HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program	Upper Columbia River Spring-run Chinook Salmon - White River Supplementation Program
Species or Hatchery Stock:	Spring Chinook Salmon *Oncorhynchus tshawyscha*
Agency/Operator:	Public Utility District No 2 of Grant County, Washington Department of Fish and Wildlife, Yakama Nation
Watershed and Region:	Wenatchee Watershed Upper Columbia Region
Date Submitted:	Draft copy for review only
Date Last Updated	July 10, 2007

SUMMARY

The goals of this program are to prevent the extinction of, to conserve, and to aid in the recovery of the naturally spawning White River spring Chinook salmon aggregation and to meet the mitigation responsibilities of Grant County Public Utility District No. 2 (Grant PUD) while factors that limit the recovery of the Wenatchee population are remediated. The integrated recovery program is funded by Grant PUD. Overall program direction is provided in the Biological Opinion approved for the Priest Rapids Hydroelectric Project, the Section 10 permit #1592 issued for scientific research/enhancement – artificial production, and the Priest Rapids Project Salmon and Steelhead Settlement Agreement. As directed by program documents, the Priest Rapids Coordinating Committee Hatchery Subcommittee has been formed to oversee the planning and implementation of the program.

The White River spring Chinook population is part of the Upper Columbia Evolutionary Significant Unit which was listed as endangered under the Endangered Species Act. Supplementation is being used as a risk aversion measure to meet mitigation obligations, to increase the number of returning adults, and to decrease the risk of extinction. It is one of several components of the recovery strategy for Upper Columbia River spring-run Chinook. Concurrent habitat, harvest, and hydro-system protection and improvement strategies are being employed throughout the region.

Since 1997, the White River spring Chinook supplementation program has been in a juvenile-based captive brood phase. The source for broodstock is 135 (or fewer) natural origin eggs or fry that are collected from up to 50 redds in the river. After rearing in captivity to adulthood, these adults are spawned and their progeny are grown to smolt size for release back into the White River. In the future, the program will transition into an adult-based supplementation phase. Starting as soon as 2012, White River origin adults will be trapped and spawned to produce the 150,000 smolts targeted for release.

The facilities required for both the captive brood and adult-based supplementation phases have the following functions: rearing captive brood, capturing adults, holding adults, rearing pre-smolts, acclimating through the winter, and acclimating at final release locations. Captive brood rearing is being done at a private hatchery in Western Washington and second generation pre-smolts are being reared at the Little White Salmon National Fish Hatchery. The other facility components have not yet been sited, designed or built.

Brood collection is an important part of the supplementation process. Capture of White River origin adults that are characteristic of the natural population is a program objective. Local acclimation is another important program component. The program goal is to hold pre-smolts in natural conditions in the White River basin for several months prior to release. Acclimation, and other facilities, will be designed and operated to improve adult survival rates, minimize straying, minimize impacts to naturally produced fish, and to fit into the existing watershed landscape.

Program managers have developed a list of performance standards and indicators that will be used to quantify the impact of using supplementation as a recovery tool. Program effectiveness in several general categories will be measured: legal mandates, conservation of the naturally spawning population, genetic characteristics, and facility operation. A monitoring and evaluation (M&E) plan is proposed that will collect the data necessary to measure program performance. The M&E plan conforms to the objectives and data collection protocols that were generated from Chelan and Douglas PUDs' Habitat Conservation Plans.

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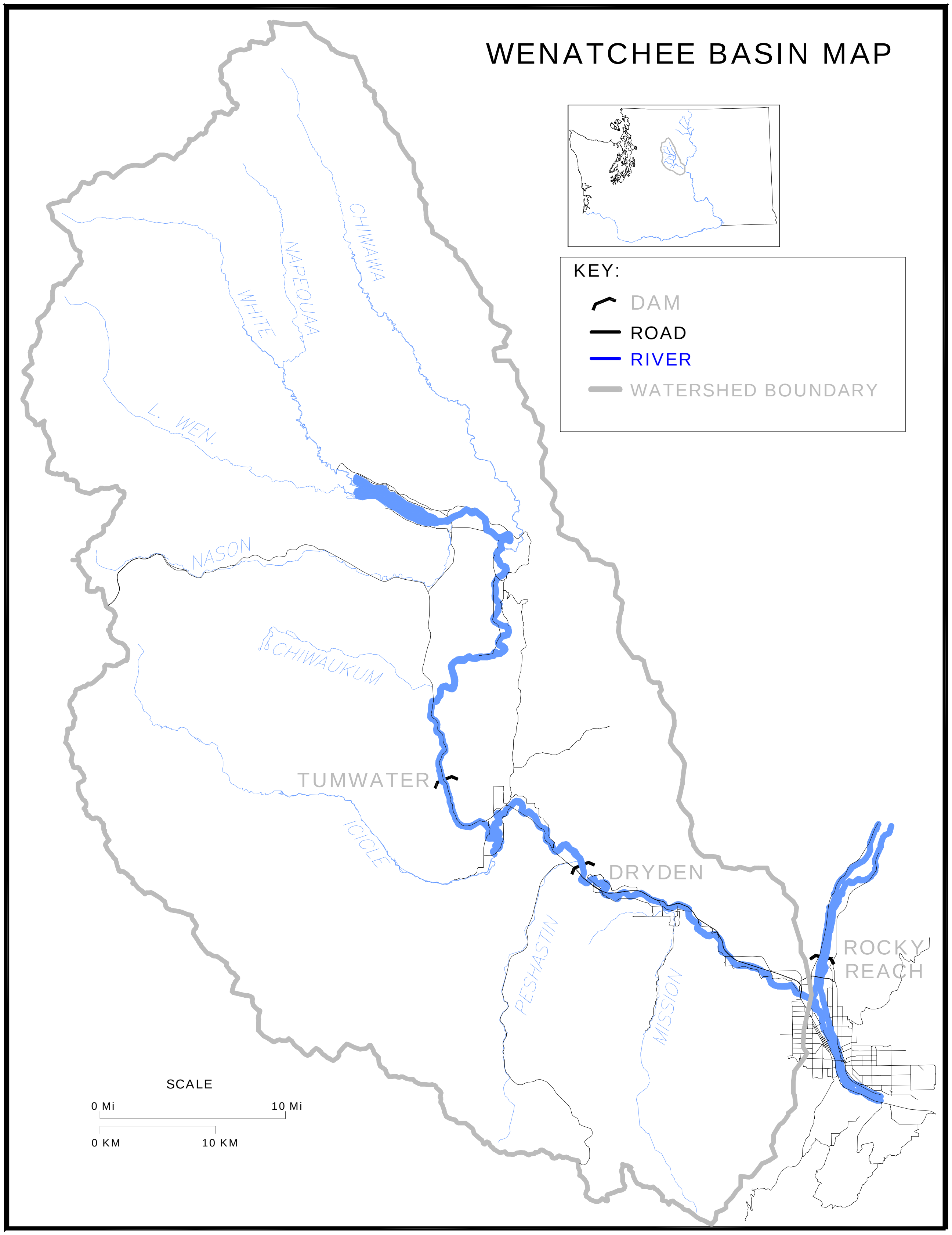
WENATCHEE BASIN MAP
KEY:
DAM
ROAD
RIVER
WATERSHED BOUNDARY
CHIWAWA
NAPEQUAA
WHITE
L. WEN.
NASON
CHIWAUKUM
TUMWATER
ICICLE
DRYDEN
PESHASTIN
MISSION
ROCKY REACH
SCALE
0 Mi
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10 KM

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Basic program description.

Name: Upper Columbia River Spring-run Chinook Salmon - White River Supplementation Program.
Species and ESA status: Spring Chinook salmon, *Oncorhynchus tshawytscha*, endangered.
Type of program (*Define as either: Integrated Recovery; Integrated Harvest; Isolated Recovery; or Isolated Harvest):* Integrated Recovery Program (see Attachment 1 for definitions).
Watersheds targeted: White River (Wenatchee River system, Washington) – Watershed Resource Inventory Area (WRIA) #45
Funding source, staffing level, and annual operating costs:
Funding: Public Utility District No.2 of Grant County (Grant PUD – see Attachment 6 for a list of acronyms). Combined program costs for the White River and Nason Creek programs are shown below. Most of these costs are for the White River program.

	Total to 2007	Estimated 2007
OPERATING COSTS		
Captive Brood Program - Aquaseed	$ 8,061,500	$ 1,340,000
Rearing - USFWS		$ 472,000
Grant PUD Admin Costs	$ 449,320	$ 250,000
Other Operating Costs	$ 1,000,300	$ 862,000
Total	$ 9,511,120	$ 2,924,000
CAPITAL COSTS		
Facility Improvements - Aquaseed	$ 1,193,000	
Facilities - Other	$ 718,263	
Property Costs	$ 563,000	$ 130,138
Total	$ 2,474,263	$ 130,138
TOTAL	$ 11,985,383	$ 3,054,138

1.2) Purpose (goal) of program.

Define as: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research.

Conservation/Preservation: The goal of this program is to prevent the extinction of and conserve the naturally spawning White River spring Chinook salmon spawning aggregation while factors that limit the recovery of the Wenatchee population are remediated.

Mitigation: The conservation/preservation program has been incorporated as part of a suite of mitigation actions listed in the Biological Opinion issued for the Priest Rapids Project by NMFS on May 3, 2004 (Biological Opinion). As recovery of natural production occurs, the responsible parties (see below) will modify the program to meet the continuing mitigation responsibilities associated with operation of the Priest Rapids hydro complex.

1.3) Responsible organization and individuals.

Indicate lead contact and on-site operations staff lead:

Agency: Grant PUD
Name (and title): Russell Langshaw – Fisheries Scientist
Address: P.O. Box 878, Ephrata, WA. 98823
Telephone: 509 754-5088
Fax: 509 989-7305
Email: Rlangsh@gcpud.org

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

- Washington Department of Fish and Wildlife (WDFW): Kirk Truscott - Co-manager and Priest Rapids Coordinating Committee, Hatchery Subcommittee (PRCC HSC) member.
- Confederated Bands and Tribes of the Yakama Nation (YN): Tom Scribner - Co-manager and PRCC HSC member.
- Confederated Tribes of the Colville Indian Reservation (CCT): Jerry Marco - Co-manager and PRCC HSC.
- Confederated Tribes and Bands of the Umatilla Indian Reservation (CTUIR): Carl Merkle - Co-manager and PRCC HSC.
- National Marine Fisheries Service (NMFS): Kristine Petersen - Administration of the Endangered Species Act and member of the PRCC HSC.
- U.S. Fish and Wildlife Service (USFWS): David Carie – Administration of the Endangered Species Act and member of the PRCC HSC.
- USFWS, Little White Salmon/Willard National Fish Hatchery: Speros Doulos - Complex Manager. Contractor to Grant PUD.
- AquaSeed Inc.: Greg Hudson - Captive broodstock rearing and spawning operations; contractor to Grant PUD.
- D. Rohr & Associates, Inc.: Denny Rohr – PRCC HSC facilitator; contractor to Grant PUD.
- Sea Springs Co: Greg Ferguson – HGMP production and facilities planning consultant to Grant PUD.
- Jacobs Engineering: David Allison – Facilities engineering consultant to Grant PUD.

1.4) Location(s) of hatchery and associated facilities.

The program is currently in a juvenile-based captive brood phase. Eggs or fry are removed from the White River and reared to adulthood in order to produce second generation smolts that are planted back in the river via acclimation. Several hatchery facilities outside the Wenatchee River basin are currently being used to rear the broodstock and their progeny.

Facilities being used during the captive brood phase include:

- AquaSeed Corporation Facilities: 10420 173rd Ave. SW., Rochester, Thurston Co., WA. 98579-9644. Captive brood are reared at AquaSeed. Receiving water: 001 and

002 Black River, Water Body ID No: WA-23-1015.

- Eastbank Hatchery, 13246 Lincoln Rock Road East, East Wenatchee WA 98802. Located on the east side of the Columbia River near Rocky Reach Dam, 7 miles north of Wenatchee, Washington (WRIA 48). River mile 473. A portion of Brood YR 2004 progeny were reared at this local and released into the White River in spring 2006. Future use of the Eastbank facility is no longer a viable consideration due to water issues and mitigation obligations in the Rock Island and Rocky Reach Dam HCPs.
- Little White Salmon National Fish Hatchery (NFH), 56961 State Route 14, Cook, WA 98605. Located at river mile 1 on the Little White Salmon River (WRIA 29). Brood year 2005 captive brood progeny were reared at Little White Salmon NFH. Additional rearing of Brood YR 2006 and 2007 progeny is being considered by the PRCC HSC.
- Tall Timbers Ranch on the White River (WRIA #45). River mile 11. Acclimation/release occurred at Tall Timbers during 2004 and 2005.
- Lake Wenatchee net pens (WRIA 45). The pen complex is located on the west end of the lake near the mouths of the White River and Little Wenatchee. Yearlings were released from the net pens in 2007.

Transition to an adult-based supplementation phase will occur as progeny from the last egg/fry removal are released. Facilities for brood capture, adult holding, rearing, and acclimation/release have not yet been located (see section 5).

1.5) Justification for the program.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population.

The supplementation program is intended to increase the numbers of returning White River origin adults. The egg to smolt survival advantages of hatchery rearing will allow increased numbers of smolts to migrate from the target watershed. By using natural origin stock in the supplementation program, the resulting improved adult run size will help reduce the threat of extinction and help prevent the loss of fitness that can result from the inbreeding depression and genetic drift effects inherent to small populations.

The White River spring Chinook spawning aggregation is severely depressed and persistently experiences escapement levels below critical population thresholds. Meyers et al. (1998) reported geometric mean escapement of 25 spawning adults between 1990 and 1994 with a negative short-term population abundance trend of –35.95 and negative long-term trend of –10.6%. More recently, the West Coast Salmon Biological Review Team (WCSBRT 2003) reported a continued negative short-term abundance trend with a 1997-2001 abundance trend of 6.6% and geometric mean of nine redds. The White River spawning aggregation is within the Upper Columbia River (UCR) spring-run Chinook salmon Evolutionary Significant Unit (ESU) which is listed as Endangered (FR Vol. 64, No. 56, March 24, 1999). This ESU includes all naturally spawning populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. McClure et al. (2003) further delineated the ESU, describing three populations: Wenatchee River (except Icicle Creek), Entiat River, and the Methow River. The White River aggregation is the most genetically unique among those spawning in tributaries within the ESU (Utter et al. 1995, Ford et al. 2001, McClure et al. 2003). An updated genetic evaluation (microsatellite analysis) of the White River aggregation and other spawning aggregates in the Wenatchee basin began in 2004 and is supported through a natural reproductive success study funded by Bonneville Power Administration (BPA Project No. 2003-0399-00). Data analysis of 2004 and 2005 reproductive success data indicates that the White River spawning aggregate continues to represent a distinct sub-population in the Wenatchee River basin (Murdoch et al. 2006). Supplementation using artificial propagation of the White River, Nason Creek, Chiwawa River, Twisp River, Methow River, and Chewuch River stocks was determined to be essential to recovery and these hatchery programs are included in the ESU.

The survival efficiency gained between the eyed egg and adult life history stage while reared in captivity (i.e., program goal = 30%) is expected to increase the quantity of naturally spawning adults when compared to that realized in the natural environment (0.1%) or to traditional adult-based supplementation hatcheries (0.5%). When eggs are collected from captive brood adults, the second generation progeny (F2) are expected to benefit from the additional survival advantage during the juvenile life history phase (about 65% vs. about 15% when compared to natural production) before being released as smolts for natural migration to the ocean and subsequent return. The rapid amplification gained through survival efficiencies while in the hatchery environment is intended to result in a greater quantity of spring Chinook salmon returning to the White River for natural spawning.

The program is expected to transition from a captive brood-based program to an adult-based supplementation program as the naturally spawning target population becomes more robust and the risk of extinction is lessened or the program is determined to fail to meet performance standards as determined by the PRCC under the Biological Opinion. The transition into adult-based supplementation is expected to occur after 2009, but may differ depending on the success of the captive broodstock program, the rate of recovery, and the availability of adult-based supplementation facilities.

McElhany (2000) provided a framework for describing Viable Salmon Populations (VSP) to aid in recovery planning for Endangered Species Act (ESA) listed species. This framework described four elements that should be satisfied before any listed species could be considered recovered. The VSP elements are abundance, population growth rate, population spatial structure, and diversity. Qualitative guidance was provided for each VSP element. Several subsequent analyses have provided refined criteria for use in applying the VSP guidance to the UCR-ESU [Ford et al. 2001, McClure 2003, Interior Columbia Basin Technical Recovery Team (ICTRT 2004b)]. Final VSP recovery criteria have not been established for the UCR spring-run Chinook ESU. The White River captive broodstock program is designed to complement recovery consistent with VSP criteria.

Abundance:
Ford et al. (2001) proposed an interim population abundance recovery level of 3,750 adult returns from natural spawning in the Wenatchee River watershed. The Wenatchee

River natural escapement continues to be below the interim VSP recovery level with a 5-yr geometric mean escapement of 274 (WCSBRT 2003). The White River spring Chinook captive broodstock program is expected to decrease short-term extinction risk within the White River spawning aggregation by rapidly increasing the abundance of naturally spawning spring Chinook. The White River recovery effort is expected to complement supplementation programs in other key tributaries of the Wenatchee River population and contribute to an overall increase in abundance, maintain/enhance diversity and spatial distribution, and enhance productivity of Wenatchee River basin spring Chinook population. Enhancing these population metrics (VSP criteria) for the Wenatchee River basin spring Chinook population is consistent with recovery of the UCR spring Chinook ESU.

Population Growth Rate:
Viable Salmonid Population (VSP) criteria state that the population growth rate should exceed a 1.0 natural return ratio (NRR) per generation and should equal at least 1.0 for recovered populations (McElhany et al. 2000, Ford et al. 2001). Previous status reviews have indicated that short-term population growth rates in the Wenatchee River population averaged –37.4% between 1977 and 1995 and continued to decline at –16% between 1990 and 2001 (Meyers et al. 1998, WCSBRT 2003). The short-term growth rates for the White River during the same periods were –35.9% and –6.6% respectively. Returns per spawner in the White River have averaged 1.37 over a 20-yr period between 1981 and 2000 with seven of 20 years showing a positive return-per-spawner (Andrew Murdoch, WDFW, personal communication). The effectiveness of the captive broodstock approach will ultimately be mediated by the productive potential of naturally spawning adults from the captive broodstock program. Adult returns from captive broodstock propagation have the potential to relieve some dispensatory pressure in the White River, including mate location and selection, nutrient enhancement from increased carcass deposition, and cleaning of impacted spawning gravel. A robust monitoring program (see section 11) will be in place to evaluate productivity and population growth rate (productivity) in response to captive broodstock augmentation.

Population Spatial Structure
Conservation and rebuilding of the White River spawning aggregation is the primary focus of the captive broodstock program and is highly consistent with VSP criteria for population spatial structure. VSP criteria describe multiple spawning aggregations or "demes" using diverse habitats in multiple streams within independent populations of the ESU (McElhany et al 2000, Ford et al. 2001, ICTRT 2004b). The Interior Columbia Basin Technical Recovery Team (ICTRT 2004b) identified the White River as one of the core spawning locations within the Wenatchee River watershed. Ford et al. (2001) provided a guideline specifying subpopulations in at least three tributaries within a given independent population, each supporting at least 5% of the population's total spawners. These subpopulations should be impacted by a minimal amount of straying caused by human activity. Eggs or fry are collected only from within the White River spawning population. Only eggs, fry or F2 augmentation progeny from parents known to be of natural origin are included in the captive broodstock program. All progeny of captive broodstock are released into the White River after a period of imprinting in acclimation sites supplied with ambient White River water.

Straying of fish from other hatchery programs not funded by Grant PUD may be affecting the population structure and diversity of spring Chinook salmon in the White River. Efforts are underway to reduce potential adverse impacts of stray fish. Currently, only eggs from natural-origin spawning pairs are retained for F1 adults (positively identified spawning-pairs during spawning ground surveys or determined through genetic analysis if spawning-pair origin is undetermined). Additional actions in the near-term to reduce potential strays to the White River include: modified water-supply piping at the Chiwawa Hatchery to increase the duration of imprinting on Chiwawa River water for improved homing fidelity of Chiwawa hatchery-origin fish to the Chiwawa River, translocation of known Chiwawa River hatchery-origin fish from Tumwater Dam to the Chiwawa River during adult migration, and may include removal/translocation of known hatchery strays in the White River during adult broodstock collection/evaluation activities in the White River basin.

Diversity:
Maintaining and rebuilding relatively isolated spawning subpopulations in multiple tributaries within an ESU population is essential to meet VSP criteria for diversity. The use of diverse spawning and rearing habitats coupled with the high homing fidelity of Pacific salmon promotes a level of genetic, demographic, and phenotypic variation that assures resilience in the face of natural, anthropogenic, and catastrophic disruptions. The fundamental goal of conserving and rebuilding the White River spawning aggregation contributes directly to maintaining diversity within the Wenatchee River population. The White River captive broodstock program in concert with artificial production programs supporting recovery in other major tributaries of the Wenatchee River watershed will, if successful, maintain and enhance diversity consistent with VSP criteria.

In addition to survival enhancement of the listed spring Chinook population, program justification includes other cultural, socio-economic, and ecological benefits. For example, the commercial value of Columbia basin tribal, commercial, and recreational fisheries is estimated by the Independent Economic Analysis Board (IEAB 2005) as contributing "about $142 million total personal income annually to communities on the West Coast." A recovered UCR spring Chinook population can help increase that harvest, directly and indirectly. Also, general ecosystem recovery is a goal of many Columbia River Tribes, communities, and citizen groups. The benefits to other listed and non-listed species in the region are discussed in section 3.5 and in Addendum A. As stated in the Endangered Species Act (1973): "various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation;…these species of fish, wildlife, and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."

1.6) Performance Standards and Indicators.

"Performance Standards" are designed to achieve the program goal/purpose, and are generally measurable, realistic, and time specific. "Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific

parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

1 Legal Mandates

1.1 *Standard*: Program contributes to mitigation requirements as stipulated in the Biological Opinion for the Priest Rapids Project and amended by the PRCC.
Indicator: Number of fish released by program. Release up to 150,000 White River spring Chinook smolts from acclimation-release site(s) located on the White River. Initial releases are from captive broodstock production. Program will transition into an adult-based supplementation program following rebuilding of White River spawning aggregation or if the program fails to meet performance standards as determined by the PRCC HSC (Biological Opinion requirement).
Monitoring and evaluation: PRCC HSC receives an annual report from Grant PUD and the operating agencies detailing production in relation to requirements of the Biological Opinion for the Priest Rapids Project (M&E Objective 6, see section 11).

1.2 *Standard*: Artificial propagation activities comply with ESA responsibilities.
Indicator: Compliance with Section 10 permit #1592 and all Reasonable and Prudent Alternatives (RPAs) listed in the Biological Opinion. Compliance includes regular reporting requirements.
Monitoring and evaluation: Provide regular reports to NMFS as required.

1.3 *Standard*: Program is consistent with other legal mandates outside of Grant PUD's mitigation requirements.
Indicator: Federal treaty obligations to Native Americans, court approved actions developed under the auspices of United States v. Oregon, and U.S./Canada Pacific Salmon Treaty obligations.

2 Conservation of Wild/Naturally Spawning Populations

2.1 *Standard*: Prevent extinction of the White River spawning aggregation using captive broodstock technology transitioning to adult-based supplementation to rapidly increase numerical abundance and improve population viability within the ESU.
Indicator: Annual number of artificially produced smolts released.
Indicator: Annual number of adults surviving from artificially produced smolts. The adult contribution would be approximately 450, if the smolt-to-adult survival rate is 0.3%. This is the historical performance of Chiwawa River hatchery spring Chinook and the expected performance standard developed in the Biological Assessment and Management Plan (BAMP 1998).
Indicator: Number of adults spawning in the wild.
An upstream, minimum escapement goal of approximately 80 adults (a number derived from NMFS recommendations for collection of broodstock for endangered Snake River spring Chinook salmon populations, see BAMP, 1998) per year will be maintained as a minimum level for natural spawning. The escapement goal will be re-evaluated as information on the White River population is collected.
Monitoring and evaluation: Smolt-to-adult survival rates through operation of a juvenile trap, recovery and analysis of coded-wire or PIT-tagging data, enumeration at adult

collection or passage facilities, and spawning ground surveys (Objective 1 and 4). Productivity of naturally spawning population using the same sampling techniques (Objective 1 and 7).

2.2 *Standard*: Minimize disease risk to wild fish. Releases do not introduce pathogens not already existing in the local populations and do not significantly increase the levels of existing pathogens
Indicator: Fish health reports. All activities are conducted in accordance with the WDFW Fish Health Manual (WDFW 1996), the Co-Managers Salmonid Fish Disease Control Policy (1997), the Pacific Northwest Fish Health Protection Committee (PNFHPC 1989) and the PRCC HSC.
Indicator: Certification of juvenile fish health 2 weeks prior to release, including pathogens present and their virulence.
Indicator: Natural-origin juvenile fish health. Methods to evaluate natural fish health have not yet been determined.
Monitoring and evaluation: Fish health specialist will visit rearing sites regularly to assess fish health, detect potential fish health problems, and draft reports. As necessary, the fish health specialist will recommend remedial or preventative measures to treat or prevent disease with administration of therapeutic or prophylactic treatments. All fish will be handled, transported, and propagated in accordance with prevailing fish health disease prevention and control standards to minimize the risk of disease transfer to wild fish (Objective 9).

2.3 *Standard*: Broodstock collection and juvenile hatchery releases minimize ecological effects on listed wild fish.
Indicator: Fish culture practices.
Hatchery spring Chinook reared to sufficient size such that smoltification occurs within nearly the entire population, reducing residence time in streams after release (CV length < 10%, condition factor 0.9 – 1.0). Smolts are to be acclimated and imprinted on surface water from the White River for up to 6 months to enhance smoltification and reduce residence time in the tributaries and mainstem migration corridors. All spring Chinook encountered in adult broodstock collection operations will be held for a minimal duration in the traps; generally less than 24 hrs. White River spring Chinook trapped in excess of broodstock collection goals will be released upstream as soon as possible, other trapped spring Chinook adults will be returned to their natal streams.
Monitoring and evaluation: Fish culture and evaluation staff will monitor fish behavior, coefficient of variation in length, and condition. Fish health specialists will certify all hatchery fish before release. At least one juvenile trap will be used to monitor the outmigration of wild fish. Outmigration may also be monitored through PIT-tag detection systems at mainstem passage facilities. Broodstock collection protocols will be developed each season and reviewed by the PRCC HSC.

2.4 *Standard*: Minimize the ecological effects of M&E on listed wild juvenile spring Chinook, hatchery spring Chinook, and steelhead juveniles.
Indicator: M&E practices.
Capture, handle, and release no more than 20% of the juveniles emigrating from the White River and limit the lethal take to less than 2%. Fish must be: anesthetized when

handled out-of-water, kept in water to the maximum extent possible, transferred in equipment that holds water, and not handled when temperatures exceed 69.8^0F. Visual observation methods must be used wherever possible.
Monitoring and evaluation: Record numbers handled, methods used, and take for all M&E activities that involve listed species.

3 Genetic Characteristics
3.1 *Standard*: Conserve and enhance spatial diversity within the ESU by culturing known White River-origin broodstock.
Indicator: Broodstock collection strategies.
(a). Captive broodstock; observe active spawners to eliminate hatchery-origin strays from collection. Triangulate redd locations and monitor temperature to determine accumulation of approximately 450 temperature units. Collect 135 or fewer eggs/fry from up to 50 redds in the White River to provide a maximum of 1,500 eggs/fry, a final brood group target of 1,200 eggs/fry of known White River origin, and a smolt release of up to 150,000 smolts.
(b.) Adult–based supplementation; collect approximately 110 adults of known White River origin (see section 7.3) that are proportional to natural run timing and strength and in appropriate proportions to manage hatchery impacts.
Monitoring and evaluation: (a.) Monitor and record number collected mortality, temperature units, dates, and family number.
(b.) Adult-based supplementation; observe and record marks identifying hatchery adults. Develop a stock identification database using genetic and/or other classification methods.

3.2 *Standard*: Enhance the genetic viability and integrity of the White River spawning aggregation.
Indicator: Traits of hatchery- and natural-origin juveniles and adults.
Monitoring and evaluation: Sample wild- and hatchery-origin adult fish, collect and evaluate the similarity of length, age composition, size-at-age, sex ratio, juvenile migration timing, adult run timing, spawning distribution, DNA, and tagging information (Objective 2 and 3). Sample juvenile fish at smolt traps to determine migration strength, timing, and composition (Objective 2).

3.3 *Standard*: Minimize loss of within-population genetic variation associated with the artificial propagation program.
Indicator: Fish production, brood capture and mating procedures.
(a.) Captive brood;
1. Family size of collected eggs or fry will be equalized to the extent possible to maintain the highest effective population size possible.
2. Mating protocols will avoid full-sib or closely related matings and between-year-class matings will be prioritized over within-year-classes. Individual spawners will be identified and spawned via approved spawning matrix to eliminate or mathematically reduce related matings and will ensure year class matings over with-in year classes.
3. Factorial matings of 2 x 2 or greater will capture a high percentage of available genetic variation.
(b.) Adult-based supplementation;
Smolt production and or adult escapement abundance and composition will be managed

to address programs effect on natural productivity, based on M&E data analysis.
Brood collection will be systematic and designed to be representative with respect to run timing, run strength, and demographic traits.
Monitoring and evaluation: Monitor and record brood selection and mating data (Objectives #1, 2, and 4).

3.4 *Standard*: Minimize loss of between-population genetic variation associated with the artificial propagation program.
Indicator: Brood capture, mating, acclimation, and procedures.
Juveniles will be imprinted for a minimum of 6 weeks and up to 6 months on White River surface water to encourage homing fidelity to the White River basin. All hatchery juveniles will be uniquely marked such that they can be identified as White River origin without sacrificing the animal.
(a.) Captive brood; eggs/fry will not be retained as broodstock from redds for which parentage is unknown or 2nd generation non-local hatchery parents are involved.
(b.) Adult-based supplementation; using genetic and other identification techniques, only adults of known White River origin will be collected for broodstock. Marks on hatchery fish will be used to determine stream of origin and minimize straying from other hatchery programs into the White River.
Monitoring and evaluation: Mark all hatchery produced fish and monitor adult traps and spawning grounds for those marks (Objectives #1, 2, and 4).

3.5 *Standard*: Minimize negative genetic impacts due to domestication selection associated with the artificial propagation program.
Indicator: Brood capture, mating and rearing procedures.
All fish rearing will occur at approved rearing criteria to minimize the effects of domestication. Attempts will be made to minimize domestic selection and maximize natural and supplementation production by balancing wild and hatchery spawning for natural-origin fish (see section 7.1).
(a.) Captive brood;
1. The captive brood phase will be limited to approximately two life cycles to reduce potential consequences of raising fish in an intense culture environment.
2. Natural production will continue to occur in the White River with egg/fry collection representing a small fraction of each female spawner's total egg deposition.
(b.) Adult-based supplementation;
Brood collection protocols will be developed to assure natural-origin genetic variability using random collection (see section 7.1). Protocols may be consistent with current protocols for spring Chinook supplementation programs in the Wenatchee basin that allow for a maximum of 33% of the total natural-origin returns to be collected for broodstock and that a minimum of 33% of the broodstock be of natural-origin.
Monitoring and evaluation: Monitor and record brood capture and mating data (Objectives #2 and 4).

3.6 *Standard*: Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.
Indicator: Genetic profiles of naturally produced adults, as developed at program's outset (e.g. through DNA or allozyme procedures) and compared to genetic profiles developed

each generation.
Indicator: Genetic composition of naturally produced adults and co-occurring adults of this program, measured annually.
Monitoring and evaluation: Monitor, record, and evaluate genetic profiles (Objectives #1, 2, and 4).

3.7 *Standard*: Hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.
Indicator: Observed and estimated total numbers of naturally produced and artificially produced adults.
Indicator: The ratio of observed and/or estimated total numbers of artificially produced fish on natural spawning grounds to total number of naturally produced fish (see section 7.1).
Indicator: Proportion of carcasses from adult returns to natural spawning areas which are of artificially produced origin.
Monitoring and evaluation: Mark all hatchery produced fish and monitor adult traps and spawning grounds for those marks. Monitor and record stray rates, ratios of hatchery fish spawning in the wild, and ratios of natural-origin fish in the broodstock (Objectives #1, 2, and 4).

4 Operation of Artificial Production Facilities

4.1 *Standard*: Conduct White River captive brood rearing and rearing of their F2 progeny in accordance with stipulated propagation criteria.
Indicator: Fish culture criteria:
(a.) Captive broodstock; Temp. ≤ 55^{o}F.
O2 > 7ppm at outfall, > 90% saturation at intake, Nitrogen < 103% saturation.
Density Index of 0.1lbs/ft^3/inch of length, < 0.5lb/ft^3 for fish > 10g.
Flow Index 1.8lbs/gpm/inch
(b.) F2 progeny; Temp. ≤ 55^{o}F.
O2 > 7ppm at outfall, > 90 saturation at intake, Nitrogen < 103% saturation.
Density Index, 0.06 lb/ft^3/inch of length for lots with bacterial kidney disease (BKD) optical density (od) ≥ 0.12; and 0.125 lb/ft^3/inch for lots with BKD od < 0.12
Flow Index, 0.6 lb/gpm/inch for lots with BKD od ≥ 0.12; 0.75lb/gpm/inch for lots with BKD od < 0.12. Preferred design flow is 1.0 - 1.5 water exchanges per hour. Note: Rearing densities for individual Lake Wenatchee net pens will not exceed 0.25lbs/ft^3 (pers. comm. B. Rodgers 2006).
Monitoring and evaluation: Monitor all specified biological criteria while reducing fish stress; record observations as prescribed by fish health specialist and monitoring plan (Objective 4 and 6).

4.2 *Standard*: Conduct White River adult-based supplementation rearing in accordance with stipulated propagation criteria.
Indicator: Fish culture criteria:
(a.) Adult holding: Temp. ≤ 55^{0}F.
O2 > 7ppm at outfall, > 90% saturation at intake, Nitrogen < 103% saturation.
Density; 10ft^3 per adult. Loading; 2 gpm/adult, increase 5% per each degree F above

50^0F.
(b.) Juvenile Rearing: O2 > 7ppm at outfall, > 90 saturation at intake. Nitrogen < 103% saturation.
Density Index: 0.06 lb/ft^3/inch for lots with BKD od ≥ 0.12; 0.125 lb/ft^3/inch for lots with BKD od < 0.12.
Flow Index: 0.6lb/gpm/inch for lots with BKD od ≥ 0.12; 0.75lb/gpm/inch for lots with BKD od < 0.12.
(c.) Acclimation: O2>7ppm at outfall. Density Index: <0.05 lb/ft^3/inch.
Flow Index: 0.5 to 1.0 lb/gpm/inch depending on water temperature.
Monitoring and evaluation: Monitor all specified biological criteria while reducing fish stress; record observations as prescribed by fish health specialist and monitoring plan (Objective 4 and 6).

4.3 *Standard*: Achieve life stage survival targets for captive broodstock and F2 progeny.
Indicator: Survival rates. Achieve the following rates:
Captive fry-to-adult = 30%
F2 green egg-to-release = 65%
F2 smolt-to-adult = 0.3%
Monitoring and evaluation: Calculate life stage survival rates (Objective 4 and 6).

4.4 *Standard*: Achieve minimum performance standards for at least half of the brood years under captive broodstock propagation.
Indicator: Survival rates and fecundity. Achieve the following rates:
Captive broodstock egg/fry-to-adult = 15%.
F2 green egg-to-smolt = 40%.
F2 smolt-to-adult = .15%
Captive broodstock fecundity of 1,000 eggs per female, and female to male ratio of 0.5:1.0.
Monitoring and evaluation: Calculate life stage survival rates (Objective 4 and 6).

4.5 *Standard*: Achieve life stage survival targets for adult-based supplementation.
Indicator: Survival rates. Achieve the following rates:
Adult holding: Female = 90% and Male 85%. Green egg to release = 81%. Smolt to adult = 0.3%.
Monitoring and evaluation: Calculate life stage survival rates (Objective 4 and 6).

4.6 *Standard*: Maximize survival at all life stages throughout captive broodstock rearing and adult-based supplementation using disease control and prevention.
Indicator: Fish health standards. Rear in a manner consistent with WDFW Fish Health Manual (1996), Co-Managers Salmonid Fish Disease Control Policy (1997), and Pacific Northwest Fish Health Protection Committee (1989).
Monitoring and evaluation: Fish health specialist will visit rearing sites regularly to assess fish health and detect potential fish health problems. (Objective 4 and 6). A fish health specialist will perform a quality assessment within 2 weeks prior to smolt release including organosomatic index (OSI) or other physiological assessments as deemed valuable. Biological sampling will be performed by M&E staff including length, weight,

and condition factor. Tag retention will be evaluated as appropriate prior to release. (Objective 6).

4.7 *Standard*: Effluent from artificial production facilities will not detrimentally affect natural populations.
Indicator: Discharge water quality parameters. Applicable water quality standards and guidelines will be met, such as those described or required by NPDES, IHOT, PNFHPC, and Co-Managers of Washington Fish Health Policy tribal water quality plans, including those relating to temperature, nutrient loading, chemicals, etc.
Monitoring and Evaluation: Environmental monitoring of rearing system total suspended solids, settleable solids, in-hatchery water temperatures, in-hatchery dissolved oxygen, nitrogen, phosphorus, ammonia, water flow, and pH will be conducted and reported as per permit conditions (NPDES reporting requirements).

4.8 *Standard*: Water intake systems minimize impacts to listed wild salmonids and their habitats.
Indicator: Water withdrawals impacts. Project construction and operating permits will evaluate withdrawal impacts. Intakes will be designed and operated to meet NMFS (NMFS 1996) and WDFW criteria for screen mesh size, approach velocity, and sweep velocity.
Monitoring and Evaluation: Operators will monitor and report on intake conditions as required. Hatcheries and acclimation sites participating in the programs will maintain all screens associated with water intakes in surface water areas to prevent impingement, injury, or mortality to listed salmonids.

4.9 *Standard*: The risk of catastrophic fish loss due to hatchery facility or operation failure is minimized.
Indicator: Facility operating procedures.
Staffing will allow for rapid response for protection of fish from risk sources (water loss, power loss, etc.).
Backup generators to provide an alternative source of power to supply water during outages.
Redundant water supply systems to minimize pump and pipeline failure risks.
Protocols in place to test standby generators and all alarm systems on a routine basis.
Possible multiple rearing sites for project activities.
Alarm systems installed and operating to detect loss or reduced flow and reduced operating head in rearing vessels.
Densities at approved criteria to reduce risk of loss to disease.
All equipment disinfected between uses on different lots of fish including nets, crowders, boots, raingear, etc.
Monitoring and Evaluation: Hatchery engineering design and construction will accommodate security measures. Operational funding accommodates security measures. Training in proper fish handling, rearing, and biological sampling for all staff. Staff is trained to respond to alarms and operate all emergency equipment on station. Maintenance is conducted as per manufacturer's requirements and according to hatchery maintenance schedules.

4.10 *Standard*: Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.
Indicator: Number and location(s) of carcasses or other products distributed for nutrient enrichment.
Indicator: Statement of compliance with applicable regulations and guidelines.
Monitoring and Evaluation: Monitor and record carcass distribution data.

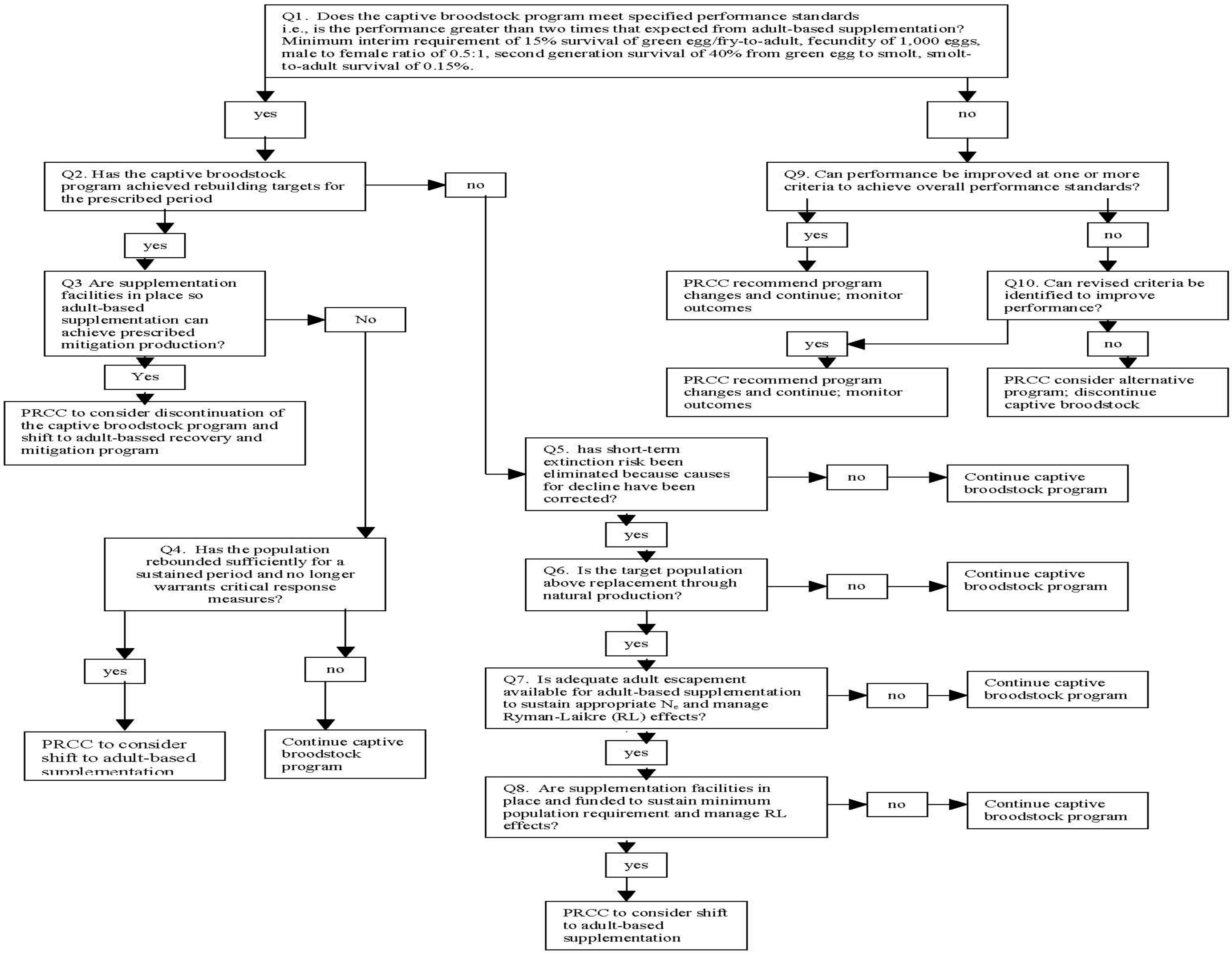
4.11 *Standard*: Design and implement projects to improve the quality of fish production at all facilities.
Indicator: All project indicators.

1.7) Special decision criteria for captive broodstock program.

The captive broodstock approach is broadly recognized as an extreme measure and is generally employed only when populations are dangerously close to extinction and when inaction may lead to continued population decline (Flagg and Mahnken 1995, Hart et al 1992, NMFS 1999a, NMFS 1999b). Intensive fish culture programs of this type are monetarily costly, largely untested, and may pose some poorly understood risks to the resource. Consequently, it is important that mechanisms be in place to assess performance of the project relative to expectations and to guide decisions concerning the future direction of this program. In particular, there is interest in a method by which the duration and appropriate end point for the captive broodstock phase of the White River spring Chinook recovery program can be recognized. The following decision framework provides a tool by which the efficacy of the captive broodstock program can be assessed by the PRCC HSC and NMFS.

The decision packet consists of a binomial key leading to possible conclusions concerning the continuation or discontinuation of the captive broodstock phase of the recovery program. Exercise of the key is dependent on the following assumptions:

- Biological fish culture criteria have been developed, documented and implemented.
- Performance criteria have been developed and documented.
- Facility design criteria have been developed, documented, and implemented.
- A robust M&E plan has been initiated and funded at levels agreed to be adequate to assess appropriate response variables.


Q1. Does the captive broodstock program meet specified performance standards i.e., is the performance greater than two times that expected from adult-based supplementation? Minimum interim requirement of 15% survival of green egg/fry-to-adult, fecundity of 1,000 eggs, male to female ratio of 0.5:1, second generation survival of 40% from green egg to smolt, smolt-to-adult survival of 0.15%.
yes
no
Q2. Has the captive broodstock program achieved rebuilding targets for the prescribed period
no
yes
Q3 Are supplementation facilities in place so adult-based supplementation can achieve prescribed mitigation production?
No
Yes
PRCC to consider discontinuation of the captive broodstock program and shift to adult-bassed recovery and mitigation program
Q4. Has the population rebounded sufficiently for a sustained period and no longer warrants critical response measures?
yes
no
PRCC to consider shift to adult-based supplementation
Continue captive broodstock program
Q9. Can performance be improved at one or more criteria to achieve overall performance standards?
yes
no
PRCC recommend program changes and continue; monitor outcomes
Q10. Can revised criteria be identified to improve performance?
yes
no
PRCC recommend program changes and continue; monitor outcomes
PRCC consider alternative program; discontinue captive broodstock
Q5. has short-term extinction risk been eliminated because causes for decline have been corrected?
no
Continue captive broodstock program
yes
Q6. Is the target population above replacement through natural production?
no
Continue captive broodstock program
yes
Q7. Is adequate adult escapement available for adult-based supplementation to sustain appropriate N_e and manage Ryman-Laikre (RL) effects?
no
Continue captive broodstock program
yes
Q8. Are supplementation facilities in place and funded to sustain minimum population requirement and manage RL effects?
no
Continue captive broodstock program
yes
PRCC to consider shift to adult-based supplementation

1.8) Expected size of program.

Up to 150,000 artificially produced smolts are planned to be released annually from White River acclimation sites and are a component of Grant PUD's overall UCR spring Chinook mitigation obligation for the operation of the Priest Rapids Projects. The 150,000 smolt production for the White River is based upon the expected 0.3% smolt-to-adult survival (SAR) for hatchery spring Chinook in the Wenatchee basin (see section 1.6), preliminary adult intrinsic spawner capacity estimates derived from data provided in the Draft Viability Criteria for Application to Interior Columbia Basin Salmonid ESU's Report (ICTRT 2007), habitat capacity estimates summarized in Ford et al (2001), and historical adult escapement to the White River.

1.8.1) Proposed annual broodstock collection level.

Captive Brood Phase:

No adults will be collected. Up to 1,200 White River origin eggs/fry for a 150,000 smolt release will be collected from the White River spawning aggregation for captive brood rearing (updated from 1000 as described in the BAMP).

Adult-based Supplementation Phase:

Approximately 110 adults are required to achieve the 150,000-smolt production objective.

1.8.2) Proposed annual fish release levels.

Maximum number by life stage and location. Use standardized life stage definitions by species presented in Attachment 2.

Life Stage	Release Location	Annual Release Level
Eyed Eggs	White River, Wenatchee River Basin	
Unfed Fry	White River, Wenatchee River Basin	
Fry	White River, Wenatchee River Basin	
Fingerling	White River, Wenatchee River Basin	Up to 200,000[1] (years 2007 – 09)
Yearling	White River, Wenatchee River Basin	150,000

[1]Fingerling spring Chinook above yearling program available for planting in the White River through 2009. Fingerling spring Chinook can be F1 or F2 progeny.

1.9) Current program performance.

The program has produced a net increase in the total number of smolts migrating from the White River system.

The survival rate for White River captive broodstock held from eyed egg to mature spawner has ranged from 4% to 31.7% and averaged 20.2% for three brood years for

which complete data are available. An average survival rate of 34% was attained for three stocks previously held for captive brood including Nason Creek, Twisp River and White River for brood years 1997 –2001 (Murdoch and Hopley 2005). The survival goal for eyed egg-to-mature adult is 30% for captive broodstock.
A small number of F2 smolts were released in 2004, 2005 and 2006 [2002-2004 Brood Year (BY)] derived from captive broodstock spawning activities. Adults have not returned from these releases but the smolt-to-adult survival rate may be 0.3%.

1.10) Project schedule.

The following summarizes the timing of past, present, and future program related activities. This schedule may change as a result of unknowns associated with permitting and facilities development issues.

Program directives and reviews:

- Biological Assessment and Management Plan: Mid-Columbia River Hatchery Program (BAMP 1998): completed in 1998.
- Priest Rapids Hydroelectric Project relicensing process (Grant PUD 2003): 1998-2007.
- Final Environmental Impact Statement for the Priest Rapids Hydroelectric Project Washington (FERC 2006): 2006.
- Priest Rapids Salmon and Steelhead Settlement (SSA 2006) between Grant PUD, State and Federal Agencies and Indian Tribes: signed in 2006 and 2007.
- Biological Opinion for ESA Section 7 Consultation on Interim Operations for the Priest Rapids Hydroelectric Project (NOAA 2004): 1998-2004.
- Columbia Basin Hatchery Scientific Review Group (HSRG) review: 2006-2008.

Permitting:

- Existing ESA authority, Section 10 Take Permit #1592: valid from 2007-2010.
- HGMP: 2003-2008.
- National Environmental Policy Act (EPA) and the State Environmental Policy Act (SEPA): 2007-2009.
- Future ESA authority, Section 10 Take Permit: expected to be received in 2010. The HGMP and NEPA processes are part of the Section 10 permit application. If the ESA evaluation process is not completed by 2010, an extension of the existing take permit #1592 may be needed.
- Water rights, JARPA, land use, and construction permits: 2007-2011. These permits are site specific and the application process can begin after locations are selected and conceptual designs are completed.
- Operating permits [WDFW fish transfer permits and National Pollution Discharge Elimination System permit (NPDES)]: required as each facility begins operation.

Monitoring and Evaluation:

- Adult monitoring: started in 1981.
- Juvenile monitoring: added in 2007.

Site location and construction:

- Site evaluations for all facilities components: 2006-2011.

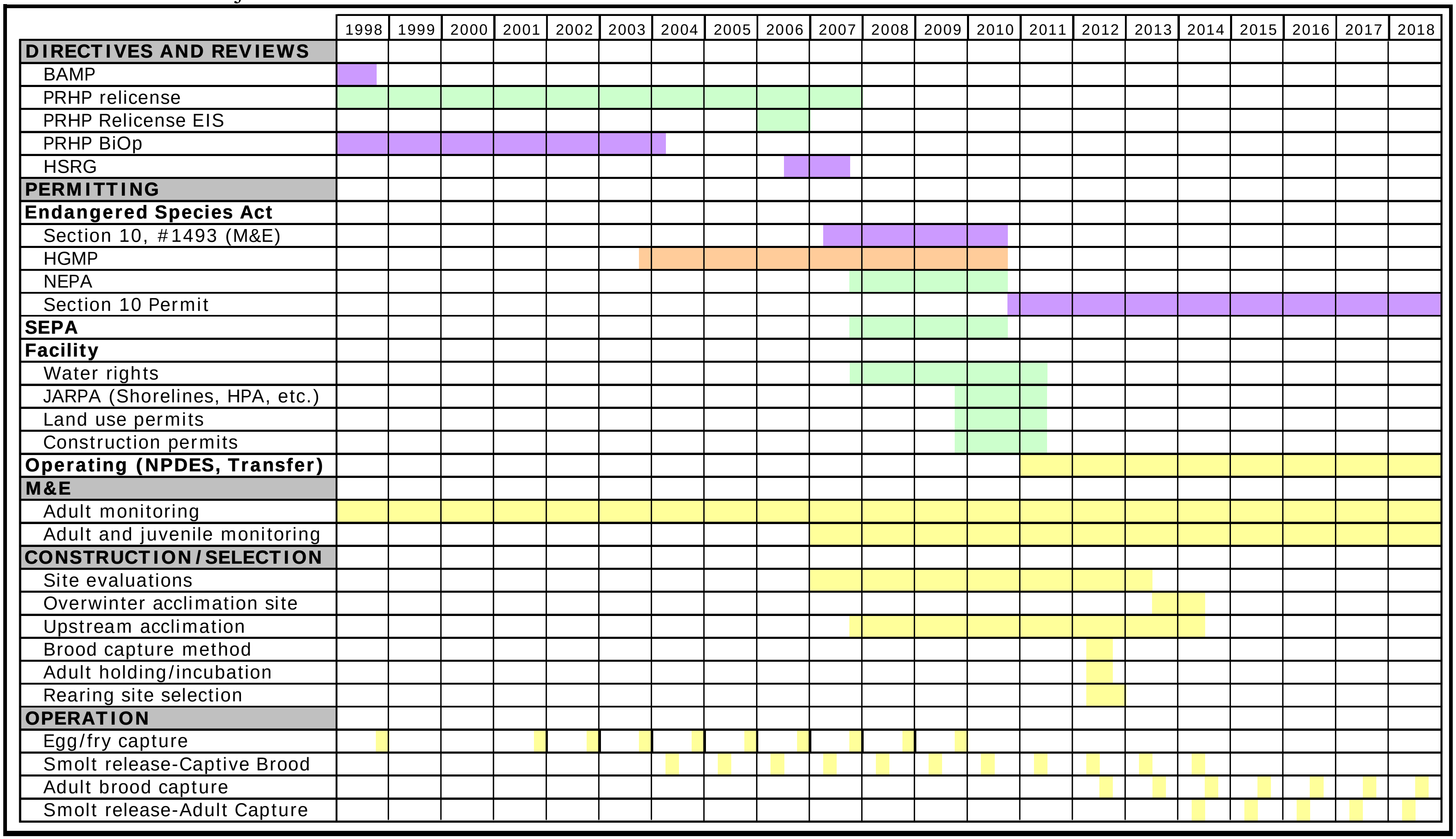
- Upriver, short-term acclimation sites: if feasible, used as soon as possible.
- Overwinter acclimation/rearing sites: if feasible, used as soon as possible.
- Brood capture method: testing as soon as 2011, full operation a year later.
- Brood holding/incubation sites: testing as soon as 2011, full operation a year later.

Operation:

- Egg/fry capture: 1997-2009. Insufficient numbers of egg/fry were collected for the captive brood phase during 1997 to 2001 (none collected for 1999 and 2001). The PRCC HSC determined that the captive broodstock program would begin with the 2002 egg/fry collection due to sufficient broodstock to reach smolt production needs.
- Smolt release, captive brood source releases: began in 2004 and will end sometime after 2014.
- Adult brood capture: trapping may need to begin by 2012.
- Smolt release, adult brood capture source: test group released as soon as 2014, followed by full operation a year later.

Mitigation is expected to be necessary for the duration of the Federal Energy Regulatory Commission (FERC) license term. The program will adapt over time as the natural population of spring Chinook salmon recovers, as planned habitat improvements take affect, and in response to new information.

Draft White River Project Schedule:



Key:

- Processes that include public involvement
- Processes that include scientific review
- Processes that include both

1.11) Alternative actions considered.

Alternative actions were considered during development of the BAMP. The co-managers, NMFS, WDFW, USFWS, CCT, CTUIR, YN, and Chelan, Douglas, and Grant PUDs (the Yakama Nation has been peripherally engaged in the current White River Captive Program) concluded in the BAMP that many populations are at high risk for extinction, and artificial propagation is essential for recovery.

The discussion of alternative actions is summarized in the BAMP as follows:
"The co-managers concluded that many populations are at high risk of extinction, and artificial propagation was essential for their recovery. However, there was substantive debate on how to categorize and propagate the populations. Critical uncertainties were: (1) the level of population structure of mid-Columbia spring Chinook salmon, (2) which strategies posed the least risk to the populations while having the highest likelihood of recovering them, and (3) whether these recovery measures were logistically feasible. The co-managers investigated several alternatives that could be used in the recovery process, while promoting within- and among-population genetic variability for the nominal populations. Some alternatives either presented an increased risk to the sustainability of the populations, or have low feasibility in implementation. As a result, the most appropriate plan included a limited use of many strategies to spread the overall risk to the populations and to test the effectiveness of each strategy. "Spreading the risk" includes the use of more than one artificial propagation strategy, collecting broodstock at more than one life stage, predetermined means to manage stray fish, variable levels of population separation, and designation of "reference" populations that will not be artificially propagated. All strategies will be monitored to allow comparison of the effectiveness of each alternative and subsequently, adaptive management of the program."

Several basic alternatives for using artificial propagation for recovery of spring Chinook were evaluated in the BAMP. These included various levels of supplementation, captive rearing of a portion of the natural population, infusion of non-native gametes into the gene pool, and consolidation of several populations. The preferred strategy for the White River was developed after considering these alternatives and the regional guidelines of establishing reference populations and reducing large scale risk by implementing multiple recovery methods.

For the White River population, alternatives that did not involve artificial propagation were determined not to be adequate to avoid the immediate risk of extinction. One of several significant mortality factors facing this stock is mortality experienced while passing through mainstem hydropower facilities during downstream smolt migration. Passage improvements to hydropower facilities have been underway for decades. However, even when passage protection is maximized there will continue to be a level of mortality that is expected to require continued artificial propagation.

SECTION 2. PROGRAM EFFECTS ON NMFS LISTED POPULATIONS

USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A.

2.1) ESA permits and authorizations.

ESA April 2007 – Section 10 permit #1592 (NOAA Fisheries 2007) was issued for a term of 3 years in April 2007 to Grant PUD, WDFW, and the YN as joint permit holders to carry out the minimal activities associated with the White River UCR spring-run Chinook salmon supplementation program. The following activities are authorized by Permit 1592:

- Collection of eggs or fry from the White River to rear in captivity to adult to use as broodstock;
- Transfer of eggs or fish between Federal, state, and private hatchery facilities as necessary to successfully rear fish to the yearling smolt stage;
- Rearing and propagation from the fertilized egg through the yearling smolt life stage at Federal, state, and private hatchery facilities;
- Acclimation of pre-smolts in the White River basin;
- Release of juvenile spring Chinook salmon into the White River in Chelan County, Washington;
- Monitoring of the programs in the hatchery environment using standard techniques such as growth and health sampling; and
- Monitoring of the programs in the natural environment using standard techniques such as juvenile fish traps and adult spawner surveys.

Permit 1592 does not authorize the construction of any permanent hatchery or fish collection facilities in the White River basin or elsewhere outside the White River basin.

This HGMP, when completed, is expected to be submitted to NMFS for a new ESA consultation and permitting process.

2.2) Descriptions and projected take actions for ESA listed populations.

2.2.1) Description of affected NMFS ESA-listed salmonid population(s).

<u>Upper Columbia River Spring-run Chinook Salmon</u>

Adult spring Chinook salmon (Oncorhynchus tshawytscha) enter the Columbia River from March through mid-May (Myers et al. 1998). Peak abundance of the run in the lower Columbia River occurs in April and May (Chapman et al. 1995). Upper Columbia-origin spring Chinook exhibit peak migration at Rock Island Dam in mid-May. The fish spawn in the Wenatchee, Entiat, and Methow rivers from August through September, peaking about mid-August. The majority of adult spring Chinook salmon mature at four (58%) and five (~40%) years of age. Adults average 66 cm for females and 67 cm for males (Chapman et al. 1995). Fecundity for female Chinook may range between 2,600 and 8,100, based on data for the Chiwawa and Methow River populations.

Juvenile wild UCR ESU spring Chinook are present at various life stages year-round in the Wenatchee, Entiat, and Methow rivers and tributaries, and may rear and over-winter in the mainstem upper Columbia River. Eggs incubate from August through late fall or early winter, when the eggs generally hatch (Chapman et al. 1995). Alevins remain in the gravel 4-6 weeks or more, emerging as fry in late winter or early spring. Spring Chinook fry disperse extensively downstream after emergence, although some fry assume residence in the natal stream near the spawning site. A second downstream movement occurs during late fall when Chinook emigrate to suitable over-wintering habitat, usually from the tributaries to the river mainstem. A third and final downstream movement takes place in the spring when the Chinook migrate as yearling smolts to the sea. The average 10%, 50%, and 90% passage of the seaward smolt migration measured at Rock Island Dam from 1985-1994 was April 21, May 10, and June 3, respectively (Chapman et al. 1995). Wild fry and sub-yearling spring Chinook may range in size from 30-40 mm in the spring, average 54 mm in June, and average 88 mm by October. Upper Columbia River spring Chinook migrating seaward as yearling fish may average 87 to 127 mm.

The proposed program will focus on the White River subpopulation within the Wenatchee River basin. Marshall and Young (1994) and Utter et al. (1995) identified the White River spawning aggregate as having sufficient genetic differentiation to be considered distinct from other sampled spring-run Chinook populations. Most recently, Murdoch et al. (2006) conducted population genetic analysis, pedigree reconstruction and fitness estimation of hatchery and natural origin spring Chinook spawning aggregates in the upper Wenatchee River basin for brood years 2004 and 2005 and concluded that population genetic structure appears to exist within Wenatchee basin spring-run Chinook and that significant allele frequency differences exist between the three major spawning aggregates (Chiwawa River, Nason Creek and White River). Furthermore, Murdoch et al. (2006) concluded that hatchery-origin Chinook from Leavenworth National Fish Hatchery (LNFH) and White River natural-origin spring Chinook represented the greatest separation from all other natural-origin spring Chinook populations in the Wenatchee basin. It is anticipated that the population genetic analysis, pedigree reconstruction, and fitness estimation efforts will continue for the next 8-10 years and compilation of multiple years of data will provide greater insight to the population structure of spring-run Chinook in the Wenatchee River basin.

The apparent genetic separation of the White River sub-population from other hatchery and natural-origin spring-run populations in the Wenatchee basin may reflect selective survival attributes specific to the White River ecosystem which is characterized by lacustrine environment (Lake Wenatchee), high fine-sediment substrates and glacial fed headwaters. Juveniles must pass through Lake Wenatchee on their way to the Columbia River, and returning adults pass through a second time to reach the spawning grounds. Spawning takes place between river mile 8 and river mile 13 from the second week in August through the fourth week in September (Murdoch and Hopley 2005). Little is known about the specific juvenile life history of the White River subpopulation. Juvenile monitoring was initiated in 2007 to characterize juvenile migration patterns, life history strategies, and productivity.

<u>Upper Columbia River Summer Steelhead</u>

Steelhead (Oncorhynchus mykiss) display the most complex life history traits of any Pacific salmonid (Busby et al. 1996). They can be anadromous or resident with the anadromous form spending up to seven years in freshwater prior to smoltification and seaward migration. They can spend up to three years in saltwater before returning to spawn (Busby et at. 1996). Two major run types are identified: ocean-maturing and stream-maturing. The ocean-maturing run type (winter steelhead) usually enters freshwater coastal and lowland streams in November through April and spawns soon thereafter. The stream-maturing run type (summer steelhead) generally enter freshwater from May through October and are sexually immature, requiring several months to spawn (Busby et al. 1996). The stream-type runs typically spawn in inland steams.

The UCR Steelhead ESU occupies the Columbia River upstream of the Yakima River (excluded) to Chief Joseph Dam (62FR43937). NMFS has identified three independent populations within the ESU: the Wenatchee, Entiat, and Methow populations (Interior Technical Recovery Team 2003). Steelhead of the UCR ESU is classified as stream-maturing type, similar to other inland steelhead ESUs (Snake and mid-Columbia rivers). Detailed descriptions of the UCR ESU are provided in Busby et al. (1996), WCSBRT (2003), and ITRT (2003).

Adult steelhead from the UCR ESU return to the Columbia River from May through September and migrate into the tributaries, usually beginning in mid-July and peaking in mid-September through October (Busby et al. 1996, WCSBRT 2003, Fisheries 2002). The predominant adult age class is 2-salt (51%) followed by 1-salt (47%). Two percent return as 3-salt (WDFW 2002). Some may stay in mainstem reservoirs and migrate into tributaries in April or May of the following year (WCSBRT 2003). Typically they spawn in late spring of the calendar year after entering freshwater. In the Wenatchee River, summer steelhead arrive in mid-July and through April the following year. Spawning is from April through June (WDFW 2002, WDFW 1993). Eggs incubate late March through June and fry emerge late spring through August (WDFW 2002). Life stages are present year-round in the tributaries of the UCR ESU. Fry and smolts disperse downstream in late summer and fall. Outmigration occurs during April and May and is dominated by 3+ (46.6%) and 2+ (43.2%) age-class smolts (Peven 1990). Since 2002, the estimated number of steelhead redds found in the White River basin has been one (range 0-3). The sporadic spawning suggests that no established spawning populations exist in the tributary (personal communication, M. Tonseth, WDFW).

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program.

Upper Columbia River Spring Chinook

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.

Upper Columbia River Summer Steelhead

2.2.2) Status of affected NMFS ESA-listed salmonid population(s).

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (see definitions in "Attachment 1").

Upper Columbia River Spring-run Chinook Salmon

Meyers et al. (1998) assessed the status of West coast Chinook salmon from Washington, Idaho, Oregon, and California in response to petitions (PRO-Salmon 1994, ONRC and R.K. Nawa 1995) to list Chinook salmon as threatened or endangered. Meyers et al. (1998) citing Nehlsen et al. 1991, WDFW 1993, PRO-Salmon 1994, ONRC and R.K. Nawa (1995), and Wilderness Society (1993) concluded that, overall, a high percentage of West coast salmon stocks were extinct or in danger of extinction. WDFW (1993) reported that 40 of 108 Chinook stocks in Washington were critical or depressed and ONRC/R.K.Nawa (1995) reported that Columbia River Chinook stocks above McNary Dam experienced the second highest level of extinctions (28%) of West coast stocks with another 44% declining.

Using a suite of biological and environmental information Meyers et al. (1998) defined the UCR spring-run Chinook salmon ESU as those stream-type Chinook salmon spawning above Rock Island Dam (i.e., spawning in the Wenatchee River basin, the Entiat River and the Methow River basin). An assessment of extinction risk for the UCR ESU determined that the 5-yr geometric mean of the natural run size for the entire ESU above Priest Rapids Dam was 4,880 adults (1990-1994).

In addition, assessments of long- and short-term abundance trends for stocks within the ESU showed that all were negative with eight of ten stocks exhibiting declines of greater than –20% per year over the period of the data set. Within the Wenatchee River basin, the short-term trend was –37.4% and the long-term trend was 11.5% (see section 1.4). Record low escapements had occurred in the previous few years. In the White River tributary of the Wenatchee River basin, the geometric mean spawning escapement for the period 1990 through 1994 was 25. Short-term decline was estimated at –35.9% and the long-term trend was –10.6%.

Meyers et al. (1998) concluded that the spring Chinook salmon of the UCR ESU were in danger of extinction. The abundance levels (1994-1996) were the lowest in 60 years. The review team was also especially concerned about the declining trends in abundance and the extremely small population size exposing the ESU to high genetic and demographic risk.

NMFS listed the UCR spring-run Chinook salmon ESU as endangered on March 24, 1999 (64FR14309). The listing described the ESU as including all naturally spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River Chinook. Chinook salmon and their progeny from the Chiwawa River, Methow River, Twisp River, Chewuch River, White River, and Nason Creek hatchery programs were determined to be necessary for recovery and were included in the ESU.

McClure et al. (2003) further delineated the ESU using genetic, dispersal, phenotypic, environmental, and demographic data. Three independent populations were identified: the Wenatchee River (except Icicle Creek), the Entiat River and the Methow River. The Interior Technical Recovery Team (ITRT) also noted that the White River and Twisp River spawning segments contributed a majority of the genetic variation between localities and shows the greatest differentiation from other areas.

More recently, WCSBRT (2003) completed an updated status review of west coast Chinook salmon including use of VSP criteria as described by McElhany et al. (2000). The Biological Review Team (BRT) concluded that all three populations within the UCR ESU were still in decline when 1996-2001 data were included. At the time of the first status review (Meyers et al. 1998), the total run into the ESU was less than 5000 with most individual tributary segments at less than 100. Within the Wenatchee River population, natural run size from 1997-2001 was 274 compared to 27 during the first status review. This represents an escapement of only 13% of the interim recovery target of 3,750 set by Ford et al. (2001). For the White River, the recent (1997-2001) average redd count was 9 (range = 1 – 104) compared to the previous average of 25. The short-term population abundance trend is –6.6% compared to –35.9% presented during the previous status review.

Given the current abundance and population trends, the WCSBRT predicted a 100% probability of decline over the next fifty years for populations within the UCR ESU. Therefore the WCSBRT determined the UCR ESU continued to be "in danger of extinction."

Upper Columbia River Summer Steelhead

The steelhead BRT (BRT, Busby et al. 1996) assessed the status of west coast steelhead (O. mykiss) from Washington, Idaho, Oregon, and California. The BRT identified 15 ESUs including the UCR summer steelhead ESU which includes all Columbia River tributaries above the Yakima River. All UCR steelhead are summer steelhead. Busby et al. 1996, citing Chapman 1994, reported pre-1960s fish counts at Rock Island Dam (1933 – 1959) averaged 2,600 – 3,700. The 1989 – 1993 natural escapement estimates were 800 for the Wenatchee River and 450 for the Methow and Okanogan rivers combined. Average total escapements for these stocks were 2,500 and 2,400, respectively. Trends in total (natural and hatchery combined) escapement between 1962 and 1993 showed a 2.6% increase. A 12% decline was reported for the Methow and Okanogan rivers combined. Nehlsen et al (1991) identified six stock in this region that were either at risk or stocks of concern. WDFW (1993) identified three stocks and characterized all as depressed.

Spawning escapement within the ESU is strongly dominated by hatchery production with estimates of recent contributions averaging 65% in the Wenatchee River and 81% in the Methow and Okanogan rivers (Busby 1996). Adult replacement ratios were 0.3:1.0 in the Wenatchee and 0.25:1.0 in the Entiat (WDFW 1993) and were believed not to be self-sustaining without continued hatchery supplementation.

Busby et al. (1996) concluded that the UCR steelhead ESU was in danger of extinction. Even though total abundance of populations within the ESU was relatively stable or increasing, it was thought to be occurring only because of major hatchery supplementation programs. The major concern of the BRT was the clear failure of natural stocks to meet self-replacement goals. In addition, the BRT was strongly concerned about problems of genetic homogenization due to hatchery supplementation within the ESU. There was also concern for high harvest rates on steelhead in rainbow trout fisheries and degradation of freshwater habitats within the region.

In August 1997, NMFS listed the UCR Steelhead ESU as endangered (62 FR 43937). Subsequently, using the VSP guidelines described by McElhany (2000) an initial set of population definitions for the UCR steelhead ESU identified the Wenatchee River, the Entiat River, and the Methow River as separate populations within the ESU (Ford 2000).

More recently, the WCSBRT (2003) completed an updated status review of west coast steelhead, including the UCR steelhead ESU. The BRT found that returns of both hatchery and naturally produced steelhead in the upper Columbia River have increased in recent years. The average combined return through Priest Rapids Dam was 12,900 steelhead between 1997 and 2001. The average for the previous five years (1992-1996) was 7,800. The total returns, however, continue to be dominated by hatchery-origin fish. Although the percentage of natural-origin returns had increased to about 25% during the 1980s, the median percent of natural-origin fish between 1997-2001 was 17% (2,200 of 12,800), a slight improvement of the period between 1992 and 1996 when the percentage of natural-origin fish in the run was less than 10% (1,040 of 7,800). The five-year geometric mean natural-origin escapement for the Wenatchee and Entiat rivers for 1997-2001 was 900, well below the interim recovery goal of 3,000 (Lohn 2002). While there is an increasing growth trend of approximately 3.4% per year, the natural-origin proportion in the Wenatchee/Entiat has declined from 35% to 29%.

The WCSBRT (2003) concluded that the UCR steelhead ESU continues to be in danger of extinction based on evaluation of natural production. The most serious risk to the natural population is the low growth rate and productivity within the ESU. Although there has been an increase in naturally-produced fish in recent years, mean abundance is still only a fraction of the interim recovery goal. The ratio of naturally produced adults to combined parents escapement is still low (about 43%, Murdoch et al. 1998) and detailed information on productivity is lacking.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

White River spring Chinook recruits per spawner 1981 – 2000.
Data provided by Andrew Murdoch – WDFW. Not adjusted for harvest impacts

Year	Spawners	Recruits	Recruits/ Spawner	Year	Spawners	Recruits	Recruits/ Spawner
2000	20	52	2.6	1990	49	6	0.1
1999	3	1	0.3	1989	141	59	0.4
1998	11	57	5.2	1988	139	98	0.7
1997	33	149	4.5	1987	99	58	0.6
1996	30	46	1.5	1986	204	49	0.2
1995	5	8	1.6	1985	404	112	0.3
1994	7	8	1.2	1984	181	131	0.7
1993	132	33	0.2	1983	308	114	0.4
1992	78	25	0.3	1982	180	165	0.9
1991	49	12	0.2	1981	60	330	5.5

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

White River spring Chinook annual redd counts and estimated run size, 1990 – 2005
(compiled from WDFW, unpublished data and NMFS 1999)

Year	Redd Count	Expansion Factor	Estimated Run Size
2006	31a_/	1.78b_/	55c_/
2005	27a_/	1.80b_/	49c_/
2004	20a_/	3.00b_/	61c_/
2003	14a_/	2.43d_/	33c_/
2002	33a_/	2.05d_/	68c_/
2001	99a_/	1.60d_/	158c_/
2000	8	2.70e_/	21
1999	1	2.2	2
1998	5	2.2	11
1997	15	2.2	33
1996	12	2.2	26
1995	2	2.2	4
1994	3	2.2	7
1993	60	2.2	147
1992	35	2.2	77
Mean	23, range=1-99		48, range=2–158

a_/ White River stock redds estimated when adjusted for stray rates
b_/ expansion based on sex ratio from Tumwater Dam
c_/ White River stock adults when adjusted for stray rates
d_/ expansion based on sex ratio from broodstock collected for Chiwawa
e_/ expansion based on sex ratios from Tumwater video

Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Brood	Origin of spawners		Brood	Origin of spawners	
Year	Wild	Hatchery	Year	Wild	Hatchery
2005	0.31	0.69	1999	100.0	0.00
2004	0.82	0.18	1998	100.0	0.00
2003	0.75	0.25	1997	100.0	0.00
2002	0.72	0.28	1996	100.0	0.00
2001	0.67	0.33	1995	0.8	0.20
2000	100.0	0.00	1994	100.0	0.00

2.2.3) Hatchery activities.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Broodstock Collection:

Juvenile-based Captive Brood.

Collection of eggs/fry for captive broodstock will result in a direct take of listed spring Chinook from natural production. Sampling might result in disturbance of redds and increased mortality of remaining eggs/fry. Fewer individuals will remain in the natural habitat for natural rearing. Although strict precautions are taken, sampling might also result in the disturbance of Bull trout redds in the immediate area of spring Chinook redds being sampled. There will be no impacts to steelhead.

Adult-based Supplementation.

Collection of adults for hatchery propagation will result in removal of a portion of the natural spawning population. Implementation of adult collection strategies may result in delay of migration for some spawners or displacement of spawners below the collection site. Specific M&E actions (i.e. snorkeling above and below the collection site to assess extent of possible delay and PIT-tag interrogation of fish passing though the collection site) will be conducted to assess potential impacts to migration. During adult collection/monitoring activities, a portion (those fish handled) that did not originate in the target tributaries (e.g., Chiwawa River) might be removed and transported to their natal tributaries or hatchery programs for spawning. Also, adults will be handled at Tumwater during the potential reproductive study or for stock identification. Impacts to listed species during adult collection/monitoring of spring Chinook will be minimized through development and implementation of NMFS, USFWS and PRCC HSC approved adult spring Chinook collection/monitoring methods/schedules, fish handling protocols, and take provisions provided by NMFS and USFWS.

Juvenile Rearing:

Juvenile-based Captive Brood.

All spring Chinook life stages will be propagated (and therefore taken) through the proposed captive rearing program. Eyed eggs and alevins will be hydraulically sampled from redds in the rivers during the late summer for incubation in the hatcheries. Fry, fingerlings and smolts produced will be similar in size to supplementation program fish with fingerling size of 1.1 – 7.0g achieved through the summer, ~15g by fall, and ~32g at yearling age. Juveniles used for the captive brood phase will be retained in the hatchery and reared for an additional two to three years to maturity. Fish reaching maturity will be spawned and the eggs transferred to either interim rearing facilities (e.g., AquaSeed, Rochester, WA) or other hatchery facilities in the Columbia River basin.

Adult-based Supplementation.

Green eggs, eyed eggs and alevins will be incubated to produce swim-up fry averaging approximately 0.45 grams each. Fry will be reared to fingerling size (1.1 – 7.0g) through the summer months, with sub-yearlings (~15g) produced by the fall. Yearling smolts at an average size of ~32g will be produced by late spring. Pre-smolts will be transported to facilities on Nason Creek for acclimation prior to release

Monitoring and evaluation activities:

Both juveniles released by the program and naturally produced fish in the White River are monitored. Also, hatchery and natural adult returns are part of the M&E program.

Take may result from adult and juvenile capture, handling, tagging, release and unintentional injury. Juvenile emigration monitoring may include up to a 0.20 encounter rate (capture) and up to 0.02 mortality rate for those encountered. Takes associated with juvenile monitoring activities will include tagging/marking, biological sampling and genetic tissue sampling. Adult spring Chinook takes associated with M&E activities may include capture/handle/release (including enumeration, origin determination, biological data collection and genetic sampling) and possibly translocation of non-White River hatchery-origin spring Chinook. No injury or mortalities are expected during the White River adult carcass and spawning ground surveys. Biological data and samples will be taken from only deceased, spawned out fish.

The Section 10 permit application (Grant Co. PUD et al. 2006) describes the estimated take that results from current M&E activities associated with the juvenile-based captive brood phase. The M&E program and resulting take is expected to be similar during the future captive adult-based phase.

Incidental and possible lethal take of steelhead may occur during juvenile M&E activities. However, this may supply valuable information on steelhead to fish resource managers.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken and observed injury or mortality levels for listed fish.

Summary of hydraulic sampling of White River spring Chinook redds (A. Murdoch, WDFW, personal communication).			
Brood Year	Number of eggs extracted from the White River		
	Live eyed eggs/fry	Sampling mortality	Unfertilized dead eggs
1997	527	0	0
1998	199	0	0
1999	0	0	0
2000	272	0	~100
2001	0	0	0
2002	183	1	16
2003	723	25	30
2004	1,529	33	36
2005	2,763	74	64
Total	6,196 (94%)	133 (2%)	246 (4%)

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program

See above and Table 1 in section 14.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Take levels for captive brood are not expected to exceed the levels described herein. Take levels will be reviewed in-season but prior to initiation of redd pumping reducing the probability they will be exceeded.

As the program converts into adult-based supplementation, take levels at the adult trapping facilities will be projected prior to the trapping season. Adjustments to collection rates will be made in season if the planned trapping schedule will result in excess collection of adults.

2.3) Long-term impacts to ESA listed populations.

Supplementation may impose genetic and ecological risks to the natural-origin White River spring Chinook population. It has been determined through the BAMP, new license permit application, new license environment impact statement, and biological opinion processes that they are outweighed by the benefits of increasing population size and reducing extinction risk.

A commonly accepted definition of supplementation (RASP 1992) is: "…. the use of artificial propagation in an attempt to maintain or increase natural production, while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on non-target populations within specified biological limits." Supplementation programs have demonstrated their ability to increase natural production, see, for example, Spring Chinook Salmon Supplementation in the Upper Yakima basin; Yakima/Klickitat Fisheries Project (YKFP) Overview (Pearson et al. 2005). However, supplementation based recovery strategies have not been evaluated long enough to fully determine what the impacts to long-term fitness will be.

The Independent Scientific Advisory Board (ISAB), which was formed to help make funding recommendations to the Bonneville Power Administration, produced an assessment of the risks and benefits of supplementation (ISAB 2003). Most of the recommendations of the ISAB report have been adopted by this program. Also, the ISAB review of existing literature stated "The conclusions that can be drawn from the collective body of existing empirical information relevant to supplementation is that there is credible potential for a benefit to very small wild populations and credible potential for harm at any population size."

The ISAB recommends a cautious, limited approach to the use of supplementation. Other regional fishery experts have different viewpoints. Discussions of the benefits of using hatcheries to supplement natural populations are presented in several papers (Brannon et al. 2004, Cuenco et al. 2003).

A NMFS analysis (see section 1.5) of the UCR spring Chinook population concluded that the benefits of using supplementation to recover the White River population offsets the risks of long-term genetic impacts. Without supplementation, loss of fitness in this small population will likely occur due to both inbreeding by White River origin adults and outbreeding with other stocks. Supplementation reduces the short-term threat of extinction of the White River population.

SECTION 3. RELATIONSHIP TO OTHER MANAGEMENT OBJECTIVES

3.1) Alignment of the hatchery program with ESU-wide hatchery plans.

The UCR Salmon Recovery Plan is in development and a draft is available. A link to the NMFS webpage indicating its progress is http://www.nwr.noaa.gov/Salmon-Recovery-Planning/Recovery-Domains/Interior-Columbia/Upper-Columbia/Index.cfm. The Upper Columbia Salmon Recovery Board directs recovery planning in the Upper Columbia basin, with funding from the Governor's Salmon Recovery Office, Upper Columbia Region. Recovery objectives and criteria for the proposed plan were identified by the Interior Columbia basin Technical Recovery Team (ICBTRT) in collaboration with Upper Columbia technical committees. Local stakeholder assistance with recovery planning in the upper Columbia involves Douglas, Chelan, and Okanogan counties, state and tribal-sponsored recovery efforts, sub-basin planning, and watershed planning. The White River supplementation program is consistent with the objectives of the proposed plan (UCRSRB 2006). A listed objective is: "Continue to use artificial production to maintain critically depressed populations in a manner that is consistent with recovery and avoids extinction."

The BAMP is a consensus plan by fish co-managers for development, operation, and evaluation of anadromous salmonid hatcheries in the Columbia River upstream of the Yakima River confluence. It is designed to bolster the productivity of salmonid populations in a manner that is compatible with self-sustaining populations. Guidance for the White River program, in addition to all artificial propagation programs for spring Chinook in the upper Columbia River, is provided in the BAMP.

The Chelan and Douglas PUDs worked cooperatively with state and federal fisheries agencies and tribes to develop the first Hydro Power Habitat Conservation Plans (HCPs) for anadromous salmon and steelhead. The plans commit the two utilities to a 50-year program to ensure that their hydro projects have no net impact on mid-Columbia salmon and steelhead runs. These HCPs were completed in 2002 and agreements are now in place which address recovery of several subpopulations of the upper Columbia River spring run Chinook ESU. The HGMP presented herein for the White River spring Chinook spawning aggregation will be consistent with the current HCPs. An additional HGMP will be written to address the Nason Creek spring Chinook subpopulation, thereby completing the integration of all augmented spring Chinook subpopulations within the UCR spring-run Chinook ESU. It is expected that all current recovery efforts will be consistent with the anticipated recovery plan.

The Hatchery Scientific Review Group (HSRG), as part of the Hatchery Reform Project, has completed a review of Puget Sound hatcheries (HSRG 2005) and has initiated a similar review process for the Columbia River watershed. The project will be conducted by an independent science team in conjunction with a Steering Committee comprised of representatives from regional agencies. The objective is to produce decisions that are based on broad policy agreements and are supported by consistent technical information about hatcheries, habitat, and harvest. The White River Supplementation Program review is scheduled for 2007.

Wy-Kan-Ush-Mi Wa-Kish-Wit (CRITFC 1995) was developed by the four Columbia River Treaty Tribes (Nez Perce, Umatilla, Warm Springs, and Yakama). It is a comprehensive plan put forward by the Tribes to restore anadromous fishes to rivers and streams that support the historical cultural and economic practices of the tribes.

3.2) Agreements under which program operates.

The program operates in accordance with the Final Application for New License, Priest Rapids Hydroelectric Project No. 2114 (Grant PUD 2003) which is expected to be approved by Federal Energy Regulatory Commission (FERC) in near future. The license application includes protection, mitigation and enhancement measures that address project effects on anadromous and resident fishes.

The overall direction for recovery of White River spring Chinook is contained in the Biological Opinion for ESA Section 7 Consultation on Interim Operations for the Priest Rapids Hydroelectric Project (FERC No. 2114). This HGMP is designed to be consistent with and implement the direction provided in the Biological Opinion.

The Priest Rapids Salmon and Steelhead Settlement (SSA 2006) between Grant PUD, State and Federal Agencies and Indian Tribes describes a comprehensive and long-term adaptive management program for the protection, mitigation and enhancement of protected species, which may pass or be affected by the Priest Rapids Project. The SSA lists 40 actions that are being undertaken for the protection of spring Chinook and steelhead. These actions involve: passage conditions, spill, total dissolved gases, habitat protection and improvement, avian and fish predator control, adult fishways, performance monitoring and reporting, and program funding and management. Actions 28 and 29 provide direction specifically for the White River Spring-Run Chinook Program.

The program must also be consistent with NMFS policy for artificial propagation under the ESA, fulfillment of federal treaty obligations to Native Americans, fulfillment of court approved actions developed under the auspices of United States v. Oregon, the discharge of fisheries mitigation responsibilities incurred as a result of water development authorizations, and achievement of U.S./Canada Pacific Salmon Treaty obligations. The proposed program implements part of the BAMP (1998) as developed and agreed upon by the co-managers.

3.3) Relationship to harvest objectives.

Incidental harvest will occur during fisheries targeted on hatchery-origin spring Chinook and is expected to be consistent with harvest rates for natural-origin spring Chinook (e.g. < 2% for selective fisheries). These fisheries are planned and managed by the Columbia River Compact, consistent with court-ordered requirements of U.S. v. Oregon and the Columbia River Fish Management Plan (CRFMP). NMFS is included in harvest planning and harvest strategies are designed to limit impacts to listed species.

3.4) Relationship to habitat protection and recovery strategies.

At the watershed scale, analysis such as the Washington State Conservation Commission's Limiting Factors Analysis (LFA), and technical tools including Ecosystem Diagnosis and Treatment (EDT) and SSHIAP (Salmon and Steelhead Inventory and Assessment Program) will be used to identify factors that currently impact salmon and to prioritize actions needed in the watershed. Degradation of remaining spawning and rearing habitat continues to be a major concern associated with urbanization, irrigation projects and livestock grazing along riparian corridors. Mainstem passage through hydroelectric projects and ocean survival conditions are major determinants of productivity for spring Chinook salmon within the ESU. The White River supplementation program and the natural spawning population in the White River will benefit from any habitat improvement affecting spawning, rearing, or migratory locations used by the population. Coordination between the White River program and numerous regional habitat and recovery planning efforts is provided via members of the PRCC who participate in concurrent regional fish and wildlife planning, especially through the Upper Columbia Salmon Recovery Board (UCSRB), FERC relicensing activities, and the ICTRT. The ICTRT has the main task of establishing biologically based viability criteria for application to ESUs of salmon and steelhead under the ESA. The ICTRT will describe criteria for habitat viability and habitat usage in the context of spatial distribution and diversity of listed populations. Three HCPs have been adopted in FERC re-licensing agreements for operation of hydropower projects in the Columbia River mainstem. These HCPs have the potential to provide improved habitat and contribute the recovery of the White River and other subpopulations of spring Chinook within the Upper Columbia ESU.

The Biological Opinion established a habitat conservation account with annual funding of $288,600 to be used to finance tributary and mainstem habitat funding projects, which includes the White River. Annual habitat contributions of $807,900 are also available through the Priest Rapids Project Salmon and Steelhead Settlement Agreement (SSA 2006). Additionally, the SSA requires annual contributions to a No Net Impact (NNI) fund – an amount based on survival percentages of covered species. All three funds are administered and allocated through the PRCC Habitat Subcommittee. As of June 12, 2006, funds available for habitat conservation projects totaled $2,668,879.

Six fish and wildlife plans (also known as "subbasin plans") have been developed for the following "subbasins" (commonly known as watersheds): Wenatchee, Entiat, Lake Chelan, Methow, Okanogan, and the mainstem Columbia River from Rock Island Dam to the Canadian border. Subbasin plans have been submitted to the Northwest Power Planning Council (2004). These subbasin plans will identify and provide the basis for prioritizing project proposals to be submitted to the Northwest Power Planning Council in future funding cycles and will be used, potentially, for salmon recovery planning in North Central Washington.

The Upper Columbia Salmon Recovery Board Final Draft Salmon Recovery Plan (UCSRB 2005) was developed to help guide federal agencies charged with species recovery. The mission of the UCSRB is to restore viable and sustainable populations of salmon, steelhead, and other at-risk species through collaborative, economically sensitive efforts, combined resources, and wise resource management of the upper Columbia region. Consistency of the current White River supplementation program with objectives of ESU recovery planning and Priest Rapids Project mitigation objectives will be the goal of the PRCC.

3.5) Ecological interactions.

If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Describe salmonid and non-salmonid fishes or other species that could:

During the captive rearing phase, program fish would not be affected by or affect other species. Progeny of captive brood, and fish from adult-based supplementation will however, be released as yearling smolt, at which time they may interact with White River naturally rearing spring Chinook or other species.

(1) negatively impact program;

Progeny of captive brood, and fish from adult-based supplementation will be released as yearling smolts at which time they may interact with White River natural-rearing spring Chinook or other species. Spring Chinook smolts are released in the spring as mostly yearlings, although other life stages could be released depending on the success of the captive brood phase and program requirements. Competition for food may play a role in the mortality of liberated Chinook. SIWG (1984) indicated that there is a high risk that competition between hatchery-origin Chinook, and Coho, steelhead and other Chinook stocks may have a negative impact on the productivity of the supplementation progeny fish. Predation in freshwater areas also may limit the productivity of the spring Chinook releases. In particular, predation by northern pikeminnow (SIWG 1984) and Bull trout pose a high risk of significant negative impact on productivity of enhanced Chinook.

(2) be negatively impacted by program;

Hatchery-reared salmon and steelhead released into spawning and rearing areas of natural species may fail to emigrate (residualize), creating a potential negative interaction with natural fish. Because of their larger size, the predation risk posed by the above species is lower to yearling smolts released from the hatcheries (Rieman et al. 1991). SIWG (1984) reported that there is a high risk that enhanced Chinook salmon populations would negatively affect the productivity of Sockeye in freshwater and during early marine residence through predation. The risk of negative effects to wild fish posed by hatchery Chinook through competition is low or unknown in freshwater and marine areas (SIWG 1984). Large concentrations of migrating hatchery fish may attract predators (birds, fish, and seals) and consequently contribute indirectly to predation of listed wild fish (Steward and Bjornn 1990). The presence of large numbers of hatchery fish may also alter wild salmonid behavioral patterns, potentially influencing their vulnerability and susceptibility to predation. The potential also exists for diseases such as BKD to be transferred from hatchery-reared fish to natural populations.

(3) positively impact program;

Increased numbers of Chinook and other salmonid species that escape to spawn in upper

Columbia River tributaries may contribute nutrients to the system upon dying that would benefit spring Chinook and listed steelhead productivity. .

<u>(4) be positively impacted by program.</u>
Spring Chinook juveniles released may benefit other species in several ways:

- A mass of hatchery fish migrating through an area may overwhelm established predator populations, providing a beneficial, protective effect to co-occurring wild fish.
- Chinook eggs, fry, and smolts (natural and hatchery) will increase the availability of prey, providing increased food supply for aquatic species including steelhead and Bull trout (Pearsons and Hopley 1999). As stated in the USFWS Biological Opinion on the Effects of the Priest Rapids Hydroelectric Project (USFWS 2007), the primary impact of the spring Chinook supplementation program on Bull trout "may be beneficial" due to the increased availability of prey in the form of migrating smolts (see Addendum A). Other bird, fish and mammal species may benefit in a similar way.
- Increased numbers of spring Chinook that return and are allowed to spawn naturally may contribute important ocean-derived nutrients to the system upon dying that would benefit the productivity of other listed salmonid species (Quinn 2005). Juvenile steelhead, for example, congregate in areas where salmon carcasses are deposited and show a dramatic increase in condition factor (Bilby et al. 1998).
- Indirect positive impacts include strengthened justification for developing regional habitat conservation measures protecting all fish species.

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SECTION 4. WATER SOURCE

4.1) Description of the water source.

Juvenile-based Captive Brood:

Captive broodstock is currently reared and spawned at AquaSeed Incorporated, a private aquaculture facility located at 10420 173rd Ave. S.W., Rochester, WA.

Water for captive broodstock rearing is drawn from the Puget Sound Aquifer System. Water is supplied to two adjacent but distinct rearing locations via pumped wells. Department of Ecology groundwater permits for the two sites total 6,000 gallons per minute (gpm). Site number 001, known as the ESA site, has four wells at 125' of depth, supplying 1,875 gpm for captive broodstock rearing. The remainder of the permitted 3,500 gpm is currently used by the grower for commercial production. Additional rearing capacity and pump upgrade during 2006 increased water usage at the ESA site to 2,875 gpm. Site number 002, known as the Carlson site, has two wells at 125' of depth supplying approximately 1,300 gallons per minute with potential under the existing permit for up to 2,500 gpm.

This rearing location is geographically remote from the White River and characteristics of the aquifer water supply clearly differ from the surface water of the natal stream. All hatchery water is sterilized prior to discharge. The water source is pathogen-free and presents minimal risk from disease introduced via the water supply. This characteristic is especially important for captive broodstock which will be held for as long as five years. Surface water supplies, including the natal stream, represent a constant reservoir for disease organisms.

Water temperature from the groundwater aquifer is constant at approximately 50^0F. In contrast, temperature in the White River fluctuates annually and exceeds 60^0F during summer months. While fluctuating ambient temperature regimes are often desirable for juvenile rearing, captive broodstock adults should not be reared in temperatures exceeding approximately 55^0F. Both survival and egg viability would be severely impacted. Past experience and trials conducted by the grower demonstrate that a water temperature regime within the 49^0F to 52^0F range contributes to excellent growth, higher fecundity, and higher egg viability of captive broodstock when compared to warmer or colder regimes. It is advantageous to reduce water temperature during egg incubation to delay emergence time to more closely match natural production and to limit growth during the first year of life to reduce early maturation of males. An incubation water chilling system became operational prior to incubation of 2005 brood year eggs/fry.

Water chemistry parameters shall be well within acceptable ranges for rearing spring Chinook captive broodstock. Total dissolved gas, hardness, and pH are routinely monitored. Total gas levels are near 107% saturation at the well head and are reduced to approximately 102% by passing through a packed column before delivery to rearing ponds and incubators. Hardness and pH are within accepted fish health criteria. Water chemistry is evaluated annually by a professional laboratory and all parameters are within accepted fish rearing criteria.

F2 generation Captive Brood Phase - Transitional, Alternate and Proposed Rearing/ Acclimation Sites:

Eastbank Hatchery Rearing - Four wells supply water from an aquifer with a temperature range of 46^{0}F in May to 57^{0}F in December. Chilled water would be available if needed but is used mostly for incubation needs.

Little White Salmon National Fish Hatchery Complex (Little White Salmon NFH) - Water source is from the Little White Salmon River and springs. New well water sources have been developed to be combined to increase water temperatures during the early rearing of Little White Salmon Chinook programs during the early spring (approximately 48° F) compared to the colder river source (mean 44° F). Water temperatures range from 45º) in the spring to 47.5ºF during the summer and fall months, while the coldest temperatures occur during January 41ºF. The river supplies most of this water flow. For pathology concerns, no anadromous fish are upstream of the water source although some resident species occur (personal communication S. Doulos 2006).

Lake Wenatchee Net Pen Rearing - The confluence of the White River with Lake Wenatchee is less than ¼ mile from the net pen location. The net pens rely on passive flow through the structure and do not withdraw water. Past lake water temperature readings during spring rearing programs from 1997–1999 indicated water temperatures ranging from a low of 38.6º F to a high of 41.5º F in April and a range from 40.8º F to 45.5ºF in May. Early summer temperatures will elevate to a range of 55ºF – 66.5ºF and increase to 69.8ºF by early fall. The proposed rearing timeframe will release fish during May before temperatures elevate. Rearing densities will be kept low (<.25lbs/per cf^3).

Adult-based Supplementation:
Facilities for the adult-based supplementation phase have not yet been selected or designed. Water requirements and conditions will be different for each of the program facility components: brood holding/incubation, rearing, overwinter acclimation, and final acclimation. Specific flow criteria are discussed in section 5, Facilities and in section 1.6, Performance Standards and Indicators.

General water quality guidelines will apply to the evaluation of all water supplies. The availability of pathogen free ground water is important for fish health during early rearing and surface water helps match natural growth profiles during extended rearing. Both supplies should be of appropriate quantity and quality. Parameters to consider when evaluating the water rearing environment include turbidity, dissolved gases, heavy metals, hardness, pH, and the potential for contamination. Very high turbidity levels (above 100,000 ppm) may cause problems such as gill irritation for fry; reduced growth rates when fish visibility is limited; and silt removal problems (low and moderate turbidity levels are not detrimental and may reduce stress). Air super-saturation, high dissolved carbon dioxide/low oxygen levels in groundwater (assumed for all supplies and easily corrected), and the presence of dissolved hydrogen sulfide are potential gas issues.

Heavy metals are generally introduced to water through improper facility construction; however, natural supplies can also contain them. Sensitivity of fish to toxic pollutants, including metals, increases at low alkalinity. Chemical spills from truck accidents, agricultural pesticides, and herbicide applications are other sources of water supply contamination. Suggested upper limits for many of quality parameters are listed in Piper (1982) and in the Alaska Fish Culture Manual (ADFG 1986). Due to the interactive aspects of chemical reactions in water, developing specific criteria is difficult. Most water supplies have some values outside these limits, yet Chinook are successfully reared in a variety of conditions throughout the Northwest. The standards can be used as general guidelines, but quality determinations will not be made until testing with live fish is completed.

4.2) Risk aversion measures used to minimize the take of listed fish.

Juvenile-based Captive Brood:

The water supply for captive broodstock rearing is pumped from wells at AquaSeed. Inc. There is no risk to listed species. Effluent water is chlorinated and managed as directed by NPDES permit #WA0040819.

Adult-based Supplementation:

Adult-based facilities have not been designed at this time. Hatchery intakes will conform to NMFS and WDFW requirements for design and operating criteria and to Department of Ecology water use permits identifying approved flow volumes. Effluent management will conform to NPDES permit requirements.

F2 generation Captive Brood Phase - Captive progeny rearing/acclimation proposed sites:

Little White Salmon NFH water supply risk aversion measures include:

- An intake structure that meets NMFS screening criteria.
- An automatic alarm system with sensors at the intake, incubators, and rearing units.
- Daily monitoring of water temperatures and reporting of any unusual fish behavior or culture incidents to hatchery supervisors (personal communication S. Doulos 2006).

Lake Wenatchee Net Pen Rearing: In the near term, fish to be reared to yearling size for release will be held for acclimation in net pens in Lake Wenatchee. Total on-site production and feed fed monthly will remain under permit limits.. The net pen site plan and operational procedures for regular and emergency procedures will minimize impact to the lake environment and resource. Net pen mesh sizes are managed to allow maximum passive water exchange through the individual pens for optimum fish health and water chemistry concerns (dissolved oxygen, etc.) while keeping fish constrained within the pen system until they reach smolt or program size for release.

SECTION 5. FACILITIES

As directed by the Biological Opinion for ESA Section 7 Consultation on Interim Operations for the Priest Rapids Hydroelectric Project (NOAA 2004), facilities will be capable of meeting the programmed production objectives plus a 10% increase in capacity.

Many of the program facilities needed to produce 165,000 smolts (150,000 for release plus 10%) for the adult capture phase of the program have not yet been selected or built. Draft design objectives have been developed and will be used to guide technology selection, site location, and construction (where needed) of the facilities.

The different program components are: brood capture, brood holding, rearing, and acclimation. Acclimation may be divided into an overwinter acclimation site located in the lower White River basin and final acclimation/release sites that are in upstream areas. The general design preference is to combine as many of these functions as possible.

Objectives common to all the components that will be used during siting and design are as follows:
Low Environmental Impact - the potential environmental impacts of proposed facilities will be reviewed in detail during the NEPA, SEPA, ESA, and site permitting processes and will be considered during siting and design. Impacts may occur to plant and animal species in the air, water and land. Surface water withdrawals will impact streams for the distance between the removal and the return. Groundwater use can affect users within the area of influence of wells and infiltration galleries. Other environmental and permit considerations include local land use zoning codes, aesthetics, flood impacts, cultural resources, receiving water quality standards, and wetlands impacts.

Flexibility – allowing program managers the option of making future changes to the fish culture program in response to the adaptive management process will be considered during location and design.

Low Failure Risk – surface water supplies will need to function reliably in all river conditions, including icing, high flow, low flow, and during times when debris loads are heavy. Surface and ground water pumps, where needed, must have generator back up and alarm systems.

Functionality – land availability, utilities, and access are other site considerations.

Studies discussed in the following sections demonstrate the impact of facilities and culturing practices on survival rates. The general importance of the rearing environment is apparent when comparing the high adult return rates of genetically similar fish reared in the wild against those reared in hatcheries. Culturing conditions are proposed for the White River supplementation project that attempt to produce smolts with “wild” characteristics.

The table below summarizes the approximate facility water and space needs for the

150,000 smolt White River program. The calculations assume that all White and Nason broodstock are held at one location, an option being considered. They also assume that surface and ground water temperatures at the facilities are typical of those found in the area and that the White River fish are reared up to November before being moved to overwinter acclimation sites. The flow and space calculations do not include safety factors, they are minimums. The values should be increased by factors that depend on the reliability of the water supply systems that are used.

	Peak Minimum Flow (cfs)	*Water Type*	*Peak Minimum Space (cft)*
White and Nason broodholding/incubation	1.2	Ground	2,742
Rearing, low BKD	4.7	Ground	11,293
Rearing, high BKD	5.2	Ground	23,527
Overwinter acclimation	6.2	Surface	41,990
Final acclimation/release	6.2	Surface	41,990

5.1) Broodstock collection methods.

Juvenile-based Captive Brood:

White River spring Chinook required to continue the captive brood phase will be obtained through removal of a limited number of eyed eggs and pre-emergent fry from selected redds in the drainage using standard hydraulic sampling methods (Young and Marlowe 1995). White River spring Chinook typically spawn between the second week in August and the fourth week in September. Redds will be identified during routine spawning surveys and their positions triangulated for subsequent sampling of eyed eggs and pre-emergent fry. Marked hatchery adults from other tributaries will be identified and redds on which they have spawned will be cataloged and precluded from collections to assure the genetic basis for the White River population. Redd sampling will occur between approximately September 9 and November 19.

Adult-based Supplementation:

The following are guidelines for the broodstock collection engineering and design efforts:

- The method used should allow selection of only White River stock. .
- It must be below all spawning habitat to support monitoring of run size, run timing, and the collection of representative broodstock.
- The system must be operational throughout the adult migratory period to assure representative adult collection.
- Truck and equipment access must be possible.
- Adequate land should be available adjacent to the adult collection facility to support operations.
- The facility must support interrogation of individual fish for mark identification and collection of biological data.
- Twenty four hour security must be available when the facility is trapping or holding fish.
- Capture methods must minimize impacts to natural spawners - for example, weir operation during a fixed percentage of time, three days on and four days off per week allows free passage for a portion of the run.
- Capture methods must minimize impacts to other species, like downstream migrating

Bull trout.

- Capture infrastructure must not impact recreational use of the White River.

Construction of the adult collection/monitoring/evaluation facility may cause some temporary habitat disturbance. Facility development methods and duration will be guided by the necessary permits.

Three methods that meet these objectives are being evaluated for brood capture: a fish wheel, a Merwin trap, and stock identification at Tumwater Dam. Fish wheels have the advantage of being relatively easily removed during the off season. They also pass a percentage of the run without impact. However, their effectiveness and ability to select representative brood are undetermined.

Tumwater stock identification ID involves capturing adults in the Tumwater ladder, removing scales, holding those fish until unique stock characteristics are measured, and then either releasing adults to the river or transporting to them to the appropriate location. Advantages are that no structure needs to be built or installed in the river, strays will not be included in the brood, and other species are not impacted. However, technologies are not yet at the level required to identify stocks with enough accuracy to make this the preferred method.

Merwin traps consist of a complex net system hung in the water that direct fish to a trap. They can also be easily removed and will pass a percentage of the run without impact. They work best in lacustrine environments and may work in the low velocity, turbid conditions of the lower White River. Further analysis of these methods will help determine which one will be selected. The effectiveness of the techniques and environmental considerations will provide important direction.

5.2) Fish transportation equipment.

Juvenile-based Captive Brood:

Eggs and Fry - Eyed eggs are transported in small buckets or custom-designed cylindrical tubes resting on insulating material over ice within a cooler. Alevins and fry are transported in heavy duty freezer bags partially filled with water and inflated with oxygen. Bags are placed on a layer of insulation over ice within a cooler.

Juveniles - Pre-smolts are transferred from rearing locations (e.g. AquaSeed/Little White Salmon NFH) to the White River acclimation facilities in tanks designed for juvenile fish transport. Program fish that may be released directly in the White River will be acclimated by tempering of water temperature differences between the tanker truck water and the receiving water (no greater than 3^0F/hr). Density, sodium (0.5%), loadings, temperature, and dissolved oxygen criteria are defined prior to transport and monitored during the transfer.

Adult-based Supplementation:

Adults – Adults will be transported from trapping facilities in the White River to adult holding facilities. Transport tanks will be designed for adult transfer and will operate within criteria provided by fish health and fish culture professionals.

Eggs and fry – In the event of transport, protocols will follow those described above.

Juveniles – Fingerling or pre-smolt spring Chinook will be transported from the rearing location to acclimation/release ponds on the White River. Fish will be transported in tanks designed for juvenile fish transport. Protocols will follow those described above.

5.3) Broodstock holding and spawning facilities.

Juvenile-based Captive Brood:
Captive broodstock are presently held at AquaSeed in circular tanks of varying size, ranging from 4 to 50 feet in diameter and 1.4 to 4 feet of operating depth depending on fish size, age, and population numbers. A covered biological processing area contains fixtures and equipment necessary for spawning including tables, scales, measuring devices, buckets, colanders, microscopes, glassware, water, and fish health sampling provisions.

Adult-based Supplementation:
Design criteria result in the requirements of 8 to 10 cubic feet of volume and water flow of approximately two gpm per adult. Surface and groundwater will be supplied to the holding ponds in a manner that will facilitate maintenance of adult holding temperature below 55^{0}F. Design will facilitate crowding and sorting of fish by gender, ripeness, etc. Spawning will occur at a dedicated bio-processing area adjacent to the adult holding facilities. The area will be supplied with water, concrete slab flooring with wash down drain, buckets, troughs, and laboratory supplies to support fish health sampling and fertilization.

Locations that will accommodate both White River and Nason Creek broodstock are being evaluated for this facility. Sites in the Wenatchee basin which are relatively close to the adult traps are being given priority in order to reduce logistical complexity and adult stress. Incubation of eggs to the eyed stage is a program function that may be included at such a facility.

5.4) Incubation facilities.

Up to ten half stacks (eight trays) of vertical incubators are used at the existing AquaSeed Inc. facility. The vertical stack incubators are supplied with 5 gpm of water each. A water chiller can drop temperatures below the 50^{0}F raw water value. .

Future incubation facilities will likely will likely use vertical stack incubators and will include chilling capability. Iso-buckets temporarily installed in shallow troughs may be used during early incubation while viral and disease screening is completed.

5.5) Rearing facilities.

Juvenile-based Captive Brood:
In the case of captive broodstock, the adult holding facilities described in section 5.3

above are the rearing facilities.

Second generation (F2) progeny spawned from captive broodstock in 2002, 2003, and 2004 have been reared at AquaSeed Inc. for a period of about 16 months and subsequently transferred to acclimation facilities on the White River. Rearing was conducted in the same array of tanks described in section 5.3 above.

<u>F2 generation Captive Brood Phase</u>:
Little White Salmon National Fish Hatchery Complex 56961 State Route 14, Cook, WA 98605. Located at river kilometer 2 on the Little White Salmon River (WRIA 29), entering the Columbia River at river kilometer 261. Proposed plans for 2006 include rearing captive brood progeny (Brood YR 2005) from spring 2006 until the following spring of 2007 at Little White Salmon NFH. Additional rearing of Brood YR 2006 and 2007 progeny up to the program goal will be considered by the PRCC HSC. Fish will be reared in 10-foot by 110-foot by 3.5-foot deep concrete raceways. Currently, five raceways are being used for this program, each having 3,850 ft^3 of rearing space. As a result, a total of 19,250 ft^3 of raceway space is available for the final rearing of White River spring Chinook.

<u>Adult-based Supplementation:</u>
Little White Salmon Hatchery may provide future rearing capacity for up to 150,000 pre-smolts for the UCR spring Chinook recovery program. It has not yet been decided if these will be Nason Creek or White River fish or both. If Little White will be rearing Nason Creek fish, rearing capacity needs to be located or constructed for the White River. Objectives for either locating existing hatcheries with excess capacity or constructing a new facility include:

- <u>High Quality Fish</u>
    - Water Quality – see section 4.1. Ground water is preferred for early rearing.
    - Rearing Criteria – this highly valuable stock will be reared using low volume density, which is critical for Chinook, and high flow volume criteria (see sections 1.6 and 9.2.3).
    - Rearing Environment – large scale experiments with spring Chinook at the Cle Elum Supplementation and Research Hatchery have not demonstrated advantages in survival due to the use of some rearing strategies. Painted walls, floating covers, and subsurface feed introduction did not substantially improve adult survivals when compared with standard raceways (BPA 2005). Rearing criteria and water conditions will be more important factors in designing the rearing environment than these strategies.
    - Fish Health – the susceptibility of Chinook to BKD will be a critical program design consideration. Rearing systems, water quality, and site locations that can minimize disease effects will be used.
- <u>Flexibility</u> – an example of design flexibility is having enough of both ground and surface water available to operate the rearing program, allowing any combination of water supplies to be used.
- <u>Low Failure Risk</u> – rearing sites must capable of managing power failures, snow and

ice accumulation, as well as flood risks.

- Functionality – designs need to incorporate the fish culture procedures required at hatcheries. Rearing units are frequently cleaned and must accommodate effective feeding practices, disease treatments when needed, vaccination, tagging, and the removal of fish to acclimation sites. Outdoor rearing units need to be fenced and covered with bird exclusion wiring to reduce predation. Shade cloth will be incorporated where summer temperatures and general stress levels need to be reduced.

Several alternatives that meet some or all of these objectives are being considered for rearing facilities. Continued rearing at the transitional hatcheries as well as construction of new facilities at sites within the Wenatchee watershed are options.

5.6) Acclimation/release facilities.

Juvenile-based Captive Brood:

Acclimation facilities adequate to contain 165,000 smolts are required for release of second generation smolts produced from captive broodstock spawning. Planning for design and construction is advancing but facilities are not yet available.

Lake Wenatchee net pens were used as a temporary acclimation site in the spring of 2007. There are eight floating net pens for juvenile rearing. Six pens are 20 ft x 20 ft x 16 ft and two pens are 16 ft x 16 ft x 20 ft. The pen complex is located on the west end of the lake adjacent to the mouth of the White River.

F2 generation Captive Brood Phase Transitional Acclimation/Release Sites:

Releases during 2004 and 2005 included temporary acclimation at the Tall Timbers Ranch site so that 2,589 smolts could be released into the White River. During spring 2006, approximately 1,654 yearling (BY 2004) White River spring Chinook were planted in the White River at a log jam site located at approximately RM 6.5. This structure is approximately 50 meters from the White River Road. The complexity of cover at this site provided protection from high flows and allowed for dispersal and predator avoidance.

Beginning in 2007, captive brood progeny were acclimated and released from the Lake Wenatchee net pens (RM 91.0 Lake Wenatchee/Wenatchee). Fish were reared from fingerling to yearling stage at Little White Salmon NFH, transferred to the net pen complex in March of 2007, and released to the lake in May 2007. A similar approach will be used in the spring of 2008.

Adult-based Supplementation:

Objectives used to determine the location and design of new acclimation sites are as follows:

- High Adult Return Rates
  - Methods that have been shown to produce smolts with improved survival rates involve natural rearing conditions. An important environmental component for acclimation is surface water. The cold winter and warming spring temperatures of surface water encourage smoltification (Appleby et al. 2002) and produces fish

that are motivated to migrate quickly. Also, acclimation sites with surface water will allow a more natural growth profile to be followed (see section 10.1).

  - Chinook smolt-to-adult survival rates increase when rearing occurs at low volume densities (Ewing et al. 1995). A study using raceways showed a 4x increase in survival when comparing Chinook reared at 1 lb/ft^3 vs. 3 lbs/ft^3 (Banks 1994), although there was not a significant difference in survival rates at flows that varied between 200 gpm and 600 gpm per raceway. Sites that have room to allow large, low density rearing units will have priority.
  - A third method of improving smolt survival is overwintering at the release site. Paired releases of summer Chinook salmon in the Mid-Columbia (Wenatchee, Methow, and Similkameen) have shown significantly higher smolt-to-adult return rates for fish acclimated on river water for seven months over those acclimated for two months. Over the five year study, the overwinter acclimation period typically resulted in a 200% increase in smolt-to-adult return (SAR) rate (A. Murdoch unpublished data).
  - Hauling has a negative impact on fish and on smolts in particular. However, the most stressful event in the trucking process is loading (Maule et al. 1988) so trucking distances are not the major contributor to negative impacts. Acclimation (and rearing) systems should minimize the number of times fish are hauled.
  - Studies have shown a survival benefit of rearing in ponds when compared to raceways, as demonstrated for Coho (Fuss 2002), cutthroat (Tipping 2001), and spring Chinook (Beckman 1999).
- <u>Low Environmental Impact</u> – current National Pollution Discharge Elimination System (NPDES) policy allows the administering agency, Washington Department of Ecology (WDOE), to waive the requirement for a discharge permit if production gains at a specific site are less than 20,000 pounds per year or food fed is less than 5,000 lbs per month and if impacts are considered minor. The upstream acclimation sites will be well under these limits. However, WDOE is concerned with the cumulative impact of multiple acclimation sites in the region. Permits may be required in the future, which at a minimum may involve water quality monitoring. It is also possible that waste treatment procedures may be implemented. Also, where possible, the acclimation sites will be environmentally beneficial. Natural acclimation ponds and habitat restoration on land that is purchased for acclimation can benefit a variety of species. Sites will be designed so that when acclimation is no longer being conducted, they can be restored to a natural condition.
- <u>Low Stray Rates</u> – fish that migrate in their natal stream for long distances stray less than fish that move short distances (Garcia et al. 2004). Release locations should then be as far upstream as practical. Acclimation on surface water will also help imprint smolts to unique White River water characteristics.
- <u>Flexibility</u> – release locations, release numbers, and acclimation technology may change in the future. Systems that can adapt to these changes are preferred.
- <u>Functionality</u> – sites need to be accessible by truck for fish delivery.

Several methods are possible for final acclimation/release. Direct truck planting of smolts has been rejected because of low survival rates and the potential for high stray rates (Johnson et al. 1990 and Labelle 1992). Concrete raceways will not be used because the reduce program flexibility and do not fit into the natural landscape of the White River. Engineered natural habitats show promise but have not yet been fully tested. Remaining options include constructed ponds and acclimation in existing river side channels.

Overwinter acclimation in large ponds at accessible upstream areas using surface water is an optimal acclimation system. However, such a location has not been found in the White River watershed. A compromise system involving overwinter acclimation at a site low in the basin is being evaluated. Upstream, short-term acclimation sites may also be used.

5.7) Difficulties or disasters.

Fish quality and survival has been a continuing difficulty at AquaSeed. Mortality rates for captive brood have been high (80% from egg to adult), although within acceptable limits. Current survival data for the 2002-2005 BYs suggest that egg- to-spawn survival is improved over the 1997-2000 BYs and is likely to exceed the program expectation of 30% (See section 9.2.1).

F2 fish reared at AquaSeed have resulted in poor quality smolts, largely due to full-term smolt rearing on ground water and rearing in circular tanks. F2 fish, beginning with the 2005 BY, are being reared at Little White Salmon NHF where smolt quality has been excellent.

5.8) Back-up systems and risk aversion measures.

Juvenile-based Captive Brood:

The interim captive broodstock facilities at AquaSeed Inc. are protected by a number of systems from catastrophic loss to listed fish.

- Both sites have backup generators to supply power to pumps.
- Both sites have backup oxygen supplies available.
- Water supplies have alarms to detect loss of flow and level.
- Both sites have alarm systems with both telephone and two-way radio signals.
- Both sites have 24-hour on-call personnel with pagers and cell phones.
- Site 001 (ESA site) has a burglar alarm system.
- Site 002 (Carlson site) has an on-site residence.
- All groups are reared at minimum pond loading densities to minimize the risk of loss due to disease and to maximize survival.
- All broodstock groups are split between the two sites to avoid complete loss of any group.
- Effluent water is treated with a chlorination/dechlorination system to protect all resources in receiving waters.
- All activities are conducted in accordance with the WDFW Fish Health Manual (WDFW 1996) and the Co-Managers Salmonid Fish Disease Control Policy (1997).
- All lots/groups of fish are separated according to disease certification status.

Adult-based Supplementation:

The proposed White River hatchery and acclimation facilities will be protected by at least the following:

- o All sites with water pumps will have backup generators and alarm systems to assure continued electrical power in the event of power service failure.
- o All water supplies and rearing vessels will have alarms for water flow and water level.
- o Protocols will be in place to test standby generators and all alarm systems on a routine basis.
- o All facilities will be staffed during operation to provide for protection of fish from vandalism and predation, and allowing for a rapid response in the event of power loss, water loss, or freezing.
- o Fish collection facilities will be staffed as required during operations to ensure effective operation, safe capture and holding of fish, and to prevent poaching.
- o Adult holding, incubation, and rearing facilities may be sited in areas that have a low flood risk.
- o All groups will be reared at minimum pond loading densities to minimize the risk of loss due to disease and to maximize survival.
- o All hatchery staff responsible for collection and propagation will be trained in proper fish handling, transport, rearing, biological sampling, and accepted fish health maintenance procedures to minimize the risk of fish loss due to human error.
- o All fish will be handled, transported and propagated in accordance with WDFW Fish Health Manual (1996), Co-Managers Salmonid Fish Disease Control Policy (1997), and Pacific Northwest Fish Health Protection Committee (PHFHPC 1989) model program.
- o Hatchery effluent will conform to conditions of the National Pollutant Discharge Elimination System (NPDES) permit.
- o Water supply systems will be redundant where possible. Dual pumps and generators, will be installed.
- o Water intake systems will be screened according to NMFS and WDFW standards to prevent mortality from impingement or removal of listed species from the natural habitat.

<u>F2 Generation Captive Brood Phase Sites:</u>

Eastbank Hatchery and Little White Salmon NFH: The hatcheries incorporate the protection measures listed above, including back-up generators, alarm systems, redundant water supply systems, and 24 hour on-call staff.

Little White Salmon NFH: Upgrades to the original hatchery were made in 2001, including raceways enclosed by 1.5-inch mesh chain link fence and overhead aircraft cable space 6-inches on center to preclude entrance by both mammalian and avian predators. All raceways are equipped with aluminum baffles to maintain a self-cleaning environment and extra metal guides at the tail end to allow installation of double screens to prevent escapement of non-endemic fish into the Little White Salmon River. The entire upper raceway area is designed to facilitate loading of fish onto large distribution trucks for off-site transfer. In addition, conveniently located utility stations can accommodate a variety of fish marking trailers. Both Little White Salmon River and spring water are available at the upper raceways. Raceway cleaning is performed full length for un-baffled raceways, while baffled raceway cleaning involves flushing of the lower compartment. All waste from cleaning operations is diverted to the pollution abatement circular clarifier. Fish mortalities are removed and recorded daily and equipment is disinfected between individual fish lots. Water temperatures are monitored daily and any unusual fish behavior or culture incidents are reported to hatchery supervision (personal communication S. Doulos 2006).

Lake Wenatchee Net Pen Rearing: This program has an emergency plan for rapid response for protection of fish from risk sources (water pollution, etc.). The net pen complex is monitored frequently in case of weather problems. Fouling articles or debris are removed from net pens to prevent tearing. Multiple rearing units (net pens) are used for rearing. Densities are held to minimum loadings to reduce risk of rearing stress or disease. Sanitation – all equipment is disinfected between uses on different lots of fish and individual net pens including nets, boots, raingear, etc.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

The proposed recovery program initially incorporated captive brood technology to rear progeny of natural origin spring Chinook spawners from the White River. Eggs or fry from naturally spawning White River spring Chinook are collected from redds and reared in captivity. The use of second generation fish (F2s) in the broodstock program may be required for augmenting deficiencies encountered during the collection of natural broodstock. The potential demographic boost from using F2 individuals in the captive broodstock program outweighs genetic risks (e.g., domestication selection, inbreeding depression) associated with two generations of captive rearing and one cycle of artificial spawning, assuming all efforts are made to prevent sibling matings (e.g., no within-brood-year matings) and to increase effective population size (e.g., factorial crosses). However, use of F2s in the captive brood is not a preferred option.

Broodstock for the adult-based supplementation phase will be a combination of hatchery and natural White River origin adults.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources.

The broodstock source for this program is the spawning aggregate of the UCR spring-run Chinook salmon ESU spawning in the White River, and tributary to the Wenatchee River (WRIA #45). The White River population segment as well as all other population segments within the ESU are endangered and at risk of extinction.

The White River spawning aggregation was one of three proposed for captive broodstock rearing to reduce the immediate risk of extinction (BAMP 1998). Eyed eggs were first collected from redds of naturally spawning adults in the White River in 1997. Egg collection has continued at varying levels for each ensuing year with the exception of 1999 and 2001. The number of eggs collected annually has ranged from 183 to 1,529. Prior to 2002, program uncertainty, impacts of hatchery strays, and access limitations to redds were limiting factors and restricted successful implementation of the program.

6.2.2) Annual size.

See section 2.2.2.

6.2.3) Genetic or ecological differences.

Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

There are no known genetic or ecological differences between the hatchery and natural components of the White River natural spawning aggregation. As of 2005, there has been no natural spawning of adult returns generated by the captive broodstock program. The M&E program will assess any changes to the natural population subsequent to the return of adults from the captive broodstock program. The program is designed to retain genetic and ecological traits of the listed target populations.

Phenotypic differences have been observed within captive broodstock at the time of spawning; age-at-maturity, size-at-maturity, and fecundity. Captive broodstock tend to mature at relatively younger ages when compared to natural spawners observed in the White River which mature exclusively at 4- (μ=67.1%) and 5-yrs (μ=32.8%) of age (M. Tonseth, WDFW, personal communication). Captive brood spawners from three stocks assessed over four brood years matured predominantly as 2-yr-olds (61.1%) followed by 3-yr-olds at 18.8%, 4-yr-olds at 16.9%, and 3.2% as 5-yr-olds. Male and female proportion for brood years 1997 through 2000 has been 85% and 15%, respectively. These shifts are thought to be phenotypic rather than genotypic due to the White River captive broodstock rearing receptacle container sizes, freshwater environment (as opposed to sea-water results) and growth rates (pers. comm. D. Witczak, 2005). However, chilled water was not available for these broods and growth rates could not be manipulated. Currently, chilled water is used to retard the development of the eyed eggs and subsequently delay the ponding date. Chilled water has been effectively used in adult-based hatchery programs to reduce growth rates and early sexual maturation. As a result, broodstock currently being reared are expected to have an older mean age at maturity and more even sex ratio. It is expected that progeny of natural-spawning adults will display normal age distribution. The M&E plan will assess this assumption.

Fecundity of White River captive broodstock has averaged 1,161 over three brood years reported in Murdoch and Hopley (2005). Typical fecundity for UCR spring Chinook salmon is 4,400 (BAMP 1998). Average size of White River female spawners at age has been 1,628g (age 3), 1,987g (age 4), and 1,582g (age 5). These sizes are significantly smaller than natural-spawning adults which average approximately 15 pounds (6,800g) at maturity. These size and fecundity reductions are typical of those experienced among captive broodstock programs in the region (Murdoch and Hopley 2005). It is assumed that phenotypic traits for adults from the F2 releases will better approximate the natural population than did the captive brood adults, although may not mimic entirely age at return and sex ratios observed in the natural population. Evidence suggest that hatchery origin fish generally mature at an earlier age than the natural origin fish and this may be expected with hatchery returning adults from the White River supplementation program.

The Chiwawa hatchery stock, which strays into the White watershed, is known to have significant allele frequency differences from the White River population (see section 2.2). There may also be phenotypic differences but comparisons have not yet been made.

6.2.4) Reasons for choosing.

Broodstock was selected to prevent extinction of the White River spawning aggregation and to conserve the spatial structure and diversity of spring Chinook subpopulations within the Wenatchee River.

6.3) Risk aversion measures used to minimize adverse effects to listed fish.

The primary purpose for use of broodstock from the White River is to conserve and rebuild the White River spawning aggregation within its natural boundaries. Risk aversion measures to minimize adverse genetic and ecological effects include:

- Conducting hydraulic egg collection or fry trapping by appropriately trained staff and supervised in the field by a journey level biologist.
- Limiting egg/fry collection to only those redds known to be from naturally produced spawning parents.
- Assuring that samples are collected randomly and are representative of the White River spawning aggregation.
- Limiting egg/fry collection from each redd to no more than 135 to assure that the majority of eggs from each redd remain in natural production.
- Managing the proportion of eggs/fry taken for artificial propagation to reduce the impacts of domestication selection.
- Uniquely marking broodstock (CWT and PIT-tag) by family to prevent full sibling matings and maximize effective population size.

SECTION 7. ADULT MANAGEMENT

7.1) Objectives.

An initial goal of the adult management effort (see section 1.5), for both the juvenile-based captive brood phase and the adult-based supplementation phase, will be to build and maintain a viable population. The target currently being used for the number of naturally spawning adults that results in a minimum population size is 80. This value was developed by NMFS for endangered Snake River spring Chinook (see section 1.6, standard 3.5) and will be revised using updated information for the White River population. Hatchery fish, if necessary, may be allowed onto the spawning grounds in excess of long-term goals in order to achieve this minimum viable population size.

When returns occur at numbers beyond this level, adults will be managed to meet long-term objectives for the ratios of natural and hatchery origin fish in the broodstock and on the spawning grounds. Ratios will be based on reproductive success data, genetic considerations, and numerical abundance. Consistent with the intent of an integrated program, the objective of this strategy is to prevent divergence of the hatchery and natural components of the White River spawning aggregation.

A concept that will be considered for adoption is Proportionate Natural Influence (PNI), which is a measure of the influence of wild spawners on a population. Numerically, it is the ratio of the proportion of natural origin fish in the broodstock divided by the sum of the ratio of the proportion of natural origin fish in the broodstock plus ratio of the proportion of hatchery origin fish on the spawning grounds (Lynch and O'Hely, 2001). At PNI values averaged over time that are greater than 0.5, characteristics are more similar to a pure natural population than a hatchery population. Managing based on PNI requires that natural progeny be used in the broodstock and that hatchery progeny be allowed on the spawning grounds in a defined ratio.

The JFP will make decisions about adoption of these adult management concepts and objectives. The HSRG will evaluate options for Columbia River populations and will provide useful input to the JFPs.

As a result of habitat evaluations, feedback from the M&E program, and due to the evolving nature of the science of salmon recovery, adaptive management will play an important role in guiding the direction and size of the program in the future. The program is structured to allow adaptive management principles to direct supplementation strategies.

7.2) Disposition of surplus hatchery-origin fish.

Excess hatchery adults may be managed through a sport or tribal fishery in the Wenatchee River. Adults may also be removed from the run at Tumwater dam to adjust the spawning ground composition to meet program objectives.

Stray adults, such as those anticipated from the Chiwawa program will be returned to the

Chiwawa River hatchery facilities, harvested, or released for natural spawning into an appropriate system.

7.3) Broodstock collection.

7.3.1) Life-history stage to be collected.

The captive brood phase uses eggs or alevins collected from redds produced by naturally spawning adults in the White River. The adult-based supplementation phase will use natural-origin and White River hatchery-origin adults captured that are returning to the White River.

7.3.2) Collection or sampling design.

Include information on the location, time, and method of capture.

See section 5.1 for juvenile-based captive brood collection methods.

Collection locations and methods for the adult-based supplementation phase have not yet been determined. Capture of White River adults will occur in equal representation throughout the immigration period of May - September. Collecting broodstock throughout the spawning migration in proportion to their abundance will reduce selection impacts attributable to broodstock collection. Trapping and adult handling facilities must provide for intensive management of adult escapement including variable operations windows, effective passage of adults upstream, and interrogation of individual adults for marks or tags. Operating protocols must be developed annually to direct capture numbers, capture rates, mixture of hatchery- and natural-origin adults in the upstream escapement and in the hatchery broodstock, and management of strays from other tributaries. Protocols may be consistent with those currently in place for spring Chinook supplementation programs in the Wenatchee basin that allow for a maximum of 33% of the total natural-origin returns to be collected for broodstock and a minimum of 33% of the broodstock be of natural-origin.

7.3.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

<u>Juvenile-based Captive Brood:</u>
Currently, all spring-run adult Chinook passing Tumwater Dam are genetically sampled, scale sampled, marks recorded and individually PIT-tagged prior to release. During spawning ground surveys, redds are flagged at time of construction and adult spawners are observed during spawning to classify adults as natural or hatchery origin by observing the presence or absence of the adipose fin and from interrogation of PIT-tags applied at Tumwater Dam. A missing adipose fin denotes a hatchery-origin adult. All hatchery-origin adults with missing adipose fins are presumed to be from other tributaries or river systems. Only redds constructed by unmarked adults will be considered for sampling to reduce risk from non-local hatchery adults. An unknown proportion of unmarked adult spawners could be progeny of naturally spawning strays.

Adult-based Supplementation:
Adults will be collected only from their natal streams or, if feasible, at mainstem Wenatchee facilities (Tumwater Dam) if individual adults can be identified by tributary of origin. Stray hatchery fish may be segregated from the broodstock.

7.4) Proposed number to be collected.

7.4.1) Program goal.
Juvenile-based Captive Brood:
Collect up to 1,500 pre-emergent fry for captive brood rearing based on a maximum sample size of up to 135 fry per redd. The number of fry per redd should be adjusted each year to result in a total collection of 1,200 eggs/fry from natural-origin White River spawners representing up to 50 redds. When there are 25 or fewer redds it is proposed that all redds be sampled.

Adult-based Supplementation:
A total of approximately 110 adults of both natural and hatchery origin of White River lineage will be collected for broodstock to meet the smolt production level of 150,000 fish.

7.4.2) Past broodstock collection levels.
(for the last 12 years or for the most recent years available)

Year	Adults Females	Males	Jacks	Eggs (families)	Juveniles
1997				527 (8)	
1998				199 (4)	
1999				235 (7)	
2000				272 (7)	
2001				na	
2002				183 (3)	
2003				723 (8)	
2004				1529 (13)	

7.5) Adult transportation and holding.
Facilities and transportation equipment will be designed and constructed to meet the following operating guidelines:
- Haul all adults in 0.5 to 0.6% salt, regardless of duration of haul.
- Haul all adults at loadings no greater than 4.5ft^3 per fish or 34 gallons per fish.
- Haul all adults in 10 ppm MS-222.
- Haul from trap site at least daily but 2x-3x per day or more, as necessary.
- Facilities for adult holding are described in section 5.3 above.

7.6) Broodstock health maintenance and sanitation.

Juvenile-based Captive Brood:

Eyed eggs collected for captive broodstock are bathed in iodophore for 10 minutes immediately after arrival at the incubation facility. See section 9.2.7 for description of fish health management during captive broodstock rearing.

Adult-based Supplementation:

Fish health management for adults following transition to adult-based supplementation is expected to follow guidance provided by Rogers, Brunson, and Evered (2002):

- Remove adults from elevated water temperatures as soon as possible to a pathogen free water source if available.
- Initiate formalin treatments for control of external parasites and/or fungus as listed on label, INAD permit or through veterinary prescription. Treatments should be no less than three times per week, but may be daily based on recommendation of attending fish pathologist.
- Inject all fish, or at least all females, intraperitoneally with antibiotic within two weeks of collection or at time of first sorting of adults as recommended by the attending fish pathologist using the following guidelines.
  - If needed, repeat injections shall be administered no less than 20 days and no more than 30 days apart to all females.
  - Inject with not less than 15mg/kg of ERYTHRO-200 or equivalent.
  - Do not inject less than 14 days prior to spawn.
- Do not exceed holding parameters greater than 1gpm/adult and 8ft^3/adult.

Sanitation procedures employed to reduce the transfer and incidence of fish diseases are in accordance with Washington Co-Manager Fish Health Policy (1998), PNFHPC (1989), and IHOT (1993) guidelines.

7.7) Disposition of carcasses.

Carcasses resulting from out-of-basin operations at AquaSeed Inc. are frozen and delivered to a municipal refuse site. Carcasses resulting from the adult-based supplementation phase of the project will follow standard disposition protocols which may include distribution into the stream of origin for nutrient enhancement.

7.8) Risk aversion measures used to minimize adverse effects to listed fish.

Risk aversion measures include (see details above):

- Collect known White River origin broodstock.
- Follow developed spawning ground and hatchery broodstock composition guidelines.
- Use broodstock collection procedures that minimize impacts to listed fish.
- Follow adult transportation, holding, and fish health maintenance guidelines.

SECTION 8. MATING

NOTE: see Hopley (2002) for detailed description of mating protocols and spawning operations.

8.1) Selection method.

Juvenile-based Captive Brood:

Mature captive broodstock are the surviving representatives of families collected as eyed eggs or fry from redd pumping three to five years previously (see sections 2.2, 5.1, and 7.3). It is intended that all maturing captive broodstock will be used for spawning. Mature fish are spawned systematically as they become ripe, usually during one spawning session per week. Each individual fish is identified by a PIT-tag and coded-wire tag denoting the specific family (redd) from which that fish was originally extracted. Each fish is spawned after ascertaining family and brood year by interrogation of the family-specific tag. The highest priority is to mate males and females from different brood years and, secondarily, from different families within brood years to assure the highest effective population size possible. Factorial matings (i.e., minimum 2 x 2) are used to further increase the genetic diversity within a given brood year. When surplus males are generated, such as early maturation of two-year-old precocial males, representative milt samples may be saved through cryopreservation. Infrequently, an adult female may mature and ripen when a mate is not available. Use of non-sibling cryopreserved males would be used to fertilize these eggs. If this is not possible, biological data will be recorded and the individual will be sacrificed without spawning.

Adult-based Supplementation:

Broodstock will be collected randomly within a collection period but the number collected during any period will be proportional to the numerical abundance of the run at large at that point in time.

8.2) Males.

Juvenile-based Captive Brood:

It is intended that all males maturing during the spawning season will be used for fertilization. However, efforts are made to ensure equal contribution from each family. Males of differing age classes, including precocious males are routinely used in the ratio they occur during captive brood spawning. Program spawning protocols strive to achieve a 1:1 ratio of males and females, combined in 2x2, 3x3, or similar matrices to capture and maintain a substantial proportion of available genetic material. When large numbers of males mature at two yrs of age, representative samples of milt will be cryopreserved; allowing the option for inclusion in subsequent spawning cycles and assuring availability of milt if an adequate number of live males are not available for spawning. Because the viability of cryopreserved sperm is generally low and highly unreliable, preference is given to using live males to achieve spawning objectives. Repeat spawners may be used when necessary if there is a shortage of males from appropriate families and age groups to meet mating protocols.

Adult-based Supplementation:

Specific spawning protocols for adult-based supplementation may be developed that are similar to those currently in use for other spring Chinook recovery and mitigation programs. They include 1:1 male to female ratios, individual matings, factorial matings using backup males, and inclusion of all age classes (jacks) in the ratio they occur.

8.3) Fertilization.

Juvenile-based Captive Brood:

See section 8.2 for the spawning protocol.

The fertilized eggs from each individual cell within a factorial mating are held separately within incubators. Two elements are of importance. First, discrete matings (cells of a factorial design) can be monitored and evaluated to attribute sources (male or female) of high or low mortality rates through analysis of variance. Secondly, individual groups can be separated based on fish health status, especially BKD or viral status, following fish health screening.

Adult-based Supplementation:

See section 8.2.

8.4) Cryopreserved gametes.

Milt has been preserved from a total of 27 males from the 2003 and 2004 brood years. Preserved milt has been used for White River spawning. Viability at AquaSeed is reported to be approximately 30% (Greg Hudson, personal communication, 2005).

8.5) Risk aversion measures used to minimize adverse effects to listed fish.

The greatest risk during spawning of captive broodstock is the loss of within-population genetic variance. Spawning protocols are in place specifically to minimize this risk.

The captive brood spawning protocol requires that individual spawners be identified to family by interrogating coded-wire tags or PIT-tags with codes unique to individual families. Tags are interrogated at time of spawning to allow design of factorial mating solutions and to assure that no full-sib matings occur. The priority is to produce matings across brood years (age classes) and across families within brood years. Milt from each male is checked for motility prior to use in matings.

The factorial mating scheme will be used to capture the maximum possible genetic variation. In rare cases single males or females may be mated to maximize numerical abundance and to assure that all genetic material is captured for ensuing generations.

Specific spawning protocols for adult-based supplementation will be developed as the program converts away from juvenile-based captive brood. As with captive broodstock, the greatest source of genetic risk is loss of within-population genetic variation. Current protocols in use for other spring Chinook recovery and mitigation programs to conserve genetic variation include 1:1 male to female ratios, individual matings, factorial matings using backup males, and inclusion of all age classes (jacks) in the ratio they occur.

SECTION 9. INCUBATION AND REARING

9.1) Incubation.

9.1.1) Number of eggs taken and survival rates.

Provide survival to eye up and/or ponding data for the most recent twelve years or for years dependable data are available.

Summary of White River captive broodstock eyed egg/fry to ponding survival rates.					
Brood Year	Number of Eyed Eggs/Fry Extracted	Survival to Ponding (%)		Number of Eyed Eggs/Fry Shipped to AquaSeed	Survival to Ponding (%)
1997	527	100.0		527	100.0
1998	199	88.7		182	97.0
2000	272	96.0		272	96.0
2002	183	91.6		171	98.0
2003	723	94.7		699	98.0
2004	1,627	82.8		1,432	94.1
2005[a]	2,775	97.9		2,742	99.1
Mean	901	93.1		849	97.5

Survival rates (%) for various life stages of White River second generation (F2) eggs from spawning of captive broodstock.				
Brood Year	Green to eyed eggs	Eyed egg to ponding	Eyed egg to release	Green egg to release[2]
2002[1]	67.5	98.0	55.7	37.6
2003[1]	36.7	94.1	75.9	27.9
2004	86.4	94.8	81.6	70.5
2005	82.1	94.2	na	na
Mean	68.2	95.3	71.7	45.3
[1] Does not include juveniles retained for broodstock [2]Goal is 65%				

9.1.2) Disposition of surplus eggs.

Program goals are designed to avoid surplus eggs by estimating the required number of females required for the program. In the event surplus eggs exist, the PRCC HSC will make a decision as to the best use of the surplus eggs. Possible actions include placement of egg incubation boxes in the White River, hatching eggs, and direct planting of unfed fry, fed fry, fingerlings, pre-smolts or smolts into the White River.

9.1.3) Loading densities.

Each tray of a vertical incubator is populated with eggs from one female. Density per tray has ranged from 183 to 1,529 eggs collected from one or more natural redds. Average tray loadings for F2 progeny of captive broodstock has ranged up to approximately 1,600 eggs over three years. Vertical style incubators are arranged in half stacks (eight trays) and receive 5 gpm of water flow each, or in full stacks. Similar protocols are expected during adult-based supplementation which is anticipated to result in approximately 4,400 eggs per tray of a vertical incubator assuming average fecundity.

9.1.4) Incubation conditions.

<u>Juvenile-based Captive Brood:</u>
Water flow system is monitored by alarm. Incubation temperatures are constant using chilled water starting with 2005 brood. Dissolved oxygen is tested periodically, usually when water flow has been adjusted. Dissolved oxygen is at saturation when water enters the incubators. Dissolved oxygen levels have decreased no more than 0.5 ppm at any check.

<u>Adult-based Supplementation:</u>
Incubation at new rearing facilities will likely be done in pathogen free water. The ability to heat and chill that water will help adjust growth profiles to meet program goals.

9.1.5) Ponding.

<u>Juvenile-based Captive Brood:</u>
Fry are presently ponded at button up directly from vertical incubators to 4 ft diameter starter tanks. Length and weight samples are not taken at ponding to minimize handling stress.

<u>Adult-based Supplementation:</u>
Button-up fry will be placed into first feeding rearing units when yolk is approximately 95-100% absorbed. This is done with a visual check of a dozen fry

9.1.6) Fish health.

<u>Juvenile-based Captive Brood:</u>
Eggs in vertical incubators are treated periodically with formalin to control fungus. Splash barriers are placed between incubation stacks. Vertical incubator trays are generally left undisturbed. Any mortality is removed by picking individual eggs at the eyed stage after shocking.

During the spawning process, organ tissue from each female is sampled by a fish health expert to screen for pathogens, especially BKD. Ovarian fluid is also sampled and submitted to USFWS or WDFW fish health laboratories for viral screening. Once fertilized, all eggs are water hardened in an iodophore solution to minimize transfer of disease organisms.

Additionally, sanitation procedures employed to reduce the transfer and incidence of fish diseases are in accordance with Washington Co-Manager Fish Health Policy (WDFW 1996), PNFHPC (1989), and IHOT (1993) guidelines.

9.1.7) Risk aversion measures used to minimize adverse effects to listed fish.

Eggs are currently incubated in pathogen-free well water at all times. Eggs are left undisturbed to maximize survival. Fungus is controlled with periodic formalin treatment. Water source has been equipped with alarms and power supply is protected by back-up generators. Future incubation systems will be similar.

9.2) Rearing.

9.2.1) Survival rates.

Juvenile-based Captive Brood:
See Section 9.1.1
Broodstock:
Average survival from eyed egg to maturity has averaged 20.2% and ranged from 4% to 31.7% for the three brood years for which complete data are available (Murdoch and Hopley 2005). Although incomplete, increases in survival of more recent brood years (2002 –2004) suggest the survival goal may be met or exceeded.

Summary of survival rates of White River captive broodstock from eyed eggs to maturity (M. Tonseth, WDFW, pers. com.).		
Brood Year	Number of Eyed Eggs/Fry Shipped to AquaSeed	Survival eyed eggs fry to Spawn (%)[1]
1997	527	4.0
1998	182	25.0
2000	272	31.7
2002	171	47.42
2003	699	44.82
2004	1,432	78.42
2005[2]	2,742	99.12
Mean	849	20.2

[1] Eyed egg to maturity survival goal of 30%
[2] Incomplete survival rates as of 1 April 2006. Should be considered maximum potential survival. Values not included in reported mean survival rates.

Second generation F2 progeny:
The F2 survival from green to eyed egg has averaged 68.2% and ranged from 37% to 86% over the four years of available data. Survival from eyed egg to ponding averaged 94.5% and ranged from 94% to 98%. Survival from fertilization to release has averaged 45.3% and ranged from 28% to 71% over the three years of data available. Recent increases in second generation survival (2004 and 2005 brood) suggest the green egg to release goal of 65% may be met or exceeded.

Summary of life stage survival rates for second generation White River captive brood juveniles (M. Tonseth, WDFW, personal communication)						
Life Stage	Brood year				Mean	Survival Standard
	2002[1]	2003[1]	2004	2005		
Fertilize to eyed egg	0.675	0.367	0.864	0.821	0.682	0.800
Eyed egg to ponding	0.980	0.941	0.948	0.942	0.945	0.980
30 days post ponding	0.973	0.966	0.996		0.979	0.970
100 days post ponding	0.955	0.965	0.881		0.934	0.930
Ponding to release	0.568	0.806	0.861		0.745	0.830
Transport to release	0.920	0.928	0.986		0.945	0.950
Fertilization to release	0.376	0.279	0.705		0.453	0.650

[1] Does not include juveniles retained for broodstock.

9.2.2) Rearing criteria.

Density and loading indices currently being used for hatchery design are the same as those presented above for second generation progeny (see also section 1.6).

9.2.3) Fish rearing conditions.

Juvenile-based Captive Brood:

At the interim AquaSeed, Inc facilities, as fry reach button up, they are presently removed from the vertical incubators and for biosecurity, placed by discrete family unit into two or more semi-round 4-ft diameter rearing tanks with volume approximately 18ft^3 and approximately 5gpm of flow. Families are held in these tanks until they are marked with individual PIT-tags denoting family and individual. The tagging scheme is necessary to differentiate families to develop mating strategies during spawning and to allow tracking of individual fish for growth and mortality assessment. In addition, a coded-wire tag denoting a specific family is placed in the adipose fin to provide redundancy if the PIT-tag is lost.

After tagging, broodstock fish are redistributed to 10-, 20-, and 50-ft diameter circular rearing tanks with volumes of 235 ft^3, 1,2563 ft, and 6,868 ft^3 and flows of 30 gpm, 125 gpm, and 250 gpm, respectively and reared for up to five years until mature. Each family is divided and reared at two locations to assure that no family is lost due to unanticipated catastrophic events. Feeding schedules are adjusted during the rearing season according to fish size, anticipated growth rates and feed conversions. Mortality is removed daily and each fish is recorded by family of origin and cause of death. Fish health monitoring is performed by WDFW fish health specialists under contract to Grant PUD.

Temperature is constant at 50^{o}F. Flow levels are adjusted periodically to stay within loading criteria. Oxygen and total gas levels are routinely monitored and checked in particular after any flow adjustments are made. Total dissolved gas is stabilized to approximately 100% - 102.5% by passing water through packed columns before delivery to incubators and rearing tanks. A total water chemistry work-up is performed by a commercial lab and results compared to established standards. Results have consistently been within acceptable ranges.

F2 rearing sites:
Little White Salmon NFH: Grant PUD has worked with the USFWS to assure that an optimal hatchery rearing environment (i.e., maintaining appropriate water flow, water temperature, dissolved oxygen, flow index, density index, and facility cleanliness; and minimize handling and other stressors) to support the production of healthy, high-quality smolts is used.

Adult-based Supplementation:
Operating criteria will be confirmed prior to design of new facilities and will be consistent with rearing standards listed in section 1.6.

9.2.4) Growth information.

Captive broodstock are not routinely sampled for length and weight to avoid additional stress that may cause elevated mortality due to BKD. Size data is estimated from mortalities. The following weight estimates for 2003 - 2004 brood captive broodstock are derived from monthly tank utilization records and are indicative of growth rates for captive broodstock through two years of rearing.

Estimated growth of the 2002 White River captive broodstock derived from mortality that occurred during rearing.					
Month	Weight (g)	% Gain	Month	Weight (g)	% Gain
January ‘03	0.39		January ‘04	45.0	50.0
February	0.91	33.3	February	64.0	42.2
March	1.7	86.8	March		
April	3.0	76.4	April	98.0	53.31
May	4.5	50.0	May	144.0	46.9
June	6.7	48.9	June	181.0	25.7
July	9.2	37.3	July	222.0	22.7
August	15.0	63.0	August	260.0	17.1
September	17.0	13.3	September	298.0	14.6
October			October	345.0	15.8
November			November		
December	30.0	76.51	December	579.0	67.81
[1] Gain over two or more months					

9.2.5) Feed details.

Include food type used, daily application schedule, feeding rate range.

Juvenile-based Captive Brood:

Broodstock:
Feed is procured from various suppliers depending on recommendations of fish health specialists and availability. Feed type is semi-moist or moist formulation and has been adjusted over the years as recommended. Feed sizes range from starter flakes or mash up to #6 brood pellets. Feed rates range from about 3.5% body weight per day for recently ponded fry to 0.5% per day for adult fish reaching maturity. Feeding is discontinued when fish mature and are near spawning. Feed conversion calculations are not applied during broodstock rearing because a slight excess of feed is provided.

Second generation progeny:
Feeding rates range from 3.5% body weight per day immediately following ponding to about 1% in the later stages of rearing and before release.

9.2.6) Fish health.

Juvenile-based Captive Brood:
Fish Health Monitoring: Fish health monitoring is performed by WDFW fish health specialists under contract to Grant PUD. During routine visits fish health examinations are performed and cause of death determined on mortalities collected since the last visit and on moribund fish from the rearing tanks.

Disease Treatments: Typical treatments are as follows:
- Formalin – prophylactic fungal treatment and post-handling.
- Aquamycin – fed for BKD treatment and prophylaxis.
- Erythromycin – fed and injected to manage BKD.
- Azithromycin – fed and injected to manage BKD.
- Choramin T – bath to treat external bacteria.
- In addition, fish health specialists are present during spawning at which time they take pathogen and viral screening samples.

Sanitation Procedures: As recommended by IHOT (1995) facilities will implement the following sanitation procedures:
1) Disinfect/water - harden eggs in buffered iodophor disinfectant. Eggs will be disinfected prior to entering “clean” areas in incubation room. 2) Place foot baths containing disinfectant at the incubation facility's entrance and exit. 3) Sanitize equipment and rain gear utilized in broodstock handling or spawning after leaving adult area and before using in other rearing vessels or the hatchery building. 4) Sanitize equipment used to collect dead fish before use in another pond and/or fish lot. 5) Disinfect equipment, including vehicles used to transfer eggs or fish between facilities, before use with any other fish lot or at any other location. Disinfecting and disinfected water will be disposed in designated areas and not in streams. 6) Sanitize rearing vessels after removing fish and before introducing a new fish lot or stock either by using a disinfectant or by leaving dry for an extended time. 7) Properly dispose dead fish and prevent fish that die of disease to enter natural waters. 8) Potential cross contamination is minimized by maintaining each rearing vessel as a separate unit. Equipment used is disinfected between use in different rearing units.

Adult-based Supplementation:
Fish health will be managed consistent with WDFW Fish Health Manual (1996), Co-Managers Fish Disease Control Policy (1997), and Pacific Northwest Fish Health Protection Committee (1989).

9.2.7) Smolt development indices.
No biochemical smolt development indices have been used to date. Use of lethal or high stress indicators is not preferred for this ESA-listed aggregate. Indicators of smoltification such as coefficient of variation in length and condition factor may be used as production levels increase. Length and weight data were taken at release in 2004, 2005 and 2006. Condition factors were subsequently calculated but were not used as predictors of smolt preparedness.

9.2.8) "Natural" rearing methods.
"Natural" type rearing has not been incorporated into the captive broodstock program at this time. All rearing takes place within buildings or covered outdoor tanks. Lighting is therefore subdued but photoperiod is normal.

Facilities constructed in the future will use natural rearing conditions as described in sections 5.5 and 5.6. The most important variables are a natural water temperature profile that can help produce smolts that survive at high rates and a low density rearing environment.

9.2.9) Risk aversion measures used to minimize adverse effects.
Risk aversion measures that may be employed include:

- Water supply, facility, and fish health risk aversion measures described previously will be employed.
- Lots will be segregated according to the BKD status of the parents.
- Survival will be maximized to the extent possible through the use of natural rearing conditions and rearing criteria to improve numerical abundance and retain maximum available genetic variation.

SECTION 10. RELEASE

10.1) Proposed fish release levels and sizes.

Age Class	Maximum Number	Size (ffp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	Up to 200,000[1] (years 2007 – 09)	80 - 30	Variable	White River
Yearling	150,000	15	April	White River

[1]Fingerling spring Chinook above interim yearling program needs available for planting in the White River through 2009.

The planned release size is 30 grams [15 fish/lb (ffp)]. This is larger than UCR spring Chinook smolts which migrate at 5 to 17 grams. The bigger size has been adopted because larger smolts survive to adulthood at higher rates (Bilton 1984) and may spend less time moving through the freshwater system.

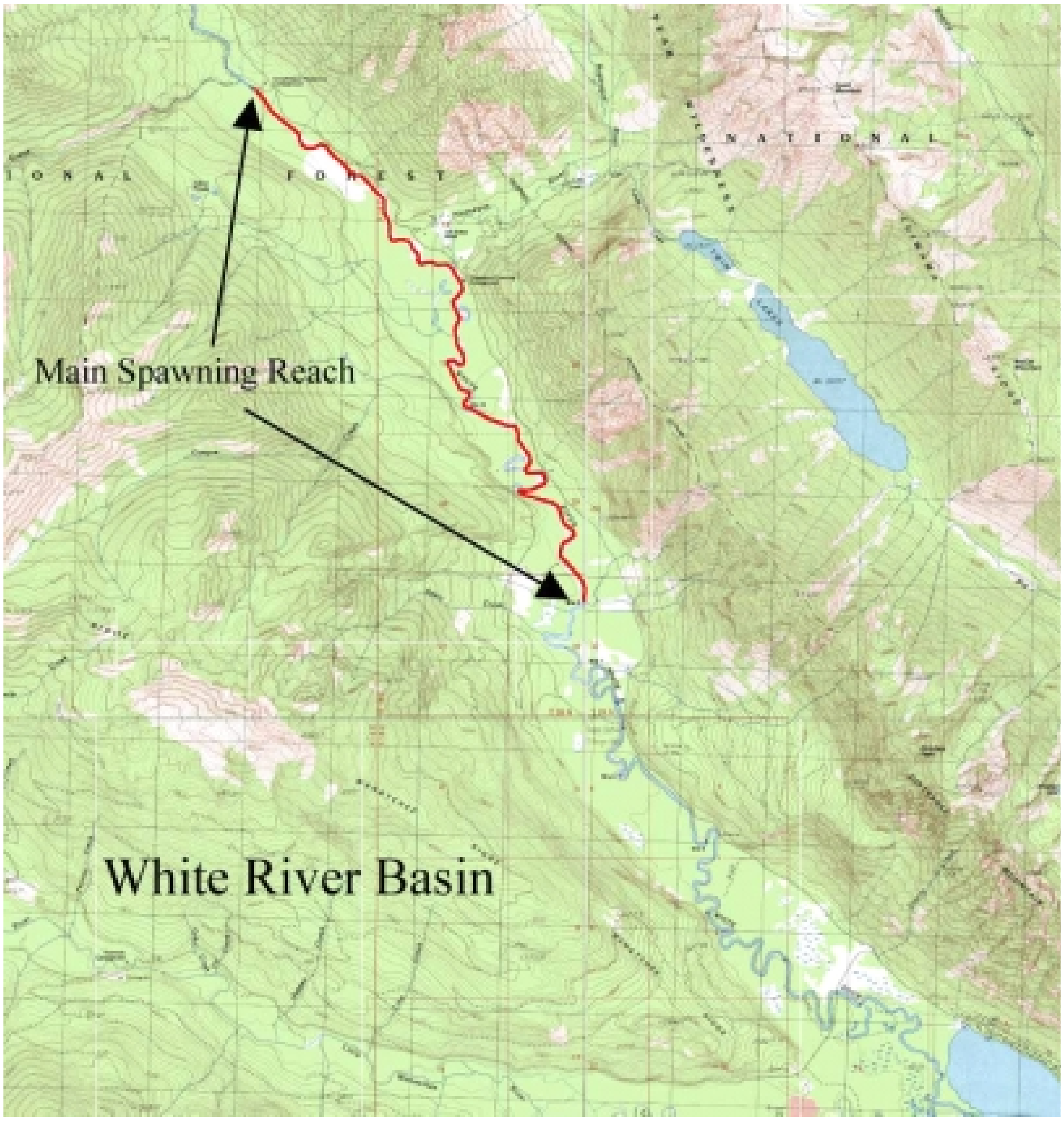
Recent research indicates that spring growth rates are also important to adult survival. Beckman et al. (1999) state: "Maintaining fish at a relatively small size initially, then inducing rapid growth in the final spring, may result in high-quality smolts…" Fast spring growth may allow smaller smolts to survive at high rates.

Studies at the Cle Elum Supplementation and Research Facility have shown that 37-49% of hatchery reared males undergo precocious maturation (Larsen et al. 2004) when reared using standard hatchery practices, which include releasing large smolts. Experiments now being done are showing that small smolts produced with a growth profile that includes fast spring growth will reduce the number of jacks in the population and increase the average weight of returning adults.

This research will be followed and may help determine future smolt release sizes for this program. For the present, due to the importance of increasing population sizes quickly, the program will adopt the strategy of using fast spring growth rates to produce large smolts.

10.2) Location(s) of proposed release(s).

Release point: White River, Wenatchee River (WRIA 45)
Basin or Region: Upper Columbia River



10.3) Numbers and sizes of fish released.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
2004							2,5891	8 ffp
2005							1,9462	8.4 ffp
2006							1,654[3]	3.6 ffp
2007					139,644	208.7 ffp	69,102	12.6 ffp
Average							2,063	8.2 ffp

Data source: [1]Murdoch and Hopley 2005; [2]Tonseth personal communication, [3]Eastbank Hatchery.

Release sizes were larger than the 15 ffp goal due to the relatively warm rearing water temperatures at AquaSeed. Future production may make use of chilled incubation water, feed ration control, and natural water temperatures to attain the 15 ffp release size.

10.4) Release protocols.

Second generation progeny of captive broodstock have been released into the White River since 2004. For 2004 and 2005, temporary acclimation tanks were installed by Grant PUD at Tall Timbers Ranch located at river kilometer 18.5. Pre-smolts from 2002 brood spawning were transported to the acclimation facilities on 5 April 2004. They were force released on 22 April 2004 after receiving 17 days of acclimation. Pre-smolts from the 2003 brood spawning were transported to the acclimation site on 16 March 2005. They were force released on 2 May 2005 after 47 days of acclimation. In each case, individual weight samples were taken as fish were being released. On April 5, 2006, smolts at 3.6 ffp were released at a selected log jam site.

Future release strategies will include volitional migration from acclimation sites. Pond screens and barrier nets will be pulled to allow volitional release during April and May.

10.5) Fish transportation procedures.

Pre-smolts will be hauled by truck from rearing and overwinter acclimation sites to the final release locations. Hauling criteria include (IHOT 1995):

- Haul tank interiors and exteriors, when transporting between watersheds, will be disinfected prior to use.
- Increase O2 levels to 15 ppm prior to loading.
- Maintain temperatures at 42-48^{0}F.
- Haul at densities of less than 1.25 lbs/gallon.
- Prior to release, temper haul water with receiving water to keep the difference below 10^{0}F. The maximum rate of temperature change will be 2^{0}F/hr.

10.6) Acclimation procedures.

See section 10.4 for fish acclimated on site at the White River. Fish that were not held in temporary rearing tanks on site (Tall Timbers Ranch) in 2006 were released from the planting tanker truck to the river water after tempering. Current protocol for tempering is to slowly pump natal water into the transport tanker truck. This is done at a rate that will not exceed tempering of more than 2ºF per hour until the temperature of the natal stream has been reached. Entire displacement of the tanker truck water will be dependent on the water flow needed to remain within the rate indicated. Dissolved oxygen levels within the tanker truck are monitored to remain between 7.0 – 12.0 ppm while internal pumps aerate and re-circulated water within the tanker truck during this process.

After acclimation sites are constructed, current plans call for fish to be reared at hatchery sites until November and then be transported to an overwinter acclimation site. In March, depending on site availability, suitability, and seasonal conditions, pre-smolts may be hauled from an overwinter acclimation site, which may be on the lower river, to upstream locations for final acclimation and release in May. Smolts may also be released from the overwinter acclimation site directly, if a suitable location is found.

Acclimation could occur in large, natural rearing ponds and/or side channels. A density index of less than 0.05 lb/ft^3/inch will be maintained at the sites. Surface water will be used for acclimation. Dissolved oxygen levels will be maintained at greater than 7 ppm at the discharge of the ponds and a flow index of 0.5 to 1.0 lb/gpm/inch, depending on water temperature, will be used. Personnel will feed fish and will maintain a presence on location to help reduce predation. Volitional migration out of the upstream locations will be allowed in concert with the spring freshet and increasing discharge in the mainstem Columbia River.

10.7) Marks applied to identify hatchery adults.

All fish produced in the hatchery will be marked or tagged prior to release. Specific marking or tagging type has not been determined, but will be selected such that fish can be interrogated without sacrifice to allow identification of individual adults by hatchery versus natural origin. Two small groups of White River smolts (2002 and 2004 brood) have been released (see sections 10.3 and 10.4) without artificial marks. This strategy was used because other hatchery groups that might be encountered would have had a similar and conflicting external tag or mark. In this situation, the absence of a mark is in itself considered equivalent to an identifiable mark, but does not allow for immediate recognition during broodstock collection. Future releases will have an external or internal tag or mark that will provide positive identification as a White River hatchery adult (i.e., CWT in adipose fin or other body location and/or PIT-tag).

10.8) Disposition plans for surplus fish.

See also section 10.1. Captive brood phase surplus White River juveniles could be available for release in the basin between 2007 and 2009. Any fish in excess of program rearing goals would be either direct planted into their natal stream or receive limited acclimation on White River water per PRCC HSC review. All hatchery fish released must be marked or tagged in order determine origin using non-lethal methods as returning adults. The number to be differentially marked from this group for evaluation purposes would be determined by the PRCC HSC.

During the adult-based supplementation phase, fish produced in excess of the 150,000 target number will be reared to a sufficient size for tagging or marking and then released into the White River, as directed by the PRCC HSC.

10.9) Fish health certification procedures.

Within two weeks of release a fish health specialist will document smolt health through such indices as condition factor, fin condition, descaling and, if necessary, autopsy-based analysis such as organosomatic indexing. Epizootics may trigger review and recommendations by the JFP before release.

10.10) Emergency release procedures.

To protect temporary acclimation sites from water system failure, three levels of redundancy were installed at the Tall Timbers site. Supplemental oxygen was plumbed to release oxygen into rearing tanks if low flow is detected via the flow alarm system. Standby generators were available to produce power in the event of electrical supply loss. Nearby staff was available to respond to interruptions of power and flow in order to restore flow and release fish if necessary.

Depending on the type of temporary sites being considered, emergency on-site release procedures will be developed by the HSC which could involve direct release to the White River if no other options are available.

Overwinter acclimation facilities will be designed and constructed with emergency alarms and back-up systems. Depending on the type of permanent sites being considered, emergency release on-site procedures will be developed by the committees which could involve direct release to the White River if no other options are available.

Short-term acclimation rearing units will be designed to survive flooding but will not be designed to prevent fish escape. Fish may be allowed to volitionally migrate during flood events.

10.11) Risk aversion measures used to minimize adverse effects to listed fish.

The risk of ecological hazards to listed species resulting from liberations of hatchery-origin spring Chinook will be minimized through the following measures:

- Hatchery spring Chinook will be reared to sufficient size such that smoltification occurs within nearly the entire population, reducing residence time in the streams after release and promoting rapid seaward migration. Degree of smoltification may be assessed through measurement of coefficient of variation for fork length or average condition factor to avoid fish stress and mortality.
- Spring Chinook smolt releases will be timed with water budget releases from upstream dams to further accelerate seaward migration, to improve survival at mainstem dams, and to reduce the duration of interactions with wild fish.
- Acclimation in natal stream water will contribute to smoltification, reducing the

residence time in the rivers and mainstem corridors.

- Release locations may be in upstream areas in the future to improve imprinting and reduce straying to other watersheds.
- The long-term goal is to acclimate fish through the winter in natal stream water to further reduce straying.
- Hatchery spring Chinook smolts will be released when environmental conditions exist that promote rapid emigration (i.e., new moon phase, increasing water temperature and increase river discharge).
- Total number of smolts released with expected adult contribution to natural spawning will be calibrated to be within the tributary carrying capacity when historical productivity has been restored.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards."

11.1) Monitoring and evaluation of "Performance Indicators".

Monitoring and evaluation will play an important role in helping measure program results and determining future direction. The initial five-year M&E Plan proposed for the program identifies nine objectives, listed below. These plan objectives and subsequent hypotheses were generated from Chelan and Douglas PUDs' M&E plan (see Habitat Conservation Plans Hatchery Committee 2006 and Chelan PUD Habitat Conservation Plan's Hatchery Committee 2005), the BAMP, and the HCP and PRCC hatchery subcommittees. They were developed to assess progress toward reaching the hatchery program goals defined by the JFPs.

The HCP M&E plan documents describe the data to be collected to test the hypotheses for each objective. The UCR White River Spring Chinook Supplementation Program has and will continue to use these documents as the basis for implementing a data collection plan. A number of adult and juvenile-based variables will be measured for both hatchery and naturally produced fish. Methods used during data collection will likely include: spawning ground surveys, broodstock sampling, hatchery juvenile sampling, smolt trapping, precocity sampling, PIT tagging, CWT tagging, radio tagging, genetic sampling, disease sampling, and snorkel surveys.

A monitoring principle included in the HCP M&E plan is use of reference streams for comparative analysis. Availability, feasibility, and viability of using reference streams are currently being evaluated. Due to concerns about finding suitable streams and the ability to detect impacts, it has not yet been decided whether this method will be used. Until the comparison technique is determined, the term "reference condition" will be substituted for "reference stream" in the M&E plan as adopted by the program.

Objective 1: Determine if supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a reference condition and if the change in the natural replacement rate (NRR) of the supplemented condition is similar to that of the reference condition.
Hypotheses:
Ho: The annual number of hatchery produced fish that spawn naturally is less than or equal to the number of naturally and hatchery produced fish taken for broodstock.
Ho: The annual change in the number of naturally spawning fish is less than or equal to the annual change observed in the reference condition.
Ho: The annual change in the number of naturally produced adults is less than or equal to the annual change observed in the reference condition.
Ho: The annual change in the NRR is less than or equal to the annual change observed in the reference condition.

Objective 2: Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.
Hypotheses:
Ho: Migration timing Hatchery = Migration timing Naturally produced
Ho: Spawn timing Hatchery = Spawn timing Naturally produced
Ho: Redd distribution Hatchery = Redd distribution Naturally produced

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.
Hypotheses:
Ho: Allele frequency Hatchery = Allele frequency Naturally produced = Allele frequency Donor pop
Ho: Genetic distance between subpopulations Year x = Genetic distance between subpopulations Year y
Ho: Δ Spawning Population = Δ Effective Spawning Population
Ho: Age at Maturity Hatchery = Age at Maturity Naturally produced
Ho: Size at Maturity Hatchery = Size at Maturity Naturally produced

Objective 4: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate) is greater than the natural adult-to-adult survival (i.e., natural replacement rate) and equal to or greater than the program specific HRR expected value based on survival rates listed in the BAMP (1998).
Hypotheses
Ho: HRR Year x ≤ NRR Year x
Ho: HRR ≤ Expected value per assumptions in BAMP

Objective 5: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.
Hypotheses:
Ho: Stray rate Hatchery fish > 5% of total brood return
Ho: Stray hatchery fish > 5% of spawning escapement of other independent populations[1]
Ho: Stray hatchery fish > 10% of spawning escapement of any non-target streams within independent population[1]

Objective 6: Determine if hatchery fish were released at the programmed size and number.

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[1] This stray rate is suggested based on a literature review and recommendations by the ICTRT. It can be re-evaluated as more information on naturally-produced Upper Columbia salmonids becomes available. This will be evaluated on a species and program-specific basis and decisions made by the PRCC HSC. It is important to understand the actual spawner composition of the population to determine the potential effect of straying.

Hypotheses:
Ho: Hatchery fish Size = Programmed Size
Ho: Hatchery fish Number = Programmed Number

Objective 7: Determine if the proportion of hatchery fish on the spawning grounds affects freshwater productivity (i.e., number of smolts per redd) of the supplemented condition when compared to the reference condition.
Hypotheses:
Ho: juveniles/redd of the supplemented condition ≤ juveniles/redd of the reference condition
Ho: The relationship between proportion of HOS and juveniles/redd is ≤ 1.
Ho: Slope of Ln (juveniles/redd vs redds) of the supplemented condition ≤ Slope of Ln (juveniles/redd vs redds) of the reference condition.
Ho: The relationship between proportion of HOS and juveniles/redd is ≤ 1.

Regional Objectives
Two additional objectives are not explicit in the goals as specified above, but are included within the total framework of this plan because they are related to the goals and are concerns related to not only Grant PUD's programs but also other artificial propagation programs in the region. These regional objectives will be implemented at various levels into all M&E Plans in the upper Columbia River (Chelan PUD, Douglas PUD, Grant PUD, USFWS, and CCT). Currently, a BKD management plan is being produced as an example of a coordinated effort to address a prevalent disease issue. These objectives may be more suitable for a specific hatchery or sub basin, the results of which could be transferred to other locations. As such, the PRCC HSC should ensure that these efforts are coordinated throughout the region so resources (e.g., fish, facilities, and cost) are used efficiently. Other objectives that are deemed more regional in nature, per the PRCC HSC, could also be included in the section.

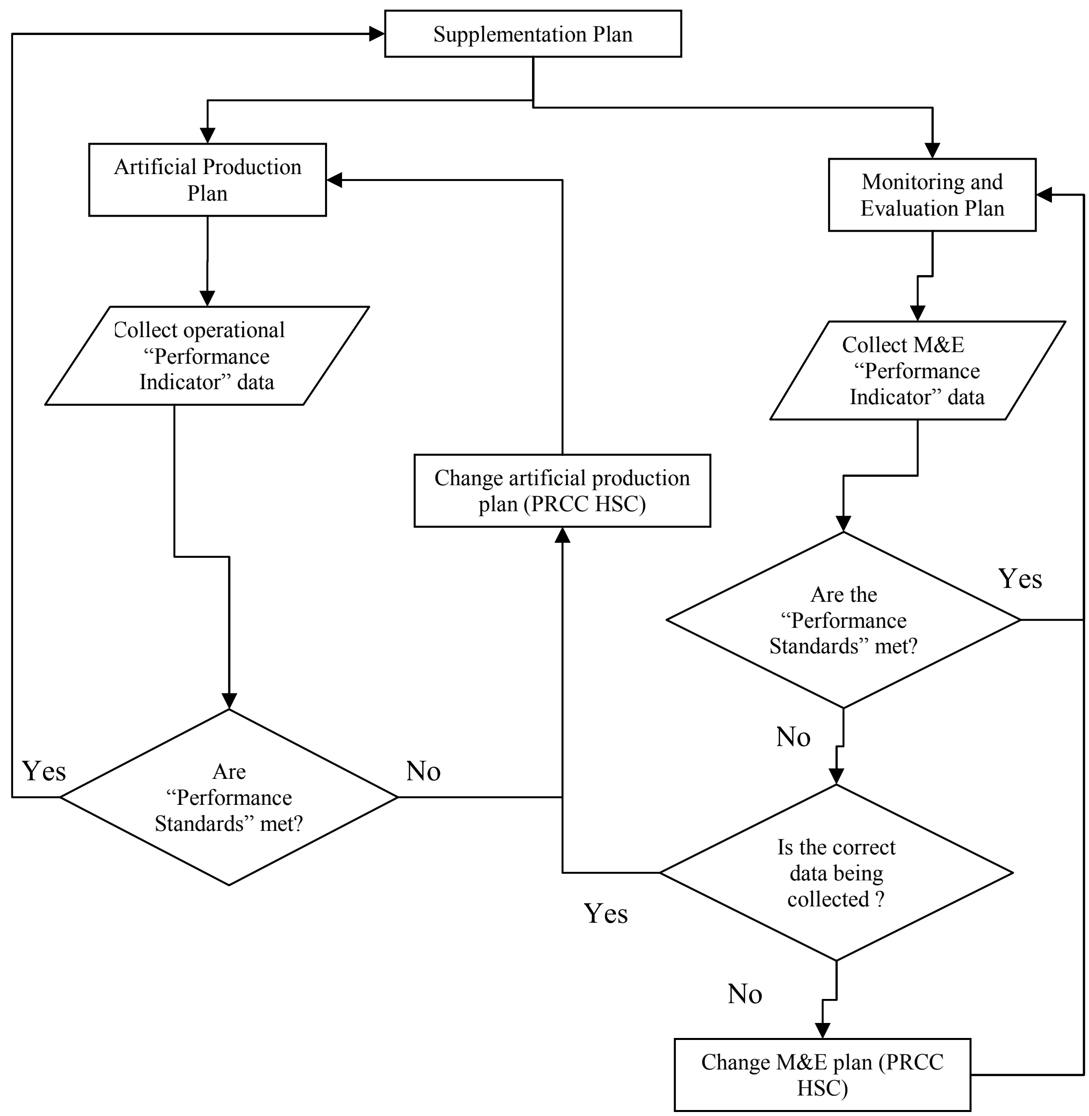
Objective 8: Determine if the incidence of disease has increased in the natural and hatchery populations.
Hypotheses:
Ho: Conc. BKD supplemented fish Time x = Conc. BKD supplemented fish Time y
Ho: Conc. BKD hatchery effluent Time x = Conc. BKD hatchery effluent Time y
Ho: Conc. BKD supplemented stream Upstream Time x = Conc. BKD hatchery effluent Time x = Conc. BKD supplemented stream Downstream Time x
Ho: Hatchery disease Year x = Hatchery disease Year y

Objective 9: Determine if the release of hatchery fish impact non-target taxa of concern (NTTOC) within acceptable limits.
Hypotheses:
Ho: NTTOC abundance Year x through y = NTTOC abundance Year y through z
Ho: NTTOC distribution Year x through y = NTTOC distribution Year y through z
Ho: NTTOC size Year x through y = NTTOC size Year y through z

The Biological Opinion for the Priest Rapids Hydroelectric Project contains requirements for development and funding of a M&E program. Proposals will be reviewed and approved by the PRCC HSC, prior to review and approval by the PRCC and funded by Grant PUD. Habitat enhancement funds and monitoring dollars are also available through the Biological Opinion and Salmon and Steelhead Settlement Agreement.

Due to the critical role that M&E plays, efforts were initiated in 1997 with an adult monitoring plan. Juvenile monitoring was added in 2007.

The principles of adaptive management will be applied to the M&E program. As data are collected, as the recovery effort progresses, and as new science is developed, the program design will change to accommodate additional input. The PRCC HSC will be responsible for adapting the M&E program to new information. The flowchart below demonstrates how collected data is used to assess performance and make needed program changes.



11.2) Risk aversion measures used to minimize adverse effects to listed fish.

Juvenile Monitoring: Injury to spring Chinook salmon, steelhead and Bull trout may occur through trapping, handling and marking procedures. Primary injury and mortality events are associated with debris accumulation in the live-box, reaction to anesthesia, handling stress, over-crowding in the live-box, predation in the live-box and increased predation post release. Injury and mortality will be minimized through diligent trap attendance. Traps will be checked a minimum of once a day in the morning or more often as needed. Injury and mortality associated with handling stress, anesthetizing and post release predation will be address by applying MS-222 to all fish handled and providing full recovery for fish prior to release. Other risk aversion measures include (see NOAA Fisheries 2007):

- No more than 20% of the natural or hatchery emigrants may be captured.
- Lethal take may not exceed 2% of the natural or hatchery fish captured.
- Tissue sampling shall be minimized to the extent possible.
- Fish must be kept in water to the maximum extent possible. Adequate water circulation and replenishment of water in holding units is required.
- Fish must be moved using equipment that holds water during transfer.
- Fish must not be handled if water temperatures exceed 69.8^{0}F at the capture site.
- The incidence of capture, holding, and handling effects shall be minimized and monitored.
- Visual observation protocols must be used instead of intrusive sampling methods whenever possible.

The Section 10 permit application (Grant PUD et al. 2006) and permit (NOAA Fisheries 2007) describe the risk aversion measures required of the current M&E activities associated with the juvenile-based captive brood phase. The juvenile M&E program is expected to be similar during the future adult capture based phase.

Adult Monitoring: No injury or mortalities are expected during the White River adult carcass and spawning ground surveys. Biological data and samples will be taken from only deceased spawned out fish. Field staff will minimize disturbance to any spawning spring Chinook salmon by identifying spawning sites and using a land route around their location.

The future adult trapping system may be used for M&E purposes. Protocols will be developed by the PRCC HSC for handling captured adults after the trapping method has been selected.

SECTION 12. RESEARCH

The program is not a research project.

SECTION 13. CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this Hatchery Genetic Management Plan is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: O. tshawytscha ESU/Population: Upper Col spring run Activity: Captive brood/supplementation				
Location of hatchery activity: AquaSeed/Wenatchee R Dates of activity: Year-round Hatchery program operator: AquaSeed Inc/WDFW				
	Annual Take of Listed Fish By Life Stage (Number of Fish)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			750	200
Collect for transport b)				
Capture, handle, and release c)			750	
Capture, handle, tag/mark/tissue sample, and release d)		150,000		200
Removal (e.g. broodstock) e)	1,500 eyed eggs	20% of hatchery and wild migrants	111	
Intentional lethal take f)	35 eyed eggs	37,500 hatchery 40 wild	111	
Unintentional lethal take g)		0-150,000	12	
Other Take (specify) h)	1,000 fry			

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at traps or weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS.

This section will be the cornerstone for any required consultation with the U.S. Fish and Wildlife Service under section 7 of the ESA. Accordingly hatcheries that may affect any federally listed/ proposed aquatic or terrestrial species under USFWS jurisdiction need to complete this section. By fully addressing the topics of this section, the HGMP will provide the information necessary to initiate formal or informal consultation under the ESA for species under USFWS jurisdiction.

15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

Section 7 biological opinions, Section 10 permits, 4(d) rules, etc.

Biological opinion (BO) prepared in accordance with section 7 of the ESA:
USFWS Biological Opinion on the Effects of the Priest Rapids Hydroelectric Project Relicensing on Bull Trout (FERC No. 2114), March 14, 2007. USFWS Reference: 13260 -200 6-P -000 8, 1 3260 -2001 -F -0062

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

General species description and habitat requirements.
Local population status and habitat use.
Site-specific inventories, surveys, etc.

Bull trout (Salvelinus confluentus) are listed as threatened. See the Biological Opinion (BO) for a description of the habitat requirements and population status.

15.3) Analyze effects.

Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects, including duration and area of effects). Please focus analysis on the impact of hatchery program on listed/proposed species reproduction, numbers, and distribution.
Identify potential level of take (past and projected future).
Consider the following:
Hatchery operations – e.g., water withdrawals, effluent, trapping, releases, routine operations and maintenance activities, non-routine operations and maintenance activities (e.g. intake excavation, construction, emergency operations, etc.), grounds management, including herbicide/pesticide use.
Fish health – e.g., pathogen transmission, therapeutics, chemicals.
Ecological/biological – e.g., competition, behavioral, etc.
Predation
M&E – e.g., surveys (trap, seine, electrofish, snorkel, spawning, carcass, boat, etc.).
Habitat – e.g., modifications, impacts, quality, blockage, de-watering, etc.

The USFWS offers this conclusion (see the BO for details):
"Summary of the Effects of the White River Supplementation Plan. Although there will be adverse effects, the primary effect of this action may be beneficial, with the release of smolts increasing the density and availability of a seasonal prey base. However, water quality impacts, disturbance of Bull trout during spawning, and the accidental capture of Bull trout is likely to occur and may result in the modification of the behavior of Bull trout or injury. Impacts to the prey base can also be substantial when thousands of smolts are released and compete for the same resources other fish, including the Bull trout, are expected to use."

15.4 Actions taken to minimize potential effects.

Identify actions taken to minimize potential effects to listed species and their habitat.

The following suggestions were received in December of 2006 from David Morgan, biologist, US Fish and Wildlife Service. They will be considered for adoption in order to minimize impacts during egg and fry collection.

"Bull trout and spring Chinook spawning locations overlap in the lower White River between the Napeequa River and Panther Creek. Generally spring Chinook spawning begins shortly before Bull trout spawning, but spring Chinook eggs are not removed until several weeks later, after Bull trout spawning has ended. When spring Chinook eggs are extracted from these spawning areas, there is a risk that Bull trout redds could be affected. For example, eggs could accidentally be removed from Bull trout redds. It is critical to be certain that eggs are only removed from redds known to be made by spring Chinook.
The Service offers the following recommendations to minimize potential adverse effects to Bull trout in the White River during egg removal activities:

1. Crews from the agency or agencies conducting spring Chinook redd surveys should GPS the location of all redds believed to be made by spring Chinook. Sites that appear to be spring Chinook redds, but where spring Chinook were not actually observed, should be noted. Spring Chinook redds should be flagged so that when the Service begins Bull trout redds surveys in the same area, our crews will know the locations of potential egg removal sites for later that year.

2. To reduce the possibility that crews looking for spring Chinook will observe redds with no fish on them, these surveys should be conducted every day until the survey period ends. Eggs should not be removed from redds that spring Chinook have not been directly observed building or defending.

3. The Service will flag Bull trout redds, and note the locations where spring Chinook and Bull trout redds are close enough that there is increased risk of confusing the two.

4. After the Services third and final Bull trout redd survey, the Service will

communicate to the appropriate agency the locations where Bull trout redds and spring Chinook redds are closest. Instead of removing our flagging after the final Bull trout redd survey, our crews will leave some of the flags as needed. Potentially our crews could GPS these locations or other location information and share these files prior to egg removal.

5. In locations where redds of both species were observed within 10 m there would be no egg removal. [Note: the 10m distance recommendation will be evaluated and may not be applied when spring Chinook redds are downstream of Bull trout redds]

6. The Service will note if there were any locations where Bull trout may have superimposed their redds on top of existing spring Chinook redds, and share this information with the appropriate agency. Since Bull trout often do not linger on their redds, and might not be directly observed, if there is any doubt about possible redd superimposition (i.e. - evidence of new digging on a spring Chinook redd), these locations would not be used for egg collection.

The Service understands that the operational details of the White River hatchery program are still in the planning phase. Once the details of the program become known, the Service recommends that the over-arching program, including the egg removal in the White River, be the subject of ESA consultation under Section 7(a)(2), or Section 10(a)(1)(B)."

15.5 References

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as "fishery enhancement".

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: dispensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as “supplementation”.

Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with natural origin recruit (NOR).

Natural origin recruit (NOR) - See natural fish.

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Supplementation - “…. the use of artificial propagation in an attempt to maintain or increase natural production, while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on non-target populations within specified biological limits." (RASP 1992)

Stock - (see "Population").

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations.

(generally from Washington Department of Fish and Wildlife, November, 1999).

SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	 Grams/fish
Chinook Yearling	<=20	>=23
Chinook (Zero) Fingerling	>20 to 150	3 to <23
Chinook Fry	>150 to 900	0.5 to <3
Chinook Unfed Fry	>900	<0.5
Sockeye Yearling[1]	<=20	>=23
Sockeye Fingerling	>20 to 800	0.6 to <23
Sockeye Fall Releases	<150	>2.9
Sockeye Fry	> 800 to 1500	0.3 to <0.6
Sockeye Unfed Fry	>1500	<0.3
Steelhead Smolt	<=10	>=45
Steelhead Yearling	<=20	>=23
Steelhead Fingerling	>20 to 150	3 to <23
Steelhead Fry	>150	<3

[1] Sockeye yearlings defined as meeting size criteria and 1 year old.

Attachment 3. Estimated production from captive brood phase.

Captive brood performance assumptions			
Egg/fry to adult survival	Goal	Average	Minimum
	30%	20%	15%
Eggs/fry collected	1,500	1,500	1,500
Adults produced	450	300	225
Fecundity per female	1,160	1,160	1,160
Eggs produced	261,000	174,000	131,000
Egg to smolt survival	68%	68%	68%
Smolts produced	177,000	118,000	89,000
Smolt to adult survival	0.30%	0.30%	0.30%
Adult returns due to smolt release	531	354	267

Attachment 4. Estimated production from adult-based supplementation phase.

Supplementation performance assumptions (does not include 10% surplus)	
Brood collection	
Number of smolts released	150,000
Green egg to smolt survival	68%
Eggs taken	220,588
Fecundity per female	4,400
Adults spawned	100
Adult holding survival	90%
Adults collected	111
Adult production	
Smolt to adult survival	0.30%
Adult returns due to smolt release	450

Attachment 5. 2005 HCP broodstock collection protocols.

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
Mid-Columbia Field Office
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12 May 2005

To: Mid-Columbia HCP Hatchery Committee

From: Kirk Truscott

Subject: 2005 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-based Broodstock Collection Protocols.

Attached is the final version of the 2005 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-based Broodstock Collection Protocols. The document is essentially the same as the "Draft 2" version submitted to committee members on April 13, 2005; of which I received no comments. The substantive change in the final document is the inclusion of hatchery spring Chinook in the Chiwawa broodstock collection as agreed to in HCP hatchery Committee conference call on May 10, 2005.

Although HCP Hatchery Committee protocols identify 10 days notice of upcoming decision items for Committee action, WDFW would appreciate the Committee's consideration of a consensus agreement on this protocol at the May 18, 2005 HCP Hatchery Committee meeting (Decision Document provided).

If committee members have questions, please feel free to contact me.

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
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12 May 2005

To: Mid-Columbia HCP Hatchery Committee

From: Kirk Truscott

Subject: FINAL 2005 UPPER COLUMBIA RIVER SALMON AND STEELHEAD BROODSTOCK OBJECTIVES AND SITE-BASED BROODSTOCK COLLECTION PROTOCOLS

This protocol was developed for hatchery programs rearing spring Chinook salmon, sockeye salmon, summer Chinook salmon, and summer steelhead associated with the mid-Columbia Habitat Conservation Plans (HCPs) and spring Chinook salmon and steelhead programs associated with the Biological Opinion for Section 7 Consultation of the Interim Operation for the Priest Rapids Hydroelectric Project (FERC No. 2114). These programs are funded by Chelan, Douglas, and Grant County Public Utility Districts (PUDs) and are operated by the Washington Department of Fish and Wildlife (WDFW). Additionally, the Yakama Nation's Coho Reintroduction Program broodstock collection protocol, when provided by the Yakama Nation, will be included in this protocol because of the overlap in trapping dates and locations.

This protocol is intended to be a guide for 2005 collection of salmon and steelhead broodstocks in the Methow, Wenatchee, and Columbia River basins and was developed using run estimates calculated by WDFW. It is consistent with previously defined program objectives such as program operational intent (i.e., conservation and/or harvest augmentation), production level targets, and to comply with ESA permits. This protocol may be adjusted in-season based on actual run monitoring at mainstem dams and other sampling locations.

Above Wells Dam

Spring Chinook
Pre-season estimates have 4,573 spring Chinook destine above Wells Dam, 33% or 1,528 are expected to be natural origin. In-season estimates of natural origin spring Chinook to individual tributaries will be adjusted proportional to the estimated returns detailed in Table 2 of the 2005 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast and the total spring Chinook passage at Wells Dam at the 50% and 75% passage dates. Natural origin fish inclusion into the broodstock will be a priority,

with natural origin fish specifically being targeted; however, natural origin fish collections will not exceed 33% of the in-season estimated return to any tributary spawning population. All hatchery origin fish retained for broodstock will be adipose present coded-wire tagged.

The Methow Fish Hatchery (FH) rears spring Chinook salmon for three acclimation/release sites on three tributaries of the Methow River; Twisp, Chewuch and Methow Ponds. The total production level target is 550,000 smolts divided equally among the three release sites (183,000 smolts per site).

Broodstock will be collected at the Methow FH outfall and at tributary traps on the Methow, Chewuch, and Twisp rivers. The Twisp Pond release group is limited to releasing progeny of broodstock collected from the Twisp River. The Chewuch Pond prioritizes progeny of Chewuch River collected broodstock, but may include progeny of broodstock collected from the Methow River. Based on these limitations and the assumptions listed below (Table 1), the following broodstock collection protocol was developed.

Table 1. Assumptions and calculations to determine number of broodstock needed for each tributary release of 183,000 smolts.

Smolt release		183,000	Smolt release goal
Fertilization-to-release survival	90%	203,333	
ELISA adjustment	15%	35,882	Eggs
Eggtake Target		239,215	Eggs
Fecundity	4,200	57	Females
Female to male ratio	1 to 1	114	
Pre-spawn survival	95%	120	Broodstock collection target

For the Twisp Pond program, up to 120 spring Chinook salmon may be collected at the Twisp River weir. Trapping will begin on 01 May and is expected to be completed by 06 August. Salmon will be retained across the run, proportionally consistent with estimated run timing. No more than 33% of the natural origin run will be retained for broodstock. The trap schedule will include a 4-days up and 3- days down sequence. Once the weekly retention target is reached, trapping will cease until the beginning of the next week. If a shortfall occurs in the weekly trapping quota, the shortfall will carry forward to the following weeks collection quota. The weir will be manned 24-hours/day during trapping days to facilitate operation to minimize impact to steelhead kelts and spring Chinook fallback. If the new weir design and operation cannot adequately address kelt migration or spring Chinook fallback, trapping will cease and the weir removed.

For the Chewuch Pond program, a total of 120 spring Chinook salmon are needed for broodstock. Collection activities will begin 01 May and are expected to be complete by 06 August. Up to 120 spring Chinook salmon may be collected from the Chewuch River at Fulton Dam. The dam does not block migrating fish and the trap is anticipated to have a low capture rate. The WDFW will also attempt to seine broodstock once a week at locations determined to be effective and where fish can be safely transported to Methow FH. Angling will be used as a last resort if all other methods do not provide adequate broodstock. No more than 33% of the natural origin return will be retained for broodstock. In the event that sufficient broodstock for the Chewuch Program cannot be attained from the Chewuch River, salmon will be collected from the Methow River as described below.

The Methow Pond program requires 120 broodstock. These will be collected at the Foghorn Dam on the Methow River in combination with the Methow FH outfall to meet the broodstock target. Trapping will begin on 01 May and is expected to be completed by 06 August. Weekly collection targets will be followed to collect from throughout the run. Once the weekly retention target is reached, all salmon will be released until the beginning of the next week. If the Chewuch Pond program is short on broodstock, then the weekly collection target may be adjusted to fill both the Methow and Chewuch broodstock targets.

Steelhead

Steelhead mitigation programs above Wells Dam utilize adult broodstock collections at Wells Dam and incubation/rearing at Wells Fish Hatchery (FH). Based on mitigation program production objectives (Table 2) and program assumptions (Table 3), the following broodstock collection protocol was developed.

Table 2. Production objectives for programs supported through adult steelhead broodstock collections at Wells Dam.

Program	# Smolts	# eyed eggs	% Wild	# Wild	# Hatchery	Total Adults
DCPUD 1/	349,000	401,149	33%	59	119	178
GCPUD 1/	100,000	114,943	33%	17	34	51
USFWS 1/	100,000	125,000	33%	18	37	55
Sub-Total	**549,000**	**641,092**	**33%**	**94**	**190**	**284**
Ringold	180,000	240,000	0%	0	105	105
Sub-Total	**180,000**	**240,000**	**0%**	**0**	**105**	**105**
Grand Total 2/	**729,000**	**881,092**	**24%**	**94**	**295**	**389**

1/- Above Wells Dam releases. Target HxW parental adults as the hatchery component

2/- Based on steelhead production consistent with Mid Columbia HCP's, GCPUD BiOp and Section 10 Permit 1395.

3/- Based on adults required for eyed egg allotment

Trapping at Wells Dam will selectively retain 389 steelhead (east and west ladder collection). The collection will retain no greater than 33% natural origin broodstock for the mitigation programs and 100% hatchery origin within the Ringold FH production component. Overall collection will be limited to no more than 33% of the natural origin return may be retained for broodstock. The east and west ladder trapping at Wells Dam will begin on 01 August and terminate by 31 October and will be operated concurrently three days per week, up to 16 hours per day, if required to meet broodstock objectives. Trapping on the east ladder will be concurrent with summer Chinook broodstocking efforts through 14 September and will continue through 31 October, concurrent with west ladder steelhead collections. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and Wells dams. Broodstock collection adjustments may be made based on in-season monitoring and evaluation.

Table 3. Program assumptions used to determine adult collection required to meet steelhead production objectives for programs above Wells Dam and at Ringold Springs Fish Hatchery.

Program assumption	Standard
Pre-spawn survival	97%
Female to male ratio	1.0 : 1.0
Fecundity	5,400
Propagation survival	
87% fertilization to eyed egg	87%
86% eyed egg to yearling release	86% [1/]
75% fertilization to yearling release	75% [1/]

[1/]- Not applicable to Ringold Springs Fish Hatchery

Summer/fall Chinook

Summer/fall Chinook mitigation programs above Wells Dam utilize adult broodstock collections at Wells Dam and incubation/rearing at Eastbank Fish Hatchery (FH). The total production level target is 976,000 summer/fall Chinook smolts for two acclimation/release sites on the Methow and Similkameen rivers (Carlton Pond and Similkameen Pond, respectively). Current return projections estimate approximately 13,000 natural origin summer/fall Chinook to migrate past Wells Dam during 2005, providing a high probability of collecting 100% natural origin fish in the broodstock. Review of recent summer/fall Chinook run timing past Wells Dam indicates previous years broodstock collection activities omitted the latter returning summer/fall Chinook. In an effort to incorporate broodstock that better represent the summer/fall Chinook run timing past Wells Dam, the broodstock collection will extend to the third week of September, concurrent with steelhead collections from the east ladder trap. In-season estimates of natural origin Chinook to Wells Dam will be adjusted proportional to the estimated returns detailed in Table 2 of the 2005 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast and the total summer/fall Chinook passage at Wells Dam at the 50% and 75% passage dates. Based on initial run projections, program objectives and program assumptions (Table 5); the following broodstock collection protocol was developed.

Table 5. Assumptions and calculations to determine number of broodstock needed for summer/fall Chinook production at Carlton and Similkameen ponds.

Program Assumption		Carlton Pond	Similkameen Pond	Total
Smolt release		**400,000**	**576,000**	**976,000**
Fertilization-to-release survival	90%			
Eggtake Target		**512,821**	**738,462**	**1,251,282**
Fecundity	5,000			
Female target		**103**	**147**	**250**
Female to male ratio	1 to 1			
Broodstock target		**206**	**294**	**500**
Pre-spawn survival	90%			
Total collection target		**229**	**327**	**556**

WDFW will retain 556 natural origin summer/fall Chinook at Wells Dam east ladder. Collection will be proportional to return timing between 01 July and 14 September. Trapping will occur 3-days/week, 16 hours/day. The 3-year old component will be limited to 10% of the broodstock collection. If the probability of achieving the broodstock goal is reduced based on the estimated escapement levels, broodstock composition will be adjusted to meet the broodstock collection objective. No more than 33% the natural origin run will be retained for broodstock.

Table 6. Assumptions and calculations to determine number of broodstock needed for summer/fall Chinook production at Wells and Turtle Rock Island hatcheries.

	Standard		Wells FH		Turtle Rock FH		Lake Chelan [1/]	Total		
Program Assumption	Sub-year.	Year.	Sub-year.	Year.	Sub-year.	Year.	eye-egg	Sub-year.	Year.	Total
Smolt release			484,000	320,000	1,078,000	200,000	NA	1,562,000	520,000	2,082,000
Fertilization-to-release survival	81%	78%					NA			
Eggtake Target			597,531	410,256	1,330,864	256,410	100,000	1,928,395	666,667	2,695,062
Fecundity	5,000	5,000								
Female target			120	82	266	51	20	386	133	539
Female to male ratio	1 to 1	1 to 1								
Broodstock target			240	164	532	102	40	772	266	1,078
Pre-spawn survival	90%	90%								
Total collection target			267	182	591	113	44	858	296	1,198

[1/]- Lake Chelan eggs will be incorporated into the last egg take and incubated at Wells Hatchery until eyed stage and then shipped to the Lake Chelan RSI program.

Columbia River Mainstem below Wells Dam

WDFW will collect 1,198 run-at-large summer Chinook including 1,077 hatchery fish from the volunteer ladder trap at Wells Fish Hatchery outfall and 121 natural origin fish from the Wells Dam west ladder. West ladder collections will begin 01 July and completed by 14 September and will be consistent with run timing past Wells Dam. Due to fish health concerns associated with the volunteer collection site, the volunteer collection will begin 10 July and terminate by 31 August, or when the summer Chinook broodstock collection objective is met, which ever is earliest. The 3-year old component will be limited to 10% of the broodstock collection to minimize the retention of surplus males.

Coho
Yakama Nation will provide broodstock collection objectives for the Coho reintroduction program in the Methow River basin. WDFW will work collaboratively with the Yakama Nation to facilitate Coho collections at Wells Dam.

Wenatchee River Basin

Spring Chinook
Pre-season estimates have 6,111 spring Chinook destine for the Chiwawa River, 56% or 3,445 are expected to be natural origin. In-season estimates of natural origin Chinook to the Chiwawa River will be adjusted proportional to the estimated returns detailed in Table 2 of the 2005 upper Columbia River Salmon and Steelhead Escapement and Broodstock Forecast and the total spring Chinook passage at Tumwater Dam at the 25%, 50% and 75% passage dates. Spring Chinook returns to the Columbia River through 09 May were approximately 20% of the pre-season forecast. The Technical Advisory Committee (TAC) has revised the projected total return estimated at 73,000-88,000 fish or approximately 33% of the pre-season forecast.

The Eastbank Fish Hatchery (FH) rears spring Chinook salmon for the Chiwawa River acclimation pond located on the Chiwawa River. The 2005 BY total production level target is 672,000 smolts.1/ Natural origin fish inclusion into the broodstock will continue to be a priority, with natural origin fish specifically being targeted. Natural origin fish collections will not exceed 33% of the in-season estimated return to the Chiwawa River and will provide, at a minimum, 33% of the total broodstock retained. Based on these limitations and the assumptions listed below (Table 7), the following broodstock collection protocol was developed.

Table 7. Assumptions and calculations to determine number of broodstock needed for Chiwawa program release of 672,000 smolts.

Program Assumption	Standard	Chiwawa program
Smolt release		**672,000**
Fertilization-to-release survival	83%	
Eggtake Target		**809,639**
Fecundity	4,400	
Female target		**184**
Female to male ratio	1 to 1	
broodstock target		**368**
Pre-spawn survival	97%	
Total broodstock collection		**379**

WDFW will retain 379 natural and coded-wire tagged hatchery origin spring Chinook from Tumwater Dam and the Chiwawa weir. Initially, 40 coded-wire tagged hatchery origin Chinook will be retained from Tumwater Dam. No additional hatchery origin Chinook will be retained at Tumwater Dam or Chiwawa weir until 20 natural origin Chinook have been retained at the Chiwawa weir. In-season assessment of the magnitude and composition of the spring Chinook return above Tumwater Dam will be used to determine the appropriate number of coded-wire tagged hatchery origin fish to include in the broodstock, consistent with a minimum 33% natural origin composition in the broodstock.

Trapping at Chiwawa weir will begin 01 June and terminate no later than 10 September. Spring Chinook trapping at the Chiwawa weir will follow a 4-days up and 3-days down schedule, consistent with weekly broodstock collection quotas that approximate the historical run timing and a maximum 33% retention of the projected natural origin escapement to the Chiwawa River.

1/- Based on concurrence (agreement/decision) in the Chelan HCP Hatchery Committee, outyear production may be reduced to 298,853 yearling smolts.

If the weekly quota is attained prior to the end of the 4-day trapping period, trapping will cease. If the weekly quota is not attained within the 4- day trapping period, the shortfall will carry forward to the next week. Retention of coded-wire tagged hatchery origin spring Chinook at Tumwater Dam will begin 16 May and will be concurrent with the trapping efforts associated with the Spring Chinook Reproductive Success Program. Spring Chinook retained will be transferred to Eastbank Fish Hatchery (FH) for holding in well water.

All Bull trout trapped at the Chiwawa weir will be transported by tank truck and released into a resting/recovery pool at least 1.0 km upstream from the Chiwawa River weir.

Steelhead

Current estimated upper Columbia River steelhead run size is sufficient to provide the 208 adult steelhead broodstock required to meet the Wenatchee basin production objective of 400,000 smolts. The steelhead mitigation program in the Wenatchee basin use broodstock collections at Dryden and Tumwater dams located on the Wenatchee River. Broodstock collection will target 50% natural origin fish and 50% hatchery origin fish, not to exceed 33% of the natural origin steelhead return to the Wenatchee basin. Based on these limitations and the assumptions listed below (Table 8), the following broodstock collection protocol was developed.

Table 8. Assumptions and calculations to determine number and origin of adult steelhead needed for Wenatchee Basin Steelhead program release of 400,000 smolts.		
Program Assumption	**Standard**	**Wenatchee program**
Smolt release		**400,000**
Fertilization-to-release survival	75%	
Eggtake Target		**533,333**
Fecundity	5,400	
Female target		**99**
Female to male ratio	1 to 1	
broodstock target		**198**
Pre-spawn survival	95%	
Total broodstock collection		**208**
Natural : hatchery ratio	1 to 1	
Natural origin collection total		**104**
Hatchery origin collection total		**104**

WDFW will retain 208 mixed origin, steelhead at Dryden and Tumwater dams. Collection will be proportional to return timing between 01 July and 12 November. Collection may also occur between 13 November and 3 December at both traps, concurrent with the Yakama Nation Coho broodstock collection activities. To attain weekly broodstock collection objectives, Dryden Dam may be operated 7-day/week, 24-hours/day and Tumwater Dam may be operated 3-days/week, up to 16-hours/day. Hatchery x hatchery parental cross, and unknown hatchery parental cross adults will be excluded from the broodstock collection. Hatchery steelhead parental origins will be determined through evaluation of VIE tags during collection.

In the event that steelhead collections fall substantially behind schedule, WDFW may capture some adult steelhead from the mainstem Wenatchee River by hook and line. Prior to hook and line collections, the JFP will be notified. In addition to trapping and hook and line collection efforts, Tumwater Dam may be operated between February and early April to supplement broodstock numbers if the fall trapping effort provides fewer than 208 adults.

Summer/fall Chinook

Summer/fall Chinook mitigation programs in the Wenatchee River basin utilize adult broodstock collections at Dryden and Tumwater dams, incubation/rearing at Eastbank Fish Hatchery (FH) and acclimation/release from the Dryden Acclimation Pond. The total production level target is 864,000 smolts.

Current return projections estimate approximately 8,500 natural origin summer/fall

Chinook will return to the Wenatchee basin during 2005, providing a moderate/high probability of collecting 100% natural origin fish in the broodstock. Review of recent summer/fall Chinook run-timing past Dryden and Tumwater dam indicates that previous broodstock collection activities have omitted the early returning summer/fall Chinook, primarily due to limitations imposed by ESA Section 10 Permit 1347 to minimize impacts to listed spring Chinook. In an effort to incorporate broodstock that better represent the summer/fall Chinook run timing in the Wenatchee basin, the broodstock collection will front-load the collection to account for the disproportionate collection timing. Approximately 43% of the summer/fall Chinook passage to the upper basin occurs prior to the end of the first week of July; therefore, the collection will provide 43% of the objective by the end of the first week of July. Weekly collection after the first week of July will be consistent with run timing of summer/fall Chinook during the remainder of the trapping period. Collections will be limited to a 33% extraction of the estimated natural origin escapement to the Wenatchee basin. Based on these limitations and the assumptions listed below (Table 9), the following broodstock collection protocol was developed.

Table 9. Assumptions and calculations to determine number of summer Chinook broodstock needed for Wenatchee Basin program release of 864,000 smolts.

Program Assumption	Standard	Wenatchee program
Smolt release		**864,000**
Fertilization-to-release survival	78%	
Eggtake Target		**1,107,692**
Fecundity	5,000	
Female target		**221**
Female to male ratio	1 to 1	
broodstock target		**442**
Pre-spawn survival	90%	
Total broodstock collection		**492**

WDFW will retain 492-natural origin, summer Chinook at Dryden and Tumwater dams. Trapping at Dryden Dam will begin 01 July and terminate no later than 31 August and operate up to 7-days/week, 24-hours/day. Trapping at Tumwater Dam may begin 15 July and terminate no later than 31 October and operate 3-days/week, 8-hours/day. Up to 25% (123) of the total broodstock collection may occur at Tumwater Dam. No selection for male or female will occur during collection with the exception of limiting the 3-year old component to 10% of the broodstock total.

If the probability of achieving the broodstock goal is reduced, based on the estimated escapement levels, broodstock composition will be adjusted to meet the broodstock collection objective of 492 fish.

Sockeye

Sockeye Salmon mitigation in the Wenatchee River basin utilizes adult broodstock collections at Tumwater Dam, incubation/rearing at Eastbank Fish Hatchery (FH) and rearing/pre-smolt releases from the net pens in Lake Wenatchee. The total production level for the 2005 BY is 200,000 pre-smolts. [1/]

Current return estimates have approximately 30,000 Lake Wenatchee sockeye returning to the Columbia River in 2005, providing a high probability of maintaining a broodstock collection goal of 100% natural origin fish. Based on projected return, 100% natural origin broodstock composition and assumptions listed below (Table 10), the following broodstock collection protocol was developed.

Table 10. Assumptions and calculations to determine number of sockeye salmon broodstock needed for Wenatchee Basin program release of 200,000 pre-smolts.

Program Assumption	Standard	Wenatchee program
Smolt release		**200,000**
Fertilization-to-release survival	80%	
Eggtake Target		**250,000**
Fecundity	2,594	
Female target		**97**
Female to male ratio	1 to 1	
broodstock target		**194**
Pre-spawn survival	89%	
Total broodstock collection		**218**

WDFW will retain 218 natural origin sockeye, proportional to run timing at Tumwater Dam. Due to the unequal sex ratio in previous years, attempts will be made to collect an equal number of males and females. Trapping may begin on 15 July and terminate by 15 August. Trapping will occur no more than 3-days/week, 8- hours/day.

If the probability of achieving the broodstock goal is reduced, based on the estimated escapement levels, broodstock number and composition will be adjusted consistent the retention of 218 sockeye with no more than 10% of the broodstock composed of adipose absent hatchery origin fish and an overall broodstock collection of no more than 10% of the total return past Tumwater Dam.

Coho

Yakama Nation will provide broodstock collection objectives and program assumptions for the Coho reintroduction program in the Wenatchee River basin. WDFW will work collaboratively with the Yakama Nation to facilitate Coho broodstock collections at Dryden and Tumwater dams.

[1/]- Chelan HCP Hatchery Committee has agreed to future production level of 280,000 fish, pending appropriate infrastructure improvements.

Attachment 6. Acronyms.

BAMP - Biological Assessment and Management Plan
BKD - Bacterial Kidney Disease
BO - Biological Opinion
BY - Brood Year
CFS - Cubic Feet per Second
CRFMP - Columbia River Fish Management Plan
CRITFC – Columbia River Intertribal Fish Commission
CWT - Coded Wire Tag
DNA - Deoxyribonucleic Acid, Genetic Information
ESA - Endangered Species Act
ESU - Evolutionarily Significant Unit
FERC - Federal Energy Regulatory Commission
FFP – Fish/pound
F2 – second generation
gpm – gallons per minute
USFWS - U.S. Fish and Wildlife Service
HCP - Habitat Conservation Plan
IEAB - Independent Economic Analysis Board
IHOT – Integrated Hatchery Operations Team
ISAB - Independent Scientific Advisory Board
JFP - Joint Fisheries Parties
M&E – Monitoring and Evaluation
NEPA - National Environmental Policy Act
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
NPDES – National Pollutant Discharge Elimination System
NNI - No Net Impact
PIT - Passive Integrated Transponder
PNFHPC - Pacific Northwest Fish Health Protection Committee
PNI – Proportionate Natural Influence
PUD - Public Utility District
RM - River Mile
RPA – Reasonable and Prudent Actions
SAR - Smolt-To-Adult Return Rate
SSHIAP - Salmon and Steelhead Habitat Inventory and Assessment Project
TRT - Technical Recovery Team
UCR - Upper Columbia Region
UCSRB - Upper Columbia Salmon Recovery Board
VSP - Viable Salmonid Population
WDFW - Washington Department of Fish and Wildlife
WDOE - Washington Department of Ecology
WRIA - Watershed Resource Inventory Area
YKFP – Yakima Klickitat Fisheries Project
YN – Confederated Tribes and Bands of the Yakama Nation