using coded-wire tags requires that the tags represent the entire population.

Recommendation LW21: Consult with Columbia River Fisheries Program Office to develop a consistent tagging strategy that accurately represents the entire population of progeny from all spawn groups. For example, one approach could be to apply the tags across several of the raceways.

Issue LW22: Downstream migration timing to Bonneville Dam is not well known . *Text.*

Recommendation LW22: PIT tag 15,000 fish to establish migration timing.

Education and Outreach

See upriver bright fall Chinook at Little White Salmon NFH section.

Alternatives to Current Program[76]

The Review Team considered the benefits and risks of the existing Spring Chinook program at Little White Salmon NFH and developed five alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified a recommended alternative (or alternatives).

Alternative 1: Current Program with recommendations

Pros

- Provides a sport and tribal terminal fisheries in Drano Lake and support for fisheries in the lower Columbia River. Spring Chinook are sought after for harvest, particularly by sport fishers.
- Little White Salmon NFH spring Chinook is an important source of fish for the reintroduction program in the Walla Walla River.
- Program has healthy productivity with a recruit per spawner rate of 3 recruits per spawner for the on-station release (BY 1990-1999).
- Provides a backup facility for maintaining the Carson NFH stock of spring Chinook.

[76] *Alternatives with asterisks (*) were favored by the Review Team over alternatives without asterisks.*

- Adults return over a long period of time (April-August) providing extended fishing opportunity compared to other stocks.

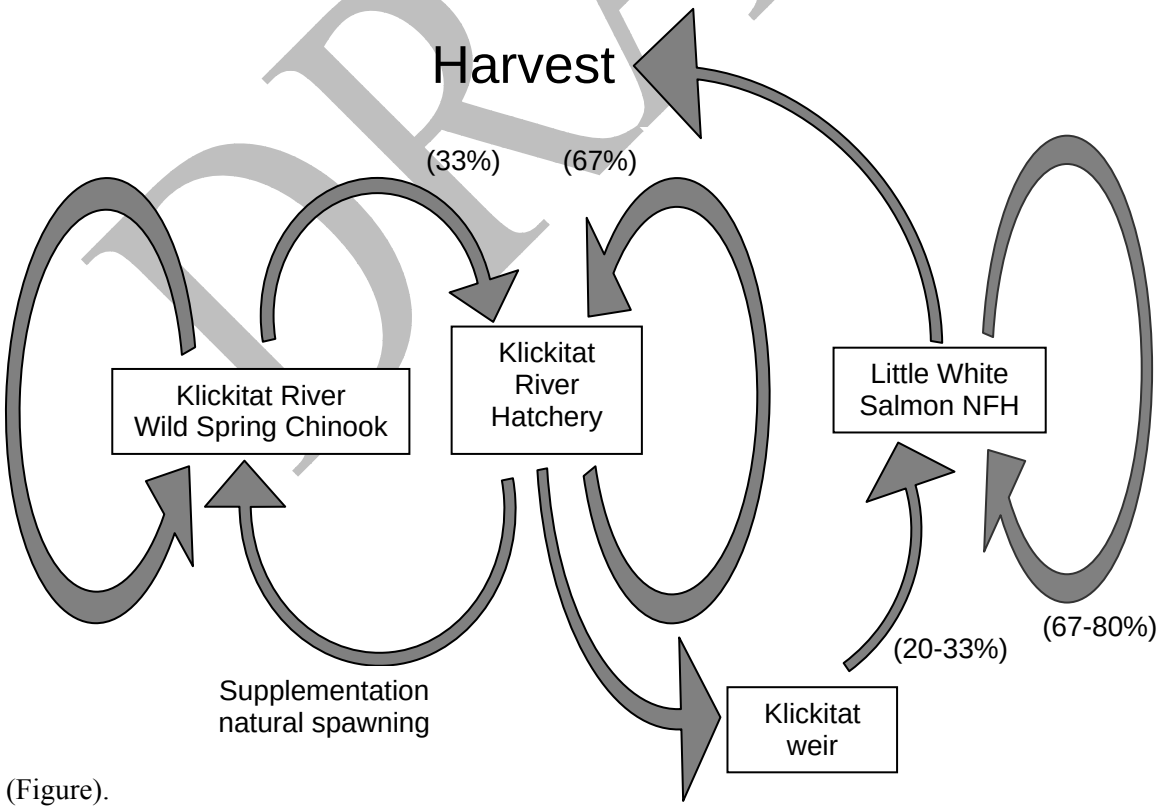
- Program has a very high homing fidelity, with few fish straying into the Big White Salmon River. Additionally, any natural spawning of spring Chinook in Big White Salmon River is not considered a risk because the natural population is ruled as extinct.

Cons

- The program continues to propagate a non-native, out-of- ESU stock that does not contribute to conservation objectives within the Columbia Gorge region.

Alternative 2: Phase out current segregated spring Chinook harvest program (Carson stock) and replace with an integrated "stepping stone" spring Chinook harvest and conservation program (Klickitat River hatchery stock).

Phase out existing Carson stock spring Chinook segregated–harvest program (over five years) and replace with a new "stepping stone" broodstock harvest and conservation program that is genetically integrated with the Klickitat River hatchery stock broodstocks that meet genetic integration guidelines (see following Figure).



(Figure).

Pros

- Reduces straying risks by producing an in-basin spring Chinook stock versus an out-of-basin spring Chinook stock.

- This provides backup broodstock to Klickitat Hatchery and provides a broodstock source for reintroduction into Big White Salmon River.

Cons

- Eliminates the benefit of having a backup program for Carson NFH spring Chinook.

- Eliminates the "known" highly productive spring Chinook stock currently at Little White Salmon NFH that contributes significantly to sport and tribal fisheries in the Drano Lake terminal fishery and fisheries in the lower Columbia River.

- The current Klickitat hatchery program may not be large enough to support this alternative in the near term.

- Klickitat hatchery spring Chinook broodstock historically included Carson NFH spring Chinook.

- Currently having a difficult time achieving an integrated stock at Klickitat Hatchery. Genetic studies show divergence between wild and hatchery populations.

Alternative 3: Terminate the current spring Chinook program and increase upriver bright fall Chinook production

Terminate the existing spring Chinook production and replace it with an additional 4.8 million upriver bright fall Chinook.

Pros

- This would meet full Service commitment of 8.5 million upriver bright fall Chinook smolts for in-kind mitigation for John Day Dam for Little White Salmon NFH.

- Increases contribution to ocean treaty harvest, Columbia River harvest, and terminal harvest in Drano Lake, including valuable tribal and sport fisheries.

- Reduces the likelihood of BKD outbreaks because the upriver bright fall Chinook stock that is less susceptible than spring Chinook.

Cons

- Eliminates the extended fishing opportunity (April-August) that is currently provided by the spring Chinook fishery.

- Increases straying into Big White Salmon River (look for bullet in other section).

- Increases the potential for incidental harvest of B-run steelhead from the Snake River.

Alternative 4: Hatchery production for restoration of naturally spawning populations in the Big White Salmon River (emphasis on spring Chinook and possibly chum) (can be combined with Alternative 1 or 2)

Use the facility to rear fish for reintroduction of native species in the Big White Salmon River after the removal of Condit Dam. This could include spring Chinook, tule fall Chinook, coho, chum, bull trout and steelhead. This would also include the recommendations for rehabilitation of Big White Ponds and a reconstruction of a conservation weir for broodstock collection and management of the naturally spawning population on the Big White salmon River (see Spring Creek NFH tule fall Chinook current program recommendations).

Pros

- The number of facilities with a diverse array of rearing environments in relative close proximity to the Big White Salmon River makes Carson NFH, Little White Salmon NFH, Willard NFH and Spring Creek NFH attractive sites for rearing fish for reintroduction.
- The removal of Condit Dam offers a unique opportunity in the Columbia River Basin to test a large-scale reintroduction project of an entire river system.
- Offers the opportunity to jump-start populations in the Big White Salmon River that were depleted by the construction of Condit Dam and later, of Bonneville Dam.
- Provides a broodstock collection and acclimation site at Big White Ponds on the Big White Salmon River and allows for the control of hatchery influence on the natural populations in the Big White Salmon River.
- Reduces the risk of straying to the Big White Salmon River that the currently reared out-of-basin populations have.

Cons

- Reduces the amount of rearing space available for the current production of fish for ocean treaty harvest, Columbia River harvest, terminal harvest in Drano Lake, including valuable sport and tribal fisheries.
- The program does not provide in-kind mitigation for the primary stocks lost by the construction of John Day Dam.
- The cost of the construction, operation and maintenance of a conservation weir, the rehabilitation of Big White Ponds and other facility improvements is high.
- May increase the risk of disease transfer within the hatchery.

Alternative 5: Terminate the program and decommission the facility

Decommission hatchery in favor of alternative mitigation strategies such as habitat restoration, passage improvements, or alternative hatchery production at another site

Pros

- Eliminates the propagation of a non-native, out-of- ESU stock that does not contribute to conservation objectives within the Columbia Gorge region.

Cons

- Eliminates the program's contribution to Columbia River harvest, and terminal harvest in Drano Lake, including valuable sport and tribal fisheries.
- Substantially reduces or eliminates social and economic benefits of Little White Salmon NFH fish programs to the Gorge community at large.
- Reduces the Service's outreach capabilities for the Gorge region.
- Eliminates the backup facility for Carson NFH spring Chinook.

Recommended Alternatives

<u>Preferred Alternative</u>: Alternative 2 – Implement an integrated "stepping stone" spring Chinook conservation and harvest program

Adopt all facility and infrastructure recommendations for the current spring Chinook program but work with the Yakama Nation and staff of the Klickitat Hatchery to develop a "stepping stone" broodstock strategy that would not require direct take of wild fish for broodstock, but would allow the Little White Salmon NFH stock to be genetically integrated with the Klickitat stock of spring Chinook. That particular stock has been identified by WDFW as the appropriate spring Chinook stock for restoration of spring Chinook in the White Salmon River. Such an approach would contribute demographically towards conservation and harvest objectives for spring Chinook in the Lower Columbia Chinook ESU (Bonneville Pool), while continuing harvest opportunities especially in Drano Lake. Under this alternative, the Klickitat Hatchery would develop an integrated broodstock by incorporating wild spring Chinook captured at Lyle's Falls into their broodstock and provide sufficient numbers of eyed eggs to Little White Salmon NFH annually to meet genetic broodstock requirements via the stepping stone approach. Implementation of this recommendation may require improved adult collection facilities in the Klickitat River. In the interim, Alternative 1 (current program with implementation of all recommendations) should be implemented until the contingencies associated with the Klickitat Hatchery are resolved.

Pros

- Does not require taking natural-*origin* adults for inclusion of adult fish in the broodstock at Little White Salmon NFH.
- Provides a biological mechanism for reducing genetic straying risks to natural populations in the Bonneville Pool while maintaining tribal and recreational fisheries in Drano Lake and the lower Columbia River.

- Reduces risks of straying into the White Salmon River by propagating an integrated stock with the naturally adapted stock.

- Little White Salmon NFH broodstock would provide an annual outlet for surplus Klickitat Hatchery eggs that exceed broodstock or supplementation needs in the Klickitat River.

- Fish from the Little White Salmon NFH would be available to assist with restoration /recovery of spring Chinook in the lower Columbia Chinook ESU, if needed.

- Would provide the most appropriate stock for reintroducing spring Chinook to the Big White Salmon River.

Cons

- The Klickitat Hatchery may have difficulty developing an integrated broodstock of Klickitat River Spring Chinook, due to the lack of adequate trapping sites available to collect wild broodstock.

- There may be insufficient number of surplus eggs available from the Klickitat integrated broodstock to meet the requirements to implement a stepping stone integrated program at Little White Salmon NFH.

- The Klickitat Hatchery has not started an integrated broodstock program, but plans do so once the Klickitat Subbasin Anadromous Fishery Master Plan has been approved and modifications to the Lyle Falls trap have been completed.

Willard NFH (Wenatchee River) Coho

Operator: U.S. Fish and Wildlife Service

Summary of Current Program

Goals

- ***Harvest goal***: The long-term goal is to establish self-sustaining hatchery and natural populations of coho salmon in the Wenatchee River in sufficient numbers and viability to support tribal and non-tribal fisheries.

- ***Broodstock escapement goal***: The broodstock collection goal is 1,464 adult coho (673 females) per year based on an average fecundity of 2,750 eggs per female. Adult coho are trapped for broodstock at Dryden Dam on the mainstem Wenatchee River. If the weekly broodstock collection goal is not met at Dryden Dam, then adult coho will be trapped concurrently at Tumwater Dam and on Icicle Creek at the Leavenworth NFH.

- ***Conservation goal***: Develop locally adapted, self-sustaining, naturally spawning populations of coho salmon in the Wenatchee River by the year 2026. Once natural populations have been established, natural-origin fish will be included in the broodstock with the ultimate goal that the proportion of the broodstock composed of natural-origin fish (*pNOB*) will exceed the proportion of naturally spawning coho composed of hatchery-origin fish (*pHOS*).

- ***Escapement goal for natural-origin adults***: Achieve a 3-year mean escapement in excess of 1,500 natural origin coho salmon per year in the Wenatchee River upstream of Tumwater Dam.

- ***Research, education, and outreach goals:*** Test the hypothesis that artificial propagation and out-of-basin hatchery stocks can be used to re-establish self-sustaining hatchery and natural populations in the Wenatchee River. Use the results of feasibility studies and assessments in the Wenatchee River as a foundation for reintroduction efforts elsewhere. Studies done in this phase will inform future decisions about whether the long-term vision can be achieved.

Objectives

- Transfer 670,000 eyed eggs derived from adults trapped in the Wenatchee River (at Dryden Dam) to the Willard NFH in December and January.

- Transfer 650,000 yearling smolts at 19-21 fish/lb. from Willard NFH back to the Wenatchee River and Leavenworth NFH in February through late March/early April for acclimation and release at multiple sites in the Wenatchee River watershed.

Program Description

The Yakama Nation, with assistance from the Service, conducts this program with the goal of reintroducing coho salmon to the Wenatchee River, Washington. The program was initiated in

1999 with the release of hatchery-origin coho from Eagle Creek and Willard NFHs (lower Columbia "early-returning" stocks) in 1999. The initial goal of the program was to establish a self-sustaining hatchery-propagated stock in the Wenatchee River. That goal has been achieved. At the present time, returning hatchery-origin adults are trapped in the Wenatchee River at Dryden Dam (near Cashmere, WA) and Tumwater Dam, and at Leavenworth NFH on Icicle Creek. Adult coho are transported to Entiat NFH (on Entiat River) and spawned. Fertilized eggs are incubated initially at Entiat NFH. Eyed eggs are transferred from Entiat NFH to Willard NFH for hatching and rearing. Yearling coho are transferred back to the Wenatchee River for acclimation and release from several locations, including Leavenworth NFH. At the present time, returning hatchery-origin adults are used exclusively for broodstock. Current goals of the program are to establish naturally spawning populations and then integrate natural-origin fish in the broodstock as part of a naturalized, Wenatchee River stock. Willard NFH currently receives 670,000 eyed eggs annually and transfers back approximately 650,000 yearling pre-smolts (19-21/lb.) for acclimation and release in the Wenatchee River one year later. The long-term goal is to attain a level of abundance and viability sufficient to support tribal harvest and conservation goals in the Wenatchee River. The Wenatchee River coho program is reviewed here for the purpose of evaluating Service options and potential priorities for Willard NFH and the Little White Salmon / Willard NFH complex.

Assessment of Current Program

Operational Considerations

Listed below are the principal operational components of the hatchery program that the Review Team considered as part of its review.

Broodstock Choice and Collection

- The Wenatchee River coho stock was derived from "early-returning", lower Columbia River hatchery stocks. These stocks have a common ancestry derived from the Toutle and Sandy rivers and have been propagated as self-sustaining hatchery populations at Eagle Creek and Willard NFHs. The Willard NFH coho program, one source of fish reintroduced into the Wenatchee River, was terminated in 2004. Adults are trapped for broodstock in the Wenatchee River at Dryden Dam and, if needed, at Tumwater Dam and Icicle Creek at Leavenworth NFH.

Hatchery and Natural Spawning, Adult Returns

- Adult returns occur in the Wenatchee River. Adults trapped for broodstock are transferred, held, and spawned at Entiat NFH on the Entiat River.

Incubation and Rearing

- Fertilization and initial incubation occurs at the Entiat NFH. Eyed eggs are transferred to Willard NFH for hatching and subsequent rearing to the yearling pre-smolt stage.

- Eyed eggs are received from Entiat NFH and the Peshastin egg incubation facility.
- 5,000 eyed eggs are loaded per tray at 3 gpm at Willard NFH. Flow rates are increased to 4 gpm after eyed eggs are shocked and dead eggs removed.
- Eggs are hatched in the incubation trays. After egg yolk absorption, fry are transferred to indoor nursery tanks (early February- March) for initial feedings. Fry are transferred to from nursery tanks to outside raceways during the first week of May (650,000 fry into 20 raceways).
- All the fish in each raceway receive a unique, raceway-specific coded wire tag (100% CWT) but no adipose fin clips. The fishery management goal is 100% escapement of these fish back to the Wenatchee River as adults. Fish in several ponds also get PIT tags. Blank wire tags are also applied (immediately below the adipose fin) to fish intended to be released into Nason Creek so that they can be identified as adults at Dryden Dam.
- Raceways have tepee covers that work well. Density indexes are approximately 0.19 for yearlings in January and stay below 0.25 prior to transfer back to Wenatchee River in February through late March/early April.
- Twenty outdoor raceways are used for the program.

Release and Outmigration

- All releases occur in the Wenatchee River watershed. No on station releases occur.

Facilities and Operations

- Two wells supply the nursery with 41.7 degree F water (1500 gpm available). Well water is used for incubation. on well water. Little White Salmon River water is used for rearing in outside raceways (39-46 degrees F.).
- The hatchery facilities include 450 incubation trays (30 stacks of 15 trays each), 52 indoor nursery tanks, and 50 outdoor raceways,.
- Water rights = 50 cfs for river water.
- Domestic water (200 gpm) is available and could potentially be utilized.
- Pollution abatement. Normal discharge water flows into the river. All cleaning effluent water is diverted into the abatement pond and effluent water from pond drains into a drain field.
- Security OK. Water alarms OK.
- Willard NFH has a demonstrated capability to rear URB fall Chinook. Facility has worked well for fall, spring Chinook and coho.

Research, Education, and Outreach

- See Little White Salmon Upriver Bright Fall Chinook section

Benefit and Risk Assessment

BENEFITS CONFERRED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to the propagated stock and local community,[77] the Review Team identified the following benefits of this hatchery program:

Harvest Benefits

- None identified.

Conservation Benefits

- The program has achieved its first major goal: establish a self-sustaining, hatchery propagated stock of coho salmon in the Wenatchee River that does not need to rely on broodstock or fish from outside the basin. This is considered a major accomplishment.

Research, Education, Outreach and Cultural Benefits

- Future goal is create a self-sustaining population that will contribute to harvest opportunity for Columbia Basin tribes and sport fishers.
- Provides a great deal of information on reintroducing a stock that is extirpated.
- Education and outreach benefits identified through Little White Salmon.

BENEFITS CONFERRED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible harvest, conservation, and other benefits that a hatchery program can confer to other species and stocks,[78] the Review Team identified the following benefits of this program:

Harvest Benefits

- None realized to date; however, the long-term goal of the program is to create a self-sustaining population that will contribute to tribal and sport fisheries.

Conservation Benefits

- Increases marine nutrient deposition in upper Columbia streams that may have been deprived due to the extirpation of several salmon populations.

Research, Education, Outreach and Cultural Benefits

- Education and outreach benefits through reintroduction programs in the Wenatchee region as laid out in the Yakama Nation Coho Master Plan.

[77] *See Components of This Report for a description of these potential benefits and risks.*
[78] *Ibid.*

- Future goal is create a self-sustaining population that will contribute to harvest opportunity for Columbia Basin tribes and sport fishers.

RISKS POSED TO THE PROPAGATED STOCK AND LOCAL COMMUNITY

In the context of all possible genetic, demographic, ecological and other risks that a hatchery program can pose to the propagated stock,[79] the Review Team identified the following risks of the hatchery program:

Genetic Risks

- None identified.

Demographic Risks

- None identified.

Ecological Risks

- None identified.

Research, Education, Outreach and Cultural Risks

- None identified.

RISKS POSED TO OTHER STOCKS, SPECIES, AND COMMUNITIES

In the context of all possible genetic, demographic, ecological, and other risks that a hatchery program can pose to other stocks and species in a watershed,[80] the Review Team identified the following risks from the hatchery program:

Genetic Risks

- The Review Team did not assess this issue. Refer to the Yakama Coho Master Plan.

Demographic Risks

- Potential disease risks involved in the transfers of juveniles from Willard NFH to Leavenworth NFH; however, the risks are being managed through established fish health protocol for the program and the established transport permitting system.

- Refer to the Yakama Coho Master Plan for non-rearing related risks.

Ecological Risks

- Refer to the Yakama Coho Master Plan for non-rearing related risks.

[79] *Ibid.*
[80] *Ibid.*

Research, Education, Outreach and Cultural Risks

- None identified.

Recommendations for Current Program

The Review Team considered all the benefits and risks outlined in the preceding section. The Team concluded that some of the risks outlined in the preceding section were either minor or their probability of occurrence was small and, thus, did not warrant a proposed change or recommendation for the current program. The recommendations outlined below, in addition to potentially increasing benefits towards achieving program goals, address the identified risks or potential problems considered by the Review Team to warrant a potential modification to the current program. Preceding each numbered recommendation is a brief summary of the issue.

Program goals and objectives

Issue WI1: The coho reintroduction program, as outlined in the Yakama Nation Master Plan, is considered a feasibility and experimental project. The project has achieved its first (Phase I) major goal.

Recommendation WI1: Continue to assist the Yakama Nation in securing funding and providing facilities to support the program. The program has the potential of conferring highly significant, long-term benefits.

Broodstock Choice and Collection

No issues were identified. Refer to the Yakama Nation Master plan for more information.

Hatchery and Natural Spawning, Adult Returns

No issues were identified. Refer to the Yakama Nation Master plan for more information.

Incubation and Rearing

No issues were identified. .

Release and Outmigration

No issues were identified. Refer to the Yakama Nation Coho Master Plan for more information.

Facilities/Operations

No issues were identified.

Research, Monitoring, and Accountability

No issues were identified. An extensive monitoring and evaluation program is currently conducted by the Yakama Nation, as described in the Yakama Nation Coho Master Plan.

Education and Outreach

See Little White Salmon NFH upriver bright fall Chinook section.

Alternatives to Current Program[81]

The Review Team considered the benefits and risks of the existing coho program at Willard NFH and developed seven alternatives designed to reduce risks and/or increase benefits. The first alternative is the current program with all previously-described recommendations adopted. The last alternative is the "no hatchery" option. Following these descriptions of alternatives, the Review Team has identified a recommended alternative (or alternatives).

Alternative 1: Current program with recommendations

Pros

- Continues support of a regionally approved coho reintroduction program in the Wenatchee River.
- Willard NFH has a long history of successfully rearing coho.
- Since there are no on-station releases, reduces risk of straying in the Bonneville Pool.
- Provides support for tribal trust responsibilities of the Service.

Cons

- Reduces or eliminates the potential for using Willard NFH to support recovery programs (e.g. White River spring Chinook) or higher priority harvest mitigation programs (e.g. upriver bright fall Chinook).

Alternative 2: Terminate current program and reinstitute a coho harvest program

Terminate the coho program at Eagle Creek NFH (Clackamas River basin) and transfer the program to Willard NFH.

Pros

[81] *Alternatives with asterisks (*) were favored by the Review Team over alternatives without asterisks.*

- Reestablishes a sport and tribal coho fishery in Drano Lake.
- Contributes to fisheries in the Columbia River and ocean harvest. Provides fish to tribal zone 6 fisheries (Bonneville Pool).
- Provides in-place, in-kind mitigation for losses in the Bonneville Pool region as a result of Bonneville Dam
- Reduces genetic and ecological risks to ESA listed coho salmon in the Clackamas River.
- Potential egg source for upriver tribal restoration programs.
- Closer geographically to upriver restoration sites.
- Frees up space at Eagle Creek NFH to support conservation hatchery programs in the Clackamas and Willamette River basins.
- Willard NFH has a long history of successfully rearing coho salmon.

Cons

- Eliminates contribution to fisheries in Eagle Creek and the lower Clackamas River.
- Reduces smolt-to-adult survivals back to the hatchery, relative to Eagle Creek NFH, because fish released from Willard NFH would have to travel past Bonneville Dam.
- May pose straying risks into rivers in the Bonneville Pool where coho restoration programs are planned or underway (i.e. Hood River, Big White Salmon River, Klickitat River).
- Reduces or eliminates the potential for using Willard NFH to support ESA recovery programs (e.g. White River spring Chinook) or higher priority harvest mitigation programs (e.g. upriver bright fall Chinook).
- Increases the risk of transferring viruses to other fish populations because Eagle Creek NFH is a virus-free facility, but Willard NFH is a virus-positive facility.
- Complicates broodstock collection at Little White Salmon NFH since coho and upriver bright return times overlap.

Alternative 3: Implement a bull trout program for reintroduction in Big White Salmon River and other sites

Willard NFH may be the most appropriate NFH in the Columbia River basin for rearing bull if artificial propagation is deemed a priority for recovery of bull trout in the Big White Salmon River or other watersheds.

Pros

- Willard NFH may be particularly useful for propagating bull trout because of the availability of cold water for rearing.
- Bull trout is a priority species for the Service.
- Supporting the recovery of bull trout addresses Service ESA trust responsibilities.
- National Fish Hatcheries have been successful at culturing bull trout (i.e. Creston NFH).

Cons

- Difficult species to culture (e.g. highly pisciverous, don't take to feed as well, etc.).
- May reduce production for other priority programs.
- May require facility modifications such as chilling capabilities.

Alternative 4: Terminate the existing coho program and replace with upriver bright fall Chinook from Little White Salmon NFH (to accommodate the White River [Wenatchee] Spring Chinook program at LWS NFH)

For more information, see the alternatives for White River (Wenatchee) spring Chinook in the Little White Salmon/Willard NFH complex alternatives section.

Pros

- Supports recovery of an ESA-listed, "endangered" stock.
- Maintains the production of a highly-valued fall Chinook harvest mitigation program.
- Contributes to fisheries in Drano Lake, the Columbia River and ocean harvest.

Cons

- Terminates or relocates a regionally approved coho reintroduction program in the Wenatchee River.

Alternative 5: Terminate the existing coho program and replace with Little White Salmon upriver bright fall Chinook (as part of Spring Creek Reprogramming)

Pros

- Maximizes the economic value of the tribes fall season fisheries, by creating a different balance of stocks in their fisheries by increasing available URBs and decreasing tule fall Chinook abundance.

- Improves in-place and in-kind mitigation responsibility for John Day Dam.
- Expands the sport and tribal terminal fishery at Drano Lake.

Cons

- Terminates or relocates a regionally approved coho reintroduction program in the Wenatchee River.
- May increase the risk of straying of out-of-basin, out-of-ESU upriver bright fall Chinook from Little White Salmon NFH into the Big White Salmon River and other watersheds in the region.

Alternative 6: Discontinue hatchery program and decommission the facility

Pros

- Willard NFH is an older facility. Decommissioning the facility would reduce the need for future major maintenance investments.

Cons

- Terminates or relocates a regionally approved coho reintroduction program in the Wenatchee River.
- Eliminates the potential for using Willard NFH to support recovery programs (e.g. White River spring Chinook) or higher priority harvest mitigation programs (e.g. upriver bright fall Chinook).
- Reduces support for tribal trust responsibilities of the Service.
- Reduces the Service's outreach capabilities for the Gorge region.

Recommended Alternatives

The Team supports alternatives 1, 3, and 5 as reasonable options for Willard NFH. These alternatives; current (coho) program, bull trout reintroduction, and upriver bright fall Chinook production in support of Spring Creek NFH re-programming may not be mutually exclusive. The team did not prioritize the three supported alternatives. Rather, program "sunsets" and new program development resulted in the immediate, short-term, and long-term goals described below. The Team does not support alternatives 2 (coho harvest program) or alternative 6 (decommission the hatchery).

Immediate recommendation: Alternative 1 (current program with recommendations). This program supports the coho reintroduction plan as outlined in the Yakama Nation Master Plan. Continued support needs to consider the following points:

- Discuss the term of the program or possible modifications to the program with the Yakama Nation.

- Discuss possible reductions to the program with the Yakama Nation regarding the short and long-term goals listed below.

Short-term goals (up to 15 years):

Alternative 3 (Implement a bull trout recovery program). Willard may be the only NFH in the area that has suitable (cold) water to support bull trout culture. This alternative would likely be a very small program and may not impact the current Yakama coho reintroduction effort. The following points should be considered in preparation for bull trout recovery programs:

- The Willard NFH HET should review existing bull trout recovery plans.
- The Willard NFH HET should contact the Oregon Fish and Wildlife Office, WDFW, and ODFW to explore recovery possibilities.
- The Willard NFH HET should contact other offices regarding past or existing bull trout culture programs to review techniques.

Alternative 5 (Terminate the existing coho program and replace with LWS URB fall Chinook as part of Spring Creek NFH re-programming). This alternative would be contingent on the following:

- Re-programming discussions.
- Discussions with the Yakama Nation as listed in alternative 1.
- Development of the "stepping stone" URB program as described in alternative 2 for LWS using Priest Rapids SFH as a broodstock source.
- Straying of URBs to the Big White Salmon River does not impede recovery and reestablishment of naturally spawning populations of tule fall Chinook after removal of Condit Dam.
- Straying of URBs to lower Columbia River production areas is addressed in relation to their affect on ESA listed lower Columbia River Chinook salmon populations.
- Implementation of the White River Captive Broodstock Program

Long-term goal (15+ years): A specific long-term production goal was not identified by the Team. The Teams expectation and optimistic view is that re-introduction and recovery programs such as coho and bull trout will be discontinued as they demonstrate successes. By default fish production at Willard NFH could be in a "perpetual" state of flux as it has been the last few years. Consequently, the Teams more generic long-term goal would be to remain flexible and seek opportunities for additional recovery efforts or to support harvest.

Little White Salmon/Willard NFH Complex Alternatives

Alternative 1: White River (Wenatchee) Spring Chinook F2 rearing program (ongoing since April 2006)

Rear 150,000 F2 White River Spring Chinook received as eyed eggs from F1 captive broodstock. Could still handle Spring Creek Reprogramming if it were to occur (which includes termination of Willard NFH coho). Little White Salmon /Willard NFH Complex currently rears 150,000 F2 White River Spring Chinook. This alternative would allow continuation of the Wenatchee Coho program and implementation of the Spring Creek reprogramming proposal.

Pros

- Supports recovery of an ESA-listed, "endangered" stock. This stock has been identified with distinct biological attributes.
- Considered a highly valued stock for the mid-Columbia river region.
- Program has strong co-manager support.
- Reduces the risk of catastrophic loss by separating broodstock and F2 generation rearing.

Cons

- Increases disease risk and the potential for increased drug use.
- Requires extensive rearing space for the relatively small size of the program.
- Limits options for high-priority programs for the region.
- Does not provide in-place, in-kind harvest mitigation for Bonneville Dam.

Alternative 2: Implement White River (Wenatchee) Spring Chinook captive brood (F1) program

Rear eggs from pumped redds to develop White River (Wenatchee) spring Chinook captive broodstock). Develop three broodlots for a maximum of 510 fish per broodlot.

Little White Salmon/Willard NFH Complex could implement the Spring Chinook captive brood (F1) program and continue the Wenatchee Coho program, but would not have sufficient space to also implement Spring Creek Reprogramming. Of the 4.5 M URBs identified in the reprogramming proposal only 2.7 M could be reared at the facility and the remaining 1.8 M would be reared at the Ringold State facility.

Pros

- Supports recovery of an ESA-listed, "endangered" stock. This stock has been identified with distinct biological attributes.
- Considered a highly valued stock for the mid-Columbia river region.
- Reduces the risk of catastrophic loss by separating broodstock and F2 generation rearing.
- Does not require the termination of the existing coho program at Willard NFH.

Cons

- Increases disease risk and the potential for increased drug use.
- Requires extensive rearing space for the relatively small size of the program.
- Captively-rearing Chinook salmon to sexual maturity in freshwater has not been very successful to date compared to captive-rearing in seawater.
- Limits options for high-priority programs for the region.
- Does not provide in-place, in-kind harvest mitigation for Bonneville Dam.
- Interferes with full implementation of Spring Creek reprogramming.
- Requires significant infrastructural changes to Willard NFH and Little White Salmon NFH (e.g. effluent treatment at Willard NFH, covered raceways at Little White Salmon NFH, effluent disinfection for Willard NFH and possibly Little White Salmon NFH, traveling screen for spring water at Willard NFH, nursery tank covers).
- Captive-rearing of F1 adults to sexual maturity at Little White Salmon NFH does not have strong comanager support.

Alternative 3: Reduce existing programs and implement White River (Wenatchee) Spring Chinook captive broodstock (F1) and F2 rearing program

Rear eggs from pumped redds to develop White River (Wenatchee) spring Chinook captive broodstock). Develop three broodlots for a maximum of 510 fish per broodlot. Early rearing at Willard NFH (complete description)…Rear 150,000 F2 White River Spring Chinook from F1 captive broodstock.

This alternative would be similar to alternative 2 where only 2.7 M of the total 4.5 M URB production could be accomplished at Little White Salmon/Willard NFH Complex when both F1 and F2 White River SCS programs are implemented. The remaining 1.8 M URBs would go to Ringold State facility. The Wenatchee Coho program would continue at Willard under this alternative also.

Pros

- Supports recovery of an ESA-listed, "endangered" stock. This stock has been identified with distinct biological attributes.
- Considered a highly valued stock for the mid-Columbia river region.
- The F2 portion of the program has strong co-manager support.

Cons

- Increases the risk of catastrophic loss by rearing captive broodstock (F1) and F2 generations at the same complex.
- Increases disease risk and the potential for increased drug use.
- Requires extensive rearing space for the relatively small size of the program.
- Limits options for high-priority programs for the region.
- Does not provide in-place, in-kind harvest mitigation for Bonneville Dam.
- Interferes with full implementation of Spring Creek reprogramming.
- Requires significant infrastructural changes to Willard NFH and Little White Salmon NFH (e.g. effluent treatment at Willard NFH, covered raceways at Little White Salmon NFH, effluent disinfection for Willard NFH and possibly Little White Salmon NFH, traveling screen for spring water at Willard NFH, nursery tank covers)
- Captive-rearing of F1 adults to sexual maturity at Little White Salmon NFH does not have strong comanager support.

Alternative 4: Use Carson Depot Springs incubation facility for conservation and recovery of listed populations in the lower Columbia

Use Carson Depot Springs incubation facility to rear fish for the recovery of listed populations. Fall chum in the upper Columbia Gorge (e.g. Wind River, Big White Salmon River, Hood River), in particular, may be a suitable target stock.

Pros

- Carson Depot Springs is currently available for incubation and is isolated from other hatchery populations.
- Targets the recovery of ESA-listed populations.
- Hatchery actions have been identified by the state of Washington to reduce the near term extinction risks to fall chum.

- Big White Ponds would be available for acclimation and release into the Big White Salmon River.

Cons

- May conflict with Spring Creek Reprogramming.
- May require the construction or utilization of additional rearing facilities and/or acclimation sites on targeted rivers (not including Big White Salmon River)
- Infrastructure improvements, such as security and circular starter tanks, would be required at Carson Depot Springs.
- Broodstock mining risk given the relatively low abundance of fall chum in the lower Columbia.
- Precludes use of Carson Depot Springs for incubation of URB fall Chinook eggs for the Klickitat Hatchery URB program, which is currently under comanager discussion.

Recommended Alternatives

The Team ***primarily*** supports alternative 1 ***or*** 2. These alternatives, White River spring Chinook F2 rearing ***or*** F1 captive brood development, are considered of equal priority by the Team. However, supporting ***both*** programs (alternative 3) ***may be*** a viable option as well. Although, the HRT has concerns regarding the risk of a catastrophic event causing the loss of the entire program if both F1 and F2 programs are conducted within the same complex. The HRT is also concerned that the infrastructure/space required to implement alternative 3 would reduce or eliminate other high priority programs identified for individual hatcheries within the complex (e.g. Willard Yakama coho reintroduction efforts). Alternative 4, use of Carson Depot for conservation and recovery programs, is also highly supported by the Team. Although Carson Depot is part of the complex, its parallel use should not impact the White River spring Chinook alternatives listed above. Again, the HRT did not specifically prioritize the alternatives. Rather, program priorities are implied within the short and long-term goals listed below.

Immediate recommendation: **Implement *either* alternative 1 *or* 2 (F2 or F1 White River spring Chinook support)**. Support for either program needs to consider the following points:

- The Team's "facility evaluation" paper with respect to specific facility capacities.
- Alternate facilities outside the LWS/Willard complex to support whichever program that is not supported within the complex.
- Need to consider impacts to existing high priority programs identified within the review of specific hatcheries within the complex.

Short-term goals (up to 15 years):

1. **Continued support of the immediate recommendation.** During this period the Service should consider the following points:

- Maintain frequent communication with the co-managers regarding program monitoring and success as it relates to phasing out of the program as described in the White River supplementation program HGMP.

- Should be prepared for program "re-direction" (adaptive management), short or long term, depending on program success.

2. **Alternative 4 (Use of Carson Depot Springs incubation facility for conservation and recovery of listed populations in the lower Columbia.** Actions required include:

    - Immediate facility/infrastructure improvements (e.g. start tanks, security, etc) regardless of whether a program has been identified that could use the Depot.

    - Initiate co-manager discussions to identify programs that could include the Depot.

<u>Long-term goal (15+ years)</u>: A specific long-term production goal for the complex as a whole, other than those identified for specific hatcheries within the complex, was not identified by the Team.

The Team's expectation and optimistic view is that the LWS/Willard complex support of recovery programs will be successful and discontinued as they demonstrate success. We also expect that more opportunities will arise to assist with other recovery needs as we demonstrate success and willingness to accept new challenges. Consequently, the Teams more generic long-term goal would be to remain flexible and seek opportunities for additional recovery program or harvest support.

VII. Conclusions

The Review Team concluded that the current spring Chinook salmon program at the Carson NFH is providing a significant harvest mitigation benefit within the Wind River basin and in fisheries in the mainstem lower Columbia River. Recent ongoing studies and other available information indicate that ecological interactions between hatchery-origin spring Chinook and natural populations of steelhead within the Wind River basin are either minor or nonsignficant. In general, the spring Chinook program at Carson NFH appears to be providing significant harvest benefits with little biological risks to natural populations in the Wind River.

The Review Team similarly concluded that the current tule fall Chinook program at Spring Creek NFH is providing significant harvest mitigation benefits to tribal fisheries in the Bonneville pool and to recreational and commercial fisheries in the mainstem lower Columbia River and coastal waters of the United States and Canada. However, the current water supply and reuse system poses demographic and fish health risks to the hatchery stock, and the Team recommends that the size of the program be reduced from 15.1 million to 10.5 million fall Chinook subyearlings to reduce those risks via lowered rearing densities.

The fall Chinook stock at Spring Creek NFH was initially developed in the early 1900's from natural-origin adult spawners in the Big White Salmon River; consequently, the Review Team supports the use of this stock and facilities at Spring Creek NFH to assist with recovery of the natural fall Chinook population of the Big White Salmon after removal of Condit Dam. The Team advises the Service to complete stock identification work on present natural spawners in the Big White Salmon and work with co-managers to develop a restoration strategy for the natural population in this watershed. The Team also recognizes that the presence of nearby large-scale hatchery production programs require means of controlling (tule fall Chinook) or excluding (URB fall Chinook) most hatchery-origin adults from the natural production areas of the Big White Salmon River.

The Team was somewhat uncomfortable with the present lack of defined recovery strategies for listed fall Chinook, coho, and chum salmon in the tributaries of Bonneville Pool. The Big White Salmon River in particular was not addressed in the development of the state of Washington component of the Lower Columbia recovery plan. The Team understands that inter-agency discussions are ongoing concerning restoration of salmon and steelhead in the Big White Salmon River following the proposed removal of Condit Dam, but a detailed restoration strategy has not yet been developed. The Team strongly advises the Service to closely track completion of the Lower Columbia Recovery Plan and adjust future program goals for Gorge NFHs consistent with those identified recovery strategies.

The Review Team concluded that the current upriver bright fall Chinook salmon program at the Little White Salmon NFH is also providing a significant harvest mitigation benefit to tribal fisheries in the Bonneville pool, particularly Drano Lake, and recreational and commercial fisheries in the mainstem lower Columbia River and coastal waters of the United States and Canada. However, the Team was concerned with the genetic and ecological impacts of this introduced mid-Columbia stock on the viability and recovery of natural populations of fall Chinook populations within the lower Columbia River ESU. The Team was also concerned about biological and management inconsistencies between the current URB fall Chinook stock and conservation/restoration goals for URB fall Chinook in the Yakima River and mid-Columbia region. The Team concluded that this program should transition to a new "stepping-stone" broodstock program that is integrated genetically with the Priest Rapids Hatchery stock or other mid-Columbia stock with a naturally-spawning component. As a long-term

goal, the Team recommends reducing releases of URB fall Chinook in the Bonneville pool region with increased upriver releases within the historic natural population areas of upriver bright fall Chinook. Such a management adjustment would also best serve the goal of providing *in-place* and *in-kind* mitigation for the loss of upriver bright fall Chinook spawning habitats inundated by the pools behind John Day Dam and other projects (e.g., McNary Dam).

Large hatchery fall chinook mitigation programs such as those at Little White Salmon and Spring Creek NFHs release large numbers of juvenile fish into the lower Columbia River. The Team is aware of little information which allows fishery managers to assess any impacts which these programs may have on the continued viability of listed naturally spawning fall Chinook salmon in the lower Columbia River including the Columbia River estuary. The Team encourages further assessment of this possible interaction and future adjustment to production programs as necessary to reduce or eliminate possible adverse effects on natural populations.

The Review Team concluded that the current spring chinook salmon program at Little White Salmon NFH is providing a significant harvest mitigation benefit within Drano Lake and in fisheries in the mainstem lower Columbia River. The Team proposes that the Service work closely with the Yakima Nation and the Washington Department of Fish and Wildlife to transition to a suitable local broodstock such as the Klickitat spring chinook stock. This would allow the present mitigation program to proceed with reduced impact on nearby natural production areas and would allow this program to support the proposed reintroduction of spring chinook into the Big White Salmon.

The Review Team concluded that the current coho salmon program at Willard NFH is providing a long-term conservation benefit to the reintroduction of coho salmon to tributaries of the upper Columbia River. The Team notes that the facilities and water supply at Willard NFH are capable of playing an important role in several proposed conservation and reintroduction programs. As upper river facilities are developed which can provide support to this reintroduction program and as the natural production of coho in the upper Columbia increases, the Team expects that this role for Willard NFH will be phased out and supplanted by other conservation programs.

Overall, the Team concludes that the National Fish Hatcheries of the Columbia River Gorge are playing a valuable and effective role in partially mitigating for the effects of habitat destruction in this section of the Columbia River caused by hydroelectric development. These facilities are also uniquely situated to support reintroduction and restoration of native salmon species in the tributary streams of the Columbia River Gorge.

Appendices

Appendix A: All-H Analyzer (AHA) output for salmon and steelhead stocks in the Columbia Gorge Province

(Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/)

Appendix B: Columbia Gorge NFH Briefing Document

Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix C: Comments on Draft Report and Review Team Responses

Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix D. Complete Text of Comment Letters Received from Stakeholders

Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Appendix E: Columbia Gorge NFH Operations and Maintenance Costs Summary

Available from the Columbia Basin Hatchery Review website, www.fws.gov/pacific/fisheries/hatcheryreview/reports.html/

Pacific Region Fishery Resources
911 NE 11th Avenue
Portland, OR 97232
503/872.2763
E-Mail: Douglas_dehart@fws.gov

U.S. Fish and Wildlife Service
www.fws.gov

For Columbia River Basin Hatchery Review Information
www.fws.gov/pacific/Fisheries/Hatcheryreview/

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people.

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