WDFW Tucannon River Endemic Stock Spring Chinook Supplementation Program

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Tucannon River Endemic Stock Spring Chinook Supplementation Program: Lyons Ferry Complex – Lyons Ferry Hatchery and Tucannon Hatchery**
Species or Hatchery Stock:	Tucannon River Spring Chinook *Oncorhynchus tshawytscha*
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Tucannon River / Snake River Basin, Washington State
Date Submitted:	September 30, 2002
Date Last Updated:	July 22, 2011

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Hatchery: Lyons Ferry Complex –
Consists of both Lyons Ferry Hatchery (LFH) and Tucannon Hatchery (TFH)

Program: Tucannon River Endemic Stock Spring Chinook Supplementation Program

1.2) Species and population (or stock) under propagation, and ESA status.

Species: Spring Chinook (*O. tshawytscha*),
Stock: Tucannon River (Snake River Spring/Summer Chinook ESU)
ESA Status: Threatened

1.3) Responsible organization and individuals

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

1. U.S. Fish and Wildlife Service – Lower Snake River Compensation Plan (LSRCP) – Program funding/oversight and provides coordination responsibility.
2. Confederated Tribes of the Umatilla Indian Reservation (CTUIR) – Co-manager.
3. Nez Perce Tribe (NPT) – Co-manager.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

The Lower Snake River Compensation Plan (LSRCP – U.S. Fish and Wildlife Service) is responsible for providing funds for mitigation production (supplementation program) of Tucannon River stock spring Chinook as a result of hydroelectric projects in the Snake River. Mitigation fish provided by the supplementation program are released in the Tucannon River as smolts (production goal of 225,000 annually).

Current staffing level at LFC consists of the Hatchery Complex Manager, 15 permanent employees, and additional seasonal employees. The evaluation staff currently has 7 biologists and technicians. Many staff members are involved in the spring Chinook program, but also have other responsibilities pertaining to the full species program at LFC. Operational and maintenance costs for the spring Chinook program at LFC from the LSRCP have been estimated at $351,291 annually. Monitoring and evaluation costs have been estimated at $175,400.

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

The locations of the hatchery facilities and other points of interest discussed throughout this HGMP are provided in Figure 1.

<u>Adult Collection</u>
Tucannon Hatchery Adult Trap – river kilometer (rkm) 59 on the Tucannon River, Columbia County, Washington

<u>Holding, Spawning, Incubation, Rearing and Marking</u>
Lyons Ferry Hatchery – along Snake River in Franklin County, Washington (rkm 90)

<u>Final Rearing</u>
Tucannon Hatchery – rkm 58 on the Tucannon River, Columbia County, Washington

<u>Smolt Acclimation and Release</u>
Curl Lake Acclimation Pond – rkm 66 on the Tucannon River, Columbia County, Washington

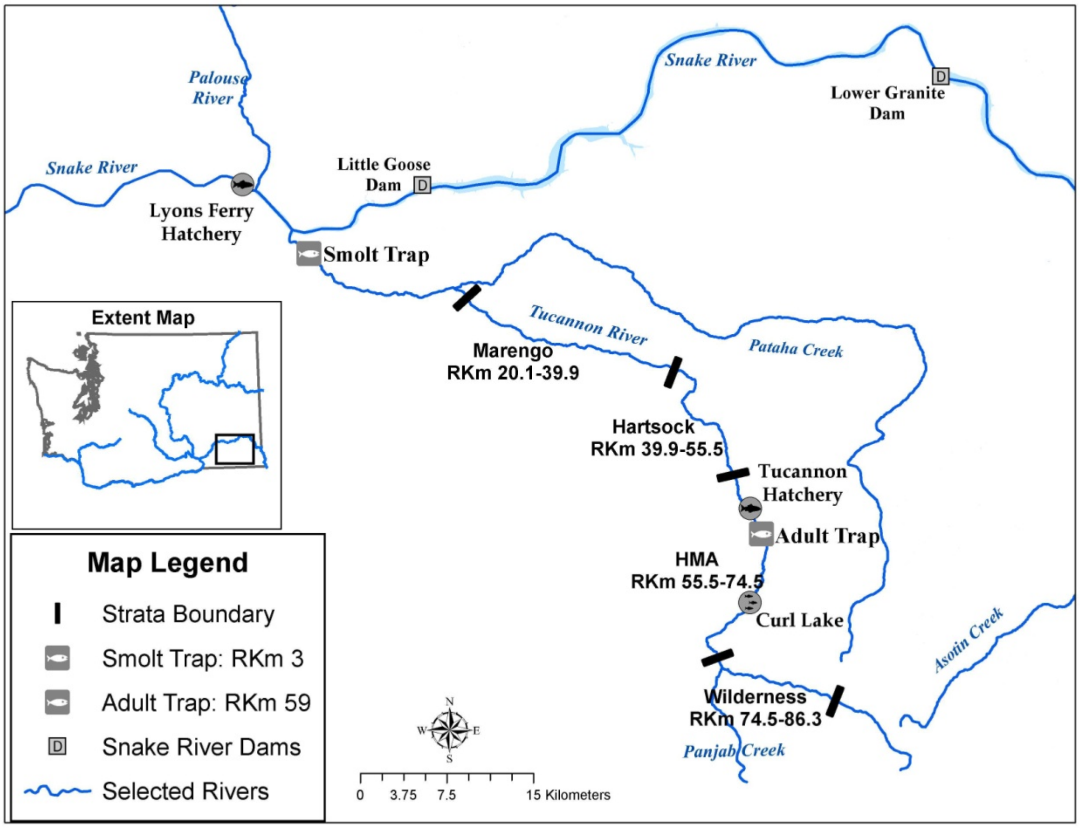

Figure 1. Location of the Tucannon River, and Lyons Ferry and Tucannon Hatcheries within the Snake River basin.

1.6) Type of program.

Integrated Recovery Program (Supplementation).

1.7) Purpose (Goal) of program (based on priority).

1. **Conservation**: The immediate short-term goal of the program is to prevent extinction of the population and contribute to the re-building of the population for de-listing.

2. **Mitigation**: The long-term goal is to provide a total annual return of between 2,400-3,400 hatchery and natural origin fish back to the Tucannon River that should include at least 750 natural origin fish over a 10-year geometric mean (population viability threshold).

This hatchery program is part of the Lower Snake River Compensation Plan (LSRCP). Legislation under the Water Resources Act of 1976 authorized the establishment of the LSRCP to replace adult salmon, steelhead, and rainbow trout lost by construction and operation of four hydroelectric dams on the Lower Snake River in Washington (USACE 1975). Specifically, the stated purpose of the plan is:

> *"…[to]…provide the number of salmon and steelhead trout needed in the Snake River system to help maintain commercial and sport fisheries for anadromous species on a sustaining basis in the Columbia River system and Pacific Ocean"* (NMFS & FWS 1972 pg. 14).

Specific mitigation goals for the LSRCP were established in a three-step process. First the adult escapement that occurred prior to construction of the four dams was estimated. Second an estimate was made of the reduction in adult escapement (loss) caused by construction and operation of the dams (e.g., direct mortality of smolts, inundation of spawning habitat). Last, the catch to escapement ratio (4:1 for Chinook) was used to estimate the future production that was forgone in commercial and recreational fisheries as a result of the reduced spawning escapement and habitat loss. Assuming that the fisheries below the project area would continue to be prosecuted into the future as they had in the past, LSRCP adult return goals were expressed in terms of the adult escapement back to, or above the project area. Other than the recognition that the escapements back to the project area would be used for hatchery broodstock, no other specific priorities or goals regarding how they might contribute to fisheries, be allowed to spawn naturally, or otherwise used was established in the enabling legislation or supporting documents.

Under the mitigation negotiations, local fish and wildlife agencies determined through a series of conversion rates of McNary Dam counts that 2,400 (2%) spring Chinook annually escaped into the Tucannon River. The agencies also estimated a 48% cumulative loss rate to juvenile downstream migrants passing through the four lower Snake River dams. The Tucannon spring Chinook program was designed to escape 1,152 adults back to the project area after a harvest of 4,608 (4x escapement goal). As such, 1,152 fish of Tucannon River origin needed to be compensated for, with the expectation that the other 1,248 would come from natural production. The agencies also determined through other survival studies at the time that a SAR of 0.87% was a reasonable expectation for spring and summer Chinook salmon. Based on that, it was determined that 132,000 fish should be produced by the LSRCP hatchery program to meet compensation needs.

Since 1976, when the LSRCP was authorized, many of the parameters and assumptions used to size the hatchery programs and estimate the flow of benefits have changed, including:

- Estimated smolt to adult survival rates (SARs) are substantially less than the SARs used to size the hatcheries.
- The failure of the natural production portion (52% of the population that was not to be compensated for by the hatchery) to remain self-sustaining and the listing under the ESA.
- The listing of many salmon and steelhead stocks in the Columbia Basin under the Endangered Species Act has resulted in significant curtailment of commercial, recreational and tribal fisheries throughout the ocean, mainstem Columbia River,

and Snake River Basin.
- The U.S. v. Oregon court stipulated Fishery Management Plan has established specific harvest and hatchery production agreements between the states, tribes and federal government.

1.8) Justification for the program.

The Lower Snake River Compensation Plan is a congressionally mandated program pursuant to PL 99-662. The LSRCP Tucannon River spring Chinook supplementation program has been operated since 1985 to provide mitigation for adult spring Chinook lost because of construction and operation of the lower Snake River dams. The current hatchery supplementation program has used Tucannon River stock since the program's inception. The Tucannon River stock was derived from fish captured at the TFH adult trap, thereby representing individuals that were endemic to the Tucannon River. The Tucannon River spring Chinook population was listed as "endangered" under the ESA as part of the Snake River spring/summer Chinook ESU (April 22, 1992; FR 57 No. 78: 14653). The listing status was changed to "threatened" in 1995 (April 17, 1995; FR 60 No. 73: 19342). The Biological Opinion issued by NMFS on the Tucannon River spring Chinook program considered the supplementation programs (included a captive broodstock program at that time) to be the best chance to maintain the existence and chance for recovery of natural spring Chinook within the Tucannon River.

Actions described within this HGMP represent the supplementation program for Tucannon River spring Chinook salmon. The program will attempt to maintain or increase numbers of naturally reproducing Tucannon River spring Chinook salmon and meet mitigation goals of the LSRCP.

1.9) List of program "Performance Standards".

See 1.10 below.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1) "Performance Indicators" addressing benefits.

A NPCC "Artificial Production Review" document (2001) provides categories of standards for evaluating the effectiveness of hatchery programs and the risks they pose to associated natural populations. The categories are as follows: 1) legal mandates, 2) harvest, 3) conservation of wild/naturally produced spawning populations, 4) life history characteristics, 5) genetic characteristics, 6) quality of research activities, 7) artificial production facilities operations, and 8) socio-economic effectiveness (Table 1). The NPCC standards represent the common knowledge up to 2001. Utilization of more recent reviews on the standardized methods for evaluation of hatcheries and supplementation at a basin wide ESU scale is warranted.

In a report prepared for Northwest Power and Conservation Council, the Independent Scientific Review Panel (ISRP) and the Independent Scientific Advisory Board (ISAB) reviewed the nature of the demographic, genetic and ecological risks that could be associated with supplementation, and concluded that the current information available was insufficient to provide an adequate assessment of the magnitude of these effects under alternative management scenarios (ISRP and ISAB 2005). The ISRP and ISAB recommended that an interagency working group be formed to produce a design(s) for an evaluation of hatchery supplementation applicable at a basin-wide scale. Following up on this recommendation, the *Ad Hoc* Supplementation Workgroup (AHSWG) was created and produced a guiding document (Galbreath et al. 2008) that describes framework for integrated hatchery research, monitoring, and evaluation to be evaluated at a basin-wide ESU scale.

The AHSWG framework is structured around three categories of research monitoring and evaluation; 1) implementation and compliance monitoring, 2) hatchery effectiveness monitoring, and 3) uncertainty research. The hatchery effectiveness category addresses regional questions relative to both harvest augmentation and supplementation hatchery programs and defines a set of management objectives specific to supplementation projects. The framework utilizes a common set of standardized performance measures as established by the Collaborative Systemwide Monitoring and Evaluation Project (CSMEP). Adoption of this suite of performance measures and definitions across multiple study designs will facilitate coordinated analysis of findings from regional monitoring and evaluation efforts. This is needed to address management questions and critical uncertainties associated with the relationships between harvest augmentation and supplementation hatchery production, and ESA listed stock status/recovery.

The NPCC (2006) has called for integration of individual hatchery evaluations into a regional plan. While the RM&E framework in AHSWG document represents our current knowledge relative to monitoring hatchery programs to assess effects that they have on population and ESU productivity, it represents only a portion of the activities needed for how hatcheries are operated throughout the region. A union of the NPCC (2001) hatchery monitoring and evaluation standards and the AHSWG framework likely represents a larger scale more comprehensive set of assessment standards, legal mandates, production and harvest management processes, hatchery operations, and socio-economic standards addressed in the 2001 NPCC document (sections 3.1, 3.2, 3.7, and 3.8 respectively). These are not addressed in the AHSWG framework and should be included in this document. NPCC standards for conservation of wild/natural populations, life history characteristics, genetic characteristics and research activities (sections 3.3, 3.4, 3.5, and 3.6 respectively) are more thoroughly developed by the AHSWG, and the later standards should apply to this document. Table 1 represents the union of performance standards described by the Northwest Power and Conservation Council (NPCC 2001), regional questions for monitoring and evaluation for harvest and supplementation programs, and performance standards and testable assumptions as described by the Ad Hoc Supplementation Work Group (Galbreath et al. 2008).

Table 1. Compilation of performance standards described by the Northwest Power and Conservation Council (NPCC 2001), regional questions for monitoring and evaluation for harvest and supplementation programs, and performance standards and testable assumptions as described by the Ad Hoc Supplementation Work Group (Galbreath et al. 2008).

Category	Standards	Indicators
1. LEGAL MANDATES	1.1. Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under U.S. v. OR and U.S. v. Washington.	1.1.1. Total number of fish harvested in Tribal fisheries targeting this program. 1.1.2. Total fisher days or proportion of harvestable returns taken in Tribal resident fisheries, by fishery. 1.1.3. Tribal acknowledgement regarding fulfillment of tribal treaty rights.
	1.2. Program contributes to mitigation requirements.	1.2.1. Number of fish released by program, returning, or caught , as applicable to given mitigation requirements.
	1.3. Program addresses ESA responsibilities.	1.3.1. Section 7, Section 10, 4d rule and annual consultation
2. IMPLEMENTATION AND COMPLIANCE	2.1. Program contributes to mitigation requirements.	2.1.1. Hatchery is operated as a segregated program. 2.1.2. Hatchery is operated as an integrated program 2.1.3. Hatchery is operated as a conservation program
	2.2. Program addresses ESA responsibilities.	2.2.1. Hatchery fish can be distinguished from natural fish in the hatchery broodstock and among spawners in supplemented or hatchery influenced population(s)
	2.3. Restore and maintain treaty-reserved tribal and non-treaty fisheries.	2.3.1. Hatchery and natural-origin adult returns can be adequately forecasted to guide harvest opportunities. 2.3.2. Hatchery adult returns are produced at a level of abundance adequate to support fisheries in most years with an acceptably limited impact to natural-spawner escapement.
	2.4. Fish for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	2.4.1. Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement. 2.4.2. Number of adult returns by release group harvested 2.4.3. Number of non-target species encountered in fisheries for targeted release group.
	2.5. Hatchery incubation, rearing, and release practices are consistent with current best management practices for the program type.	2.5.1. Juvenile rearing densities and growth rates are monitored. and reported. 2.5.2. Numbers of fish per release group are known and reported. 2.5.3. Average size, weight, and condition of fish per release group are known and reported. 2.5.4. Date, acclimation period, and release location of each release group are known and reported.
	2.6. Hatchery production, harvest management, and monitoring and evaluation of hatchery production are coordinated among affected co-managers.	2.6.1. Production adheres to plans documents developed by regional co-managers (e.g. US vs. OR Management agreement, AOPs etc.). 2.6.2. Harvest management harvest, harvest sharing agreements, broodstock collection schedules, and disposition of fish trapped at hatcheries in excess of broodstock needs are coordinated among co-management agencies. 2.6.3. Co-managers react adaptively by consensus to monitoring and evaluation results. 2.6.4. Monitoring and evaluation results are reported to co-managers and regionally in a timely fashion.
EFFECTIVENESS MONITORING REGIONAL FOR AUGMENTATION AND SUPPLEMENTATIO	3.1. Release groups are marked in a manner consistent with information needs and protocols for monitoring impacts to natural- and hatchery-origin fish at the targeted life stage(s) (e.g., in juvenile migration corridor, in fisheries, etc.).	3.1.1. All hatchery origin fish recognizable by mark or tag and representative known fraction of each release group marked or tagged uniquely. 3.1.2. Number of unique marks recovered per monitoring stratum sufficient to estimate number of unmarked fish from each release group with desired accuracy and precision.

Category	Standards	Indicators
	3.2. The current status and trends of natural origin populations likely to be impacted by hatchery production are monitored.	3.2.1. Abundance of fish by life stage is monitored annually. 3.2.2. Adult to adult or juvenile to adult survivals are estimated. 3.2.3. Temporal and spatial distribution of adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored. 3.2.4. Timing of juvenile outmigration from rearing areas and adult returns to spawning areas are monitored. 3.2.5. Ne and patterns of genetic variability are frequently enough to detect changes across generations.
	3.3. Fish for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.	3.3.1. Number of fish release by location estimated and in compliance with AOPs and US vs. OR Management Agreement. 3.3.2. Number of adult returns by release group harvested 3.3.3. Number of non-target species encountered in fisheries for targeted release group.
	3.4. Effects of strays from hatchery programs on non-target (unsupplemented and same species) populations remain within acceptable limits.	3.4.1. Strays from a hatchery program (alone, or aggregated with strays from other hatcheries) do not comprise more than 10% of the naturally spawning fish in non-target populations. 3.4.2. Hatchery strays in non-target populations are predominately from in-subbasin releases. 3.4.3. Hatchery strays do not exceed 10% of the abundance of any out-of-basin natural population.
	3.5. Habitat is not a limiting factor for the affected supplemented population at the targeted level of supplementation.	3.5.1. Temporal and spatial trends in habitat capacity relative to spawning and rearing for target population. 3.5.2. Spatial and temporal trends among adult spawners and rearing juvenile fish in the available habitat.
	3.6. Supplementation of natural population with hatchery origin production does not negatively impact the viability of the target population.	3.6.1. Pre- and post-supplementation trends in abundance of fish by life stage is monitored annually. 3.6.2. Pre- and post-supplementation trends in adult-to-adult or juvenile to adult survivals are estimated. 3.6.3. Temporal and spatial distribution of natural origin and hatchery origin adult spawners and rearing juveniles in the freshwater spawning and rearing areas are monitored. 3.6.4. Timing of juvenile outmigrations from rearing area and adult returns to spawning areas are monitored.
	3.7. Natural production of target population is maintained or enhanced by supplementation.	3.7.1. Adult progeny per parent (P:P) ratios for hatchery-produced fish significantly exceed those of natural-origin fish. 3.7.2. Natural spawning success of hatchery-origin fish must be similar to that of natural-origin fish. 3.7.3. Temporal and spatial distribution of hatchery-origin spawners in nature is similar to that of natural-origin fish. 3.7.4. Productivity of a supplemented population is similar to the natural productivity of the population had it not been supplemented (adjusted for density dependence). 3.7.5. Post-release life stage-specific survival is similar between hatchery and natural-origin population components.
	3.8. Life history characteristics and patterns of genetic diversity and variation within and among natural populations are similar and do not change significantly as a result of hatchery augmentation or supplementation programs.	3.8.1. Adult life history characteristics in supplemented or hatchery influenced populations remain similar to characteristics observed in the natural population prior to hatchery influence. 3.8.2. Juvenile life history characteristics in supplemented or hatchery influenced populations remain similar to characteristics in the natural population those prior to hatchery influence. 3.8.3. Genetic characteristics of the supplemented population remain similar (or improved) to the unsupplemented populations.
	3.9. Operate hatchery programs so that life history characteristics and genetic diversity of hatchery fish mimic natural fish.	3.9.1. Genetic characteristics of hatchery-origin fish are indistinguishable from natural-origin fish. 3.9.2. Life history characteristics of hatchery-origin adult fish are indistinguishable from natural-origin fish. 3.9.3. Juvenile emigration timing and survival differences between hatchery and natural-origin fish must be minimal.

Category	Standards	Indicators
	3.10. The distribution and incidence of diseases, parasites and pathogens in natural populations and hatchery populations are known and releases of hatchery fish are designed to minimize potential spread or amplification of diseases, parasites, or pathogens among natural populations.	3.10. Detectable changes in rate of occurrence and spatial distribution of disease, parasite or pathogen among the affected hatchery and natural populations.
4. OPERATION OF ARTIFICIAL PRODUCTION FACILITIES	4.1. Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and MDFWP.	4.1.1. Annual reports indicating level of compliance with applicable standards and criteria. 4.1.2. Periodic audits indicating level of compliance with applicable standards and criteria.
	4.2. Effluent from artificial production facility will not detrimentally affect natural populations.	4.2.1. Discharge water quality compared to applicable water quality standards and guidelines, 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.
	4.3. Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	4.3.1. Water withdrawals compared to applicable passage criteria. 4.3.2. Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria. 4.3.3. Number of adult fish aggregating and/or spawning immediately below water intake point. 4.3.4. Number of adult fish passing water intake point. 4.3.5. Proportion of diversion of total stream flow between intake and outfall.
	4.4. Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	4.4.1. Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence. 4.4.2. Juvenile densities during artificial rearing. 4.4.3. Samples of natural populations for disease occurrence before and after artificial production releases.
	4.5. 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.	4.5.1. Number and location(s) of carcasses or other products distributed for nutrient enrichment. 4.5.2. Statement of compliance with applicable regulations and guidelines.
	4.6. Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.	4.6.1. Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.
	4.7. Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	4.7.1. Mortality rates in trap. 4.7.2. Pre-spawning mortality rates of trapped fish in hatchery or after release.
	4.8. Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	4.8.1. Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present. 4.8.2. Number of fish in stomachs of sampled artificially produced fish, with estimate of natural fish composition.
5. SOCIO-ECONOMIC EFFECTIVENESS	5.1. Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	5.1.1. Total cost of program operation. 5.1.2. Sum of ex-vessel value of commercial catch adjusted appropriately, appropriate monetary value of recreational effort, and other fishery related financial benefits.
	5.2. Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	5.2.1. Total cost of program operation. 5.2.2. Average total cost of activities with similar objectives.

Category	Standards	Indicators
	5.3. Non-monetary societal benefits for which the program is designed are achieved.	5.3.1. Number of adult fish available for tribal ceremonial use. 5.3.2. Recreational fishery angler days, length of seasons, and number of licenses purchased.

Use of the above information will be used to determine whether the population has declined, remained stable, or has been recovered to sustainable levels.

1.10.2) "Performance Indicators" addressing risks.

The suite of performance measures developed by CSMEP represents a crosswalk mechanism that is needed to quantitatively monitor and evaluate the standards and indicators listed in Table 1. The CSMEP measures have been adopted by the AHSWG (Galbreath et al. 2008). The adoption of this regionally applied means of assessment will facilitate coordinated analysis of findings from basin-wide monitoring and evaluation efforts and will provide the scientifically based foundation to address the management questions and critical uncertainties associated with supplementation and ESA listed stock status/recovery.

Listed below (Table 2) are the suite of Performance Measures and the assumptions that need to be tested for each standard [modified from Beasley et al. (2008)].

Table 2. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring and the associated performance indicator that it addresses. (Taken from Galbreath et al. 2008).

Performance Measure		Definition	Related Indicator
Abundance	Adult Escapement to Tributary	Number of adults (including jacks) that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with mark recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries, and maximum net upstream approach for DIDSON and underwater video monitoring. Provides total escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses ICTRT population definition where available	2.3.2, 3.1.2, 3.2.1, 3.2.2, 3.2.4, 3.6.1, 3.7.1, 3.7.4, 5.3.1
Abundance	Fish per Redd	Number of fish divided by the total number of redds. Applied by: The population estimate at a weir site, minus broodstock and mortalities and harvest, divided by the total number of redds located upstream of the weir.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
Abundance	Female Spawner per Redd	Number of female spawners divided by the total number of redds above weir. Applied in 2 ways: 1) The population estimate at a weir site multiplied by the weir derived proportion of females, minus the number of female prespawn mortalities, divided by the total number of redds located upstream of the weir, and 2) DIDSON application calculated as in 1 above but with proportion females from carcass recoveries. Correct for mis-sexed fish at weir for 1 above.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3

Performance Measure		Definition	Related Indicator
	Index of Spawner Abundance - redd counts	Counts of redds in spawning areas in index area(s) (trend), extensive areas, and supplemental areas. Reported as redds and/or redds/km.	3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.6.1
	Spawner Abundance	In-river: Estimated number of total spawners on the spawning ground. Calculated as the number of fish that return to an adult monitoring site, minus broodstock removals and weir mortalities and harvest if any, subtracts the number of female pre-spawning mortalities and expanded for redds located below weirs. Calculated in two ways: 1) total spawner abundance, and 2) wild spawner abundance, which multiplies by the proportion of natural origin (wild) fish. Calculations include jack salmon. In-hatchery: Total number of fish actually used in hatchery production. Partitioned by gender and origin.	3.2.1, 3.2.3, 3.2.4, 3.6.3, 3.7.3
	Hatchery Fraction	Percent of fish on the spawning ground that originated from a hatchery. Applied in two ways: 1) Number of hatchery carcasses divided by the total number of known origin carcasses sampled. Uses carcasses above and below weirs, 2) Uses weir data to determine number of fish released above weir and calculate as in 1 above, and 3) Use 2 above and carcasses above and below weir.	2.2.1, 3.1.1, 3.4.1, 3.4.2, 3.4.3, 3.7.2, 3.7.4
	Ocean/Mainstem Harvest	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	1.1.1, 1.1.2, 2.3.1, 2.4.2, 2.6.2, 3.3.2, 3.3.3
	Harvest Abundance in Tributary	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	1.1.1, 1.1.2, 2.3.1, 2.4.2, 2.6.2, 3.3.2, 3.3.3
	Index of Juvenile Abundance (Density)	Parr abundance estimates using underwater survey methodology are made at pre-established transects. Densities (number per 100 m2). Hanken & Reeves estimator.	3.2.1, 3.5.1, 3.5.2
	Juvenile Emigrant Abundance	Gauss software is (Aptech Systems, Maple Valley, Washington) is used to estimate emigration estimates. Estimates are given for parr pre-smolts, smolts and the entire migration year. Calculations are completed using the Bailey Method and bootstrapping for 95% CIs. Gauss program developed by the University of Idaho (Steinhorst et al. 2004).	3.2.1, 3.6.1, 3.7.4

Performance Measure		Definition	Related Indicator
	Smolts	Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance estimate at the tributary comprised of each juvenile life stage (parr, presmolt, smolt) that survive to first mainstem dam. It is calculated by multiplying the life stage specific abundance estimate (with standard error) by the life stage specific survival estimate to first mainstem dam (with standard error). The standard error around the smolt equivalent estimate is calculated using the following formula; where X = life stage specific juvenile abundance estimate and Y = life stage specific juvenile survival estimate: $Var(X \cdot Y) = E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$	3.2.1, 3.6.1, 3.7.4
	Run Prediction	This will not be in the raw or summarized performance database.	2.3.1,

Performance Measure		Definition	Related Indicator
Survival – Productivity	Smolt-to-Adult Return Rate	The number of adult returns from a given brood year returning to a point (stream mouth, weir) divided by the number of smolts that left this point 1-5 years prior. Calculated for wild and hatchery origin conventional and captive brood fish separately. Adult data applied in two ways: 1) SAR estimate to stream using population estimate to stream, 2) adult PIT tag SAR estimate to escapement monitoring site (weirs, LGR), and 3) SAR estimate with harvest. Accounts for all harvest below stream. *Smolt-to-adult return rates* are generated for four performance periods; tributary to tributary, tributary to tributary, tributary to first mainstem dam, first mainstem dam to first mainstem dam, and first mainstem dam to tributary. *First mainstem dam to first mainstem dam S*AR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the estimated number of PIT tagged juveniles at first mainstem dam. Variances around the point estimates are calculated as described above. *Tributary to tributary SAR* estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific SAR's. Direct counts are calculated by dividing the estimated number of natural and hatchery-origin adults returning to the tributary (by length break-out for natural fish) by the estimated number of natural-origin fish and the known number of hatchery-origin fish leaving the tributary. *Tributary to* first mainstem dam SAR estimates are calculated by dividing the number of PIT tagged adults returning to first mainstem dam by the number of PIT tagged juveniles tagged in the tributary. There is no associated variance around this estimate. The adult detection probabilities at first mainstem dam are near 100 percent. First mainstem dam *to tributary* SAR estimates are calculated by dividing the number of PIT tagged adults returning to the tributary by the estimated number of PIT tagged juveniles at first mainstem dam. The estimated number of PIT tagged juveniles at first mainstem dam is calculated by multiplying life stage specific survival estimates (with standard errors) by the number of juveniles PIT tagged in the tributary. The variance for the estimated number of PIT tagged juveniles at first mainstem dam is calculated as follows, where X = the number of PIT tagged fish in the tributary and Y = the variance of the life stage specific survival estimate: $Var(X \cdot Y) = X^2 \cdot Var(Y)$ The variance around the SAR estimate is calculated as follows, where X = the number of adult PIT tagged fish returning to the tributary and Y = the estimated number of juvenile PIT tagged fish at first mainstem dam: $Var\left(\frac{X}{Y}\right) = \left(\frac{EX}{EY}\right)^2 \cdot \left(\frac{Var(Y)}{(EY)^2}\right)$	3.2.1, 3.2.2, 3.7.4

Performance Measure		Definition	Related Indicator
	Progeny-per- Parent Ratio	Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric. Two variants calculated: 1) escapement, and 2) spawners.	3.2.1, 3.2.2, 3.7.4
	Recruit/spawner (R/S)(Smolt Equivalents per Redd or female)	Juvenile production to some life stage divided by adult spawner abundance, adjusted for the confounding effects of spawner density. Derive adult escapement above juvenile trap multiplied by the pre-spawning mortality estimate. Adjusted for redds above juv. trap. *Recruit per spawner* estimates, or *juvenile abundance (can be various life stages or locations) per redd/female*, is used to index population productivity, since it represents the quantity of juvenile fish resulting from an average redd (total smolts divided by total redds) or female. Several forms of juvenile life stages are applicable. We utilize two measures: 1) juvenile abundance (parr, presmolt, smolt, total abundance) at the tributary mouth, and 2) smolt abundance at first mainstem dam.	3.2.1, 3.2.2, 3.7.4
	Pre-spawn Mortality	Percent of female adults that die after reaching the spawning grounds but before spawning. Calculated as the proportion of “25% spawned” females among the total number of female carcasses sampled. (“25% spawned” = a female that contains 75% of her egg compliment).	3.2.3, 4.5.1
	Juvenile Survival to first mainstem dam	Life stage survival (parr, presmolt, smolt, subyearling) calculated by CJS Estimate (SURPH) produced by PITPRO 4.8+ (recapture file included), CI estimated as 1.96*SE. Apply survival by life stage to first mainstem dam to estimate of abundance by life stage at the tributary and the sum of those is total smolt abundance surviving to first mainstem dam. Juvenile survival to first mainstem dam = total estimated smolts surviving to first mainstem dam divided by the total estimated juveniles leaving tributary.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
	Juvenile Survival to all Mainstem Dams	*Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s)*, which is estimated using PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tags are available from the stream. Using tags from all life stages combined we will calculate (SURPH) the survival to all mainstem dams.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
	Post-release Survival	Post-release survival of natural and hatchery-origin fish are calculated as described above in the performance measure “Survival to first mainstem dam and Mainstem Dams”. No additional points of detection (i.e., screw traps) are used to calculate survival estimates.	3.2.2, 3.6.2, 3.7.5, 3.9.3,
Distribution	Adult Spawner Spatial Distribution	Extensive area tributary spawner distribution. Target GPS redd locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations.	3.2.3, 3.2.4, 3.6.3, 3.7.3, 4.3.3, 4.6.1
	Stray Rate (percentage)	Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir.	3.4.1, 3.4.2, 3.4.3

Performance Measure		Definition	Related Indicator
	Juvenile Rearing Distribution	Chinook rearing distribution observations are recorded using multiple divers who follow protocol described in Thurow (1994).	
	Disease Frequency	Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely samples fish for disease and will defer to then for sampling numbers and periodicity	3.10, 4.4.3
Genetic	Genetic Diversity	Indices of genetic diversity – measured within a tributary) heterozygosity – allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST).	3.2.5, 3.8.3, 3.9.1
Genetic	Reproductive Success (Nb/N)	Derived measure: determining hatchery:wild proportions, effective population size is modeled.	3.7.2
Genetic	Relative Reproductive Success (Parentage)	The survival or productivity of offspring of hatchery spawners relative to offspring of wild spawners in the same basin.	3.2.1, 3.2.2, 3.2.4, 3.6.1, 3.7.1, 3.7.2 3.7.4, 5.3.1
Genetic	Effective Population Size (Ne)	Derived measure: the number of breeding individuals in an idealized population that would show the same amount of dispersion of allele frequencies under random genetic drift or the same amount of inbreeding as the population under consideration.	3.2.5
Life History	Age Structure	Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries. Juvenile age is determined by brood year (year when eggs are placed in the gravel) Then age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	3.8.1, 3.8.2, 3.9.2
Life History	Age–at–Return	Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries.	3.8.1, 3.8.2, 3.9.2

Performance Measure		Definition	Related Indicator
	Age–at-Emigration	Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	3.8.1, 3.8.2, 3.9.2
	Size-at-Return	Size distribution of spawners using fork length and mid-eye hypural length. Raw database measure only.	3.8.1, 3.9.2
	Size-at-Emigration	Fork length (mm) and weight (g) are representatively collected weekly from natural juveniles captured in emigration traps. Mean fork length and variance for all samples within a lifestage-specific emigration period are generated (mean length by week then averaged by lifestage). For entire juvenile abundance leaving a weighted mean (by lifestage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery.	3.8.2, 3.9.2
	Condition of Juveniles at Emigration	Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	3.8.2, 3.9.2
	Percent Females (adults)	The percentage of females in the spawning population. Calculated using 1) weir data, 2) total known origin carcass recoveries, and 3) weir data and unmarked carcasses above and below weir. Calculated for wild, hatchery, and total fish.	3.8.1, 3.9.2
	Adult Run-timing	Arrival timing of adults at adult monitoring sites (weir, DIDSON, video) calculated as range, 10%, median, 90% percentiles. Calculated for wild and hatchery origin fish separately, and total.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Spawn-timing	This will be a raw database measure only.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Juvenile Emigration Timing	Juvenile emigration timing is characterized by individual life stages at the rotary screw trap. Emigration timing at the rotary screw trap is expressed as the percent of total abundance over time while the median, 0%, 10, 50%, 90% and 100% detection dates are calculated for fish at first mainstem dam.	3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1
	Mainstem Arrival Timing (Lower Granite)	Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by lifestage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group. Weighted detection dates are also calculated by multiplying unique PIT tag detection by a life stage specific correction factor (number fish PIT tagged by lifestage divided by tributary abundance estimate by lifestage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates.	3.2.4, 3.6.4, 3.8.2, 3.9.2, 3.9.3, 4.8.1
bit at	Physical Habitat	TBD	

Performance Measure		Definition	Related Indicator
	Stream Network	TBD	
	Passage Barriers/Diversions	TBD	
	Instream Flow	USGS gauges and also staff gauges	
	Water Temperature	Various, mainly Hobo and other temp loggers at screw trap sights and spread out throughout the streams	
	Chemical Water Quality	TBD	
	Macroinvertebrate Assemblage	TBD	
	Fish and Amphibian Assemblage	Observations through rotary screw trap catch and while conducting snorkel surveys.	2.4.3, 3.3.3, 3.4.1
In-Hatchery Measures	Hatchery Production Abundance	The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish-per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked).	2.5.2, 2.5.3, 2.6.1, 4.4.2
In-Hatchery Measures	In-hatchery Life Stage Survival	In-hatchery survival is calculated during early life history stages of hatchery-origin juvenile Chinook. Enumeration of individual female's live and dead eggs occurs when the eggs are picked. These numbers create the inventory with subsequent mortality subtracted. This inventory can be changed to the physical count of fish obtained during CWT or VIE tagging. These physical fish counts are the most accurate inventory method available. The inventory is checked throughout the year using 'fish-per-pound' counts. Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to ponded fry, fry to parr, parr to smolt and overall green egg to release) Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Life stage at release varies (smolt, presmolt, parr, etc.).	
In-Hatchery Measures	Size-at-Release	Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during pre-release sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (smolt, presmolt, parr, etc.).	2.5.1, 2.5.3
In-Hatchery Measures	Juvenile Condition Factor	Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	2.5.3,3.8.2, 3.9.2
In-Hatchery Measures	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter.	3.8.1, 3.8.2, 3.9.2

Performance Measure		Definition	Related Indicator
	Spawn Timing	Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates.	3.2.4, 3.6.4, 3.8.1, 3.9.2
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawn mortality.	2.2.1
	Hatchery Broodstock Prespawn Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	4.7.2
	Female Spawner ELISA Values	Screening procedure for diagnosis and detection of BKD in adult female ovarian fluids. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum.*	3.10, 4.4.3
	In-Hatchery Juvenile Disease Monitoring	Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock	3.10, 4.4.3
	Length of Broodstock Spawner	Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging.	3.9.2
	Prerelease Mark Retention	Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either "present" or "absent"	3.1.1, 3.1.2
	Prerelease Tag Retention	Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either "present" or "absent". ("Marks" refer to adipose fin clips or VIE batch marks).	3.1.1, 3.1.2
	Hatchery Release Timing	Date and time of volitional or forced departure from the hatchery. Normally determined through PIT tag detections at facility exit (not all programs monitor volitional releases).	2.5.4, 4.8.1
	Chemical Water Quality	Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities; ammonia (NH_3) nitrite (NO_2)	4.2.1
	Water Temperature	Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The maximum number of adult broodstock is 175, but our target level is 170. The current goal is 50% natural origin broodstock, although under our preferred alternative the natural origin broodstock would shift to 100% when at least 350 natural origin spring Chinook adults are expected at the Tucannon Hatchery trap. Additional jacks can be collected for broodstock up to their proportion of the run with an upper limit of 10% of the hatchery broodstock.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

The U.S. v. Oregon 2008-2017 Management Plan production goal is 225,000 yearling smolts (U.S. v. OR 2008) based on a broodstock collection goal of 170 adults of which 50% are female. The maximum production would be 247,500 yearling smolts due to rearing space constraints and other programs (Table 3). Excess production over the 225,000 goal will be reared to maximize survival as either (in order of preference) yearling smolts, fingerlings, or fed fry depending on hatchery space limitations and funding (care, feeding, marking) constraints at that time. Contingency plans for excess production will be developed by the co-managers in the annual operations plan for this hatchery program. The priority of this hatchery program is to release fish into the Tucannon River, although there is general agreement among the co-managers that surplus Tucannon spring Chinook can be utilized to reintroduce spring Chinook into Asotin Creek. Details of if, or when, adult and jack hatchery spring Chinook would be transferred to Asotin Creek will be included in an adult Chinook management plan to be developed and provided to NMFS and the co-managers within nine months of issuance of the Section 10 permit.

Table 3. Tucannon River spring Chinook production from Lyons Ferry Complex into the Tucannon River.

Life Stage	Release Location (release method)	Stock	Production Goal	Maximum Annual Release Level
Eyed Eggs			0	0
Unfed Fry			0	0
Fry			0	0
Fingerling			0	0
Yearling	Curl Lake Acclimation Pond (volitional)	Tucannon Supplementation	225,000	247,500

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The Tucannon River spring Chinook supplementation program has been operating since 1985. Survivals within the hatchery for the supplementation program have generally been above program expectations by returning adults to the program above the replacement level. However, the program has not met the hatchery mitigation goal (1,152 adults) to date, as specified under the LSRCP, due to poor smolt-to-adults return rates. Mean SAR for the supplementation program has averaged 0.21% (Table 4). Expected SAR under the LSRCP was 0.87% (Gallinat and Ross 2009). At the observed SAR value, the hatchery program would need to produce approximately 550,000 hatchery smolts to meet the mitigation goal.

One issue possibly contributing to poor Tucannon SAR rates is non-direct homing behavior by Tucannon River spring Chinook (See 1.16.1). This non-direct homing behavior does not appear to be a hatchery effect as both hatchery and natural-origin fish bypassed the Tucannon River at the same rate (Gallinat and Ross 2010). Non-direct homing behavior has been documented for adult Chinook in the Columbia River System (Keefer et al. 2008). However more research is needed to examine whether they are natural straying occurrences, or if it is related to hydropower operations.

The WDFW evaluation program has documented natural and hatchery spawned smolt-to-adult return rates and progeny-to-parent (R/S) ratios (Table 4), and escapement levels (Table 5) since 1985 (Gallinat and Ross 2009). Smolt-to-adult return rates of smolts produced from natural spawning in the river have consistently outperformed the hatchery smolts. However, the natural spawning population (including hatchery fish spawning naturally) is generally below replacement (geometric mean = 0.58 returns/spawner), whereas the hatchery spawned population has exceeded replacement (geometric mean = 1.64 returns/spawner). Therefore, the current hatchery supplementation is returning more adults per spawner and boosting adult returns to the Tucannon River

Table 4. Smolt-to-adult and progeny-to-parent (R/S) ratios for natural and hatchery reared Tucannon River spring Chinook salmon (1985-2004 brood years).

	Natural Origin		Hatchery Origin	
Brood Year	**SAR**	**R/S**	**SAR**	**R/S**
1985	0.93	0.69	0.35	5.00
1986	0.80	0.90	0.21	3.59
1987	0.54	0.49	0.12	2.27
1988	1.41	1.73	0.31	5.11
1989	0.53	0.57	0.25	1.99
1990	0.19	0.15	0.03	0.36
1991	0.02	0.02	0.03	0.35
1992	0.39	0.35	0.09	0.99
1993	0.41	0.47	0.15	2.27
1994	0.17	0.17	0.03	0.49
1995	8.00	0.55	0.29	4.56
1996	4.28	0.51	0.35	3.61
1997	3.79	5.47	0.75	2.03
1998	7.06	7.63	0.62	9.36
1999	1.73	1.32	0.03	0.27
2000	2.22	1.87	0.15	2.15
2001	0.64	0.27	0.09	1.20
2002	0.33	0.23	0.10	1.29
2003	0.75	0.47	0.10	0.95
2004	1.89	0.83	0.18	1.36
Mean	1.80	1.23	0.21	2.46
Geometric Mean	0.84	0.58	0.14	1.64

Table 5. Estimated total returns of natural and hatchery-origin spring Chinook to the Tucannon River, 1985-2009.			
Return Year	**Natural Origin**	**Hatchery Origin**	**% Natural**
1985	591	0	100.0
1986	636	0	100.0
1987	582	0	100.0
1988	410	19	95.6
1989	336	109	75.5
1990	494	260	65.5
1991	260	268	49.2
1992	418	335	55.5
1993	317	272	53.8
1994	98	42	70.0
1995	21	33	38.9
1996	165	85	66.0
1997	160	191	45.6
1998	85	59	59.0
1999	3	242	1.2
2000	82	257	24.2
2001	718	294	70.9
2002	350	655	34.8
2003	248	196	55.9
2004	400	173	69.8
2005	289	131	68.8
2006	140	113	55.3
2007	198	146	57.6
2008	534	657	44.8
2009	750	1,112	40.3

1.13) Date program started (years in operation), or is expected to start.

The supplementation program started in 1985, and has been under continuous operation since then. The Tucannon River spring Chinook captive broodstock program began operation in 1997 and ended with the release of progeny from the 2006 BY in 2008. The last adult captive brood progeny are expected to return to the Tucannon River in 2011.

1.14) Expected duration of program.

The supplementation program is part of the LSRCP mitigation program, and will continue as long as mitigation is required under the LSRCP. Conservation and recovery actions described for the Tucannon River play a vital role in the overall success of the spring Chinook program. It is anticipated that natural origin spring Chinook survival must be improved to a level where the population can be determined to be at or above the replacement level across a ten-year geometric mean standardized to a spawner abundance level of 750 fish..

As described in the Tucannon River Captive Broodstock Master Plan (1999), WDFW collected sac fry from the supplementation program for the 1997-2001 brood years with additional fish collected from the 2002 brood year to have males on hand to spawn with females at the end of the program. Fish from the 1997-2002 brood years were raised to adults and spawned. The final captive brood progeny were released into the Tucannon River in 2008 (2006 brood year). Hatchery operations for the captive broodstock program ended with the last release. Monitoring and final evaluation of the captive broodstock program will continue until 2011, when the last captive brood adults are expected to return to the Tucannon River.

1.15) Watersheds targeted by program.

The supplementation program targets natural and hatchery spring Chinook within the Tucannon River (WRIA 35). WDFW and the co-managers have recently agreed (U.S. v. Oregon Agreement indicated TBD) on re-introduction of spring Chinook into Asotin Creek using Tucannon River stock. This proposed action is supported by recent DNA data, which shows that the unmarked spring Chinook found in Asotin Creek are closely related to the Tucannon population. This relationship may stem from migration behavior that is affected by the Hydro-system (see 1.16.1 below) which results in Tucannon stock hatchery and naturally produced fish straying into Asotin Creek. Specific details regarding transferring Tucannon hatchery spring Chinook into Asotin Creek will be described as part of the adult management plan to be developed in conjunction with the HGMP witin nine months of issuance of the Section 10 permit.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1) Brief overview of Key Issues

WDFW has observed that nearly a quarter (24%, or 13 of 55) of the returning adult Tucannon River spring Chinook (both naturally produced and hatchery origin) that were PIT tagged as juveniles prior to emigration from the Tucannon, bypassed the Tucannon River as returning adults and were detected at Lower Granite Dam (Gallinat and Ross 2009). Although the straying proportion is based on small numbers of PIT tagged returning adults, the phenomenon did not appear to be related to origin as both hatchery and natural origin fish bypassed at approximately the same level. More research into these events should be conducted to examine whether they are natural straying occurrences, or if it is related to hydropower operations. Returning adults bypassing the Tucannon River is a concern, especially if they are unable to return to the Tucannon River, and may potentially explain why the co-managers have had difficulties increasing this population.

With the exception of the 1988 and 1997-2000 brood years, the number of recruits per spawner for naturally produced fish, unadjusted for the effect of spawner abundance, has been less than 1.0.. Based on adult returns from the 1985-2004 broods, naturally reared salmon produced only 0.6 adults for every spawner in the river (both hatchery and natural origin fish), while hatchery reared fish produced 1.6 adults (Gallinat and Ross 2009). The general decline in abundance and productivity are likely the result of multiple factors and could eventually lead to extirpation of the Tucannon population unless they are corrected. Despite possible demographic and genetic risks associated with the hatchery supplementation program, it appears to have increased population abundance, and may have prevented more serious population genetic bottlenecks.

Beginning with the 2006 brood year, the annual smolt goal was increase from 132,000 to 225,000 to help offset for the higher mortality (reduced SAR), of hatchery origin fish after they leave the hatchery. In conjunction with increased smolt production, WDFW is conducting an experiment to examine size at release as a possible means to improve SAR of hatchery fish.

Hatchery Reviews

In 2009 and 2010, scientific review groups have assessed the program extensively. Their findings are summarized as follows:

The Hatchery Scientific Review Group (HSRG) made several recommendations to improve the Tucannon spring Chinook hatchery program:

The HSRG developed a solution that allows this population to meet the standards of a Primary or a Contributing population. If managed as a Primary population, a program of approximately 100,000 smolts with a 50% pNOB (proportion of natural origin broodstock) and a pHOS (proportion of hatchery origin spawners) of 25% would be consistent with this designation. For this to be achieved, a minimum of 50% of the hatchery fish returning to the Tucannon River would need to be removed at the weir or by selective terminal harvest. **Response: The co-manager emphasis has been to maximize adult returns to the Tucannon through implementation of supplementation and captive broodstock programs. The program has followed a broodstock protocol that calls for a 50% pNOB, but has not limited pHOS in the basin because of poor wild fish performance (low R/S ratios). With the intent of increasing adult escapement, fisheries to remove returning hatchery fish have not occurred in recent years. A series of alternatives have been devised under this HGMP for consideration by the co-managers, however the existing program was agreed upon under the 2008-2017 U.S. v. Oregon Management Agreement. Alternative 1a (preferred alternative shown below) is acceptable to the co-managers and does not alter the agreement in the US v OR agreement. Co-managers will utilize monitoring and evaluation data to assess performance of the program and bring modification suggestions for discussion through the U.S. v. Oregon forum.**

If managed as a Contributing population, a larger program of approximately 160,000 smolts with a 50% pNOB and a pHOS of 48% would be consistent with this designation. For this to be achieved, a minimum of 50% of the hatchery fish returning to the Tucannon River would need to be removed at the weir or by selective terminal harvest. **Response:**

This population will be managed as a Primary Population because it is the only extant population within the Lower Snake River MPG, and therefore it is required to meet highly viable status under ESA recovery plans. See comments above regarding management of a primary population.

Unless habitat improvements occur, it does not appear that planned program size of 225,000 smolts can be achieved and be consistent with the standards of a Primary or Contributing population. Managers should consider demographic risks to the population and modify their protocols during periods of low abundance. Managers also should develop a variable sliding scale for abundance so that in low abundance years, more of the appropriate stock is allowed to reach the spawning grounds. **Response: A sliding scale approach to setting level and nature of escapement into the Tucannon is provided as part of alternatives 1a and 1b in this HGMP (see below). Further discussion with co-managers is scheduled to occur to develop a sliding scale and adult management plan within nine months of issuance of the Section 10 permit.**

The managers should investigate ways to address straying of Tucannon Spring Chinook above Lower Granite Dam and the distribution of spawners within the Tucannon watershed. **Response: The co-managers have recently increased PIT tagging of spring Chinook to better account for straying behavior within the Snake River Basin. Further, a radio telemetry study for Tucannon spring Chinook in the Snake has been proposed to better understand Tucannon spring Chinook behavior around the confluence of the Tucannon River and the fate of these fish upstream of Lower Granite Dam. Additionally, an evaluation of the potential for use of chemical imprinting in the Tucannon River has been proposed to improve homing to the Tucannon River. The co-managers currently believe that WDFW evaluation activities within the Tucannon adequately describe both hatchery and wild fish distribution within the Tucannon River Basin.**

The HSRG recommends that managers implement a BKD control strategy for their spring and summer/fall Chinook hatchery programs where BKD has proved a recurring problem. Ideally, the strategy should include culling (destroying) eggs/progeny from hatchery- and natural-origin brood that are found to be infected with the BKD agent. In programs using ESA-listed natural-origin brood fish, the culling of their eggs/progeny may, at the managers' discretion, be dispensed with. However, the ESA-listed broodstock should be injected, pre-spawning, with an appropriate antibiotic (preferably, azithromycin at 40 mg/kg fish), and the resulting eggs should be surface-disinfected with an iodophor. Finally, eggs and hatchlings derived from broodstock found to be heavily infected with the BKD agent should be incubated/reared in isolation from those obtained from broodstock with no or lesser levels of the BKD agent. In addition, the hatchlings should be reared at the lowest possible densities (below current standards), and, at the first signs of infection with the BKD agent, they should be treated with orally administered erythromycin (100 mg/kg fish) for 28 days. The treatment should be repeated if there is evidence that the BKD agent has persisted in the hatchlings. **Response: The co-managers bacterial kidney disease control strategy with Tucannon spring Chinook is: 1) an adult pre-spawning erythromycin injection, 2) a single preventative erythromycin feeding, and 3) optimal**

fish culture conditions (i.e., pathogen free water supply, low rearing densities, and limited fish handling.). The above BKD control strategy has been successful in that no BKD outbreaks have occurred in the last five years. Also, annual BKD-ELISA testing of female spawners has shown no or very few moderate or high level BKD-ELISA fish during the same period. Due to the low number of adult Tucannon spring Chinook and low prevalence of BKD; BKD culling and or segregation strategies have not been employed.

The Hatchery Review Team (HRT) provided 20 preliminary recommendations and five draft programmatic alternative actions. Individual recommendations on the Facility, RM&E, Management, or Education and Outreach are presented below.

Issue TR-SC1: Program goals, separate from mitigation goals and escapement goals for natural-origin adults, are not prioritized or expressed in terms of numeric outcomes that quantify intended benefits. *According to the HGMP (2005), the purpose of the program is to "provide mitigation under the LSRCP program [by returning 1,152 hatchery-origin spring Chinook back to the Tucannon River] while meeting conservation and recovery criteria established for the Tucannon River population and the Snake River spring/summer Chinook ESU." Additionally, the HGMP states that, "the goal of the program is the restoration and enhancement of spring Chinook salmon in the Tucannon River using supplementation with the indigenous stock. The HGMP also lists a preservation/conservation goal of conserving the genetic resources of the naturally reproducing Tucannon River spring Chinook population. These are both short-term and long-term goals that are not prioritized and under current conditions with the existing hatchery program, appear to be confounded and not jointly attainable. Methods and goals are also confounded because "supplementation" is a "method", not a "goal". In this context, other "methods" may have a higher likelihood of achieving the desired or presumed "goal" of the program.*

Recommendation TR-SC1: Restate and prioritize program goals in terms of long-term numeric outcomes for the following parameters: (a) natural population abundance and viability (conservation goals); (b) the total number of hatchery-origin fish returning to the Tucannon River (mitigation goal), and (c) the proportions and desired numbers of the preceding two groups of fish allocated for broodstock, natural-spawning escapement, and harvest. Both short-term and long-term goals need to be clearly articulated before objectives and methods are developed. Short-term goals should be established that are attainable under current conditions. Benchmarks should also be established for measuring success or failure of the program in meeting goals and to provide guidance for future program actions. Based upon the information available about the program and the current condition of the naturally spawning population of spring Chinook in the Tucannon River (with a geometric mean recruit-to-spawner ratio of R/S≈0.6), the Team has assumed that the immediate short-term goal of the program is to prevent extinction of the Tucannon River spring Chinook stock. **Response: The co-managers have established short and long term goal statements for this program as requested, and they are included in this document (1.7). Discussions among the co-managers regarding numerical abundance goals for natural and hatchery fish in the basin have resulted in several alternatives listed in this document.**

Issue TR-SC2: An insufficient number of hatchery and natural-origin adults return to the Tucannon River to meet the current broodstock collection goal of 170 spring Chinook, composed of 50% natural-origin and 50% hatchery-origin fish. *Establishing a broodstock collection goal of 170* *fish as a priority may result in "broodstock mining" of natural-origin fish and impede achievement of short-term conservation goals for the natural population. Broodstock collection goals need to be adjusted and prioritized to avoid conflicts between conservation goals for the naturally spawning population and mitigation-harvest goals of the program (see Issue TR-SC1).*

Recommendation TR-SC2: Reduce the broodstock collection goal and the size of the program to levels that (a) can fluctuate annually depending on the availability of natural and hatchery-origin fish and (b) allow attainment of HSRG guidelines for integrated hatchery populations of primary conservation value (i.e., pHOS <30% and proportionate natural influence (PNI) > 0.67). These guidelines can be achieved if pHOS is less than 25% and the current broodstock strategy of pNOB = 50% is retained. To meet these guidelines, the deliberate passage of hatchery-origin spring Chinook upstream of the weir will need to be terminated (see Issue and Recommendation TR-SC3 below). In addition, the number and proportion of hatchery and natural-origin fish retained for broodstock each year should be based on a sliding scale that is a function of the numbers and relative abundances of hatchery and natural-origin fish intercepted at the weir. Potentially reducing the proportion of the broodstock composed of natural-origin fish to a value less than 50% (e.g., pNOB = 25%) while maintaining PNI > 0.50 (i.e., pHOS < 25%) may be desirable as an interim measure while the naturally spawning population upstream of the weir potentially develops and stabilizes after passage of hatchery-origin fish is terminated as a near-term management action. These recommendations assume that the first priority of the program, as a short-term interim goal, is reducing demographic risks to the natural population. These recommended actions would need to be closely monitored, consistent with ongoing efforts. **Response: Several alternatives are listed in this document, and decisions on the size and nature of the hatchery program depend upon the management paradigm ultimately adopted. Because the current program has been identified in the U.S. v. Oregon Management Agreement, changes to the number of fish produced and released, or the marking plans, will require discussions in the US v OR forum, where a preferred alternative will be adopted. A preferred alternative is proposed here that is generally expected to approach or achieve the PNI goal of 0.67 by increasing the natural origin adults included in hatchery broodstock.**

Hatchery and Natural Spawning, Adult Returns

Issue TR-SC3: The composite natural spawning of hatchery- and natural-origin spring Chinook in the Tucannon River has a geometric mean recruit-to-spawner that is less than one (R/S<1.0). *The relatively large number of hatchery-origin spring Chinook spawning naturally in the Tucannon River (mean pHOS ≈ 47%) exceeds the HSRG guideline of pHOS < 30% for integrated hatchery programs. Moreover, the relatively large proportion of natural spawners composed of hatchery-origin fish is, most likely, (a) contributing to a mean R/S < 1.0 and (b) reducing R/S for natural-origin fish. The past management practice of allowing all hatchery-origin fish not retained for broodstock to spawn naturally upstream of the weir is a strategy that is not achieving desired management goals. In addition, approximately 1/3 of all natural spawning of spring Chinook in the Tucannon River occurs downstream of the hatchery weir.*

Recommendation TR-SC3: Discontinue passing hatchery-origin spring Chinook upstream of the hatchery weir and manage that portion of the naturally spawning population as a natural population reserve. Monitor and evaluate recruit-to-spawner ratios for the natural population for at least one full generation (5-6 years) to determine whether the value of R/S increases with a different management strategy. A second generation of not passing hatchery-origin fish upstream should be investigated to determine whether the population upstream of the weir can achieve a level of self-sustainability with R/S > 1.0. Investigate the feasibility of constructing a permanent weir in the lower Tucannon River, downstream from all natural spawning areas, to provide greater management control of the naturally-spawning population. Such a weir would also facilitate management of steelhead in the Tucannon River (see Tucannon River steelhead Issue and Recommendation TR-SS11). The Review Team concluded that the demographic risks of drastically reducing the "supplementation" component of the program upstream of the weir were minor - compared to the potential genetic and demographic benefits of such actions - because that supplementation component could be reinstated at any time if such actions were necessary to prevent extinction of a naturally spawning population of spring Chinook in the upper Tucannon River. At the present time, the population dynamics of spring Chinook in the Tucannon River are dominated by hatchery-origin fish, thus masking the natural reproductive capabilities of the natural population. Surplus hatchery-origin fish trapped at the weir but not retained for broodstock can be provided to the tribes for subsistence or to food banks. A selective fishery on hatchery-origin spring Chinook downstream from the weir may also be possible in high return years. **Response: Several alternatives are listed in this document, and decisions on the size and nature of the hatchery program depend upon the management paradigm ultimately adopted. Because the current program has been identified in the U.S v. Oregon Management Agreement, change in production goals, releases and marks will require discussions in the U.S. v OR forum. A preferred alternative is proposed in this document that would begin to address adult management, with the intent of development of a detailed adult management plan as a supplement to this HGMP.**

Incubation and Rearing

Issue TR-SC4: Juvenile spring Chinook are given a medicated feed to help control bacterial kidney disease. *These treatments are given prophylactically (i.e., when the fish do not show clinical signs of disease). The U.S. Department of Agriculture and other federal agencies have published warnings and advisories regarding the biological risks and potential overuse of antibiotics.*

Recommendation TR-SC4: Re-evaluate the need for regularly scheduled prophylactic use of erythromycin feed with the goal of phasing out its use. Included in this phase-out could be a study that evaluates adult returns from erythromycin treated and untreated (control) juvenile groups. **Response: The co-managers are concerned with antibiotic resistance but current erythromycin use is very limited. Also, there's no evidence that *Renibacterium salmoninarum* (causative agent of bacterial kidney disease) strains have developed resistance to erythromycin despite its use in the Pacific Northwest for over 30 years.**

Release and Outmigration

Issue TR-SC5: Currently, no fish-health examination of juvenile spring Chinook occurs before those fish are transferred from Tucannon FH to Curl Lake and/or released from Curl Lake into the Tucannon River. The spring Chinook juveniles are held on river water that contains migrating adult salmonids, a potential source of pathogen transmission to hatchery juveniles. *Pre-release exams which include testing for virus, bacteria and parasites are not done. There is a risk that endemic or exotic pathogens with no clinical signs of infection among juveniles prior to release into the Tucannon River can go undetected with potential transmission to other aquatic animals. Expanded sampling for pathogens prior to release may also provide increased insight into Tucannon spring Chinook survival. Pre-release exams, conducted 4-6 weeks before release or transfer, are required by USFWS fish health policy FW 713 and the Integrated Hatchery Operations Team (IHOT).*

Recommendation TR-SC5: Sample 60 fish of each brood for pre-release inspections to meet the American Fisheries Society – Fish Health Section Blue Book requirements to ensure a 95% confidence in detecting pathogens at the minimum assumed pathogen prevalence level of 5%. Along with viral testing, juvenile spring Chinook should also be tested for bacteria and parasites which may be endemic to the Tucannon River. Potential, undetected infections with pathogens could be a factor in post-release survival and return rates. **Response: WDFW fish health staff questions the value of testing all fish for selected pathogens before release. If viral or other pathogens were detected, we would be strongly hesitant to destroy these ESA listed fish. Testing will simply document the infection, and the cost raises the question of the value of such actions.**

Facilities/Operations

Lyons Ferry Hatchery

(See the Lyons Ferry Hatchery Steelhead and Fall Chinook sections for additional facility issues and recommendations)

Tucannon Fish Hatchery

See Issue/recommendation TR-SS11 in the Tucannon River steelhead section regarding establishing a permanent weir at the location of the temporary weir.

Issue TR-SC6: Lack of shade covers over the raceway increases crowding of fish, particularly during the summer months, potentially increasing stress and disease risks to spring Chinook juveniles. *However, Tucannon Fish Hatchery receives limited sunlight due to its location.*

Recommendation TR-SC6: Consider constructing shade covers over the raceways. **Response: The co-managers do not currently believe that the expense of covers for shade at Tucannon Hatchery is warranted, as no evidence of mortality or stress induced disease outbreaks have occurred because of lack of shade.**

Issue TR-SC7: Although on-station predation is considered minimal, the facility lacks predator exclusion mechanisms such as bird netting and fencing around some of the ponds and raceways.

Recommendation TR-SC7: Construct complete predator exclusion mechanisms around all rearing units (i.e., fencing and bird netting). **Response: Partial exclusions were completed in 2009, and WDFW is investigating options for completing exclusions. These actions are dependent on available funding.**

Issue TR-SC8: The intake diversion (sluice way) is being undermined and requires repair. Intake failure could result in a catastrophic loss to fish reared on station.

Recommendation TR-SC8: Consult with the Service Engineering Department to repair the sluice way. **Response: This action has been completed.**

Issue TR-SC9: Rainbow Lake is used as a water source for Tucannon Fish Hatchery and is also stocked with catchable trout, which may pose a fish health risk to fish in hatchery.

Recommendation TR-SC9a: In the near term, discontinue stocking Rainbow Lake with catchable trout. **Response: WDFW does not believe that there is evidence that rainbow trout plants are jeopardizing fish health within the hatchery. Natural and hatchery populations of anadromous**

exist within the basin above the hatchery intake, and provide a source of pathogens, regardless of the presence of trout in the lake. WDFW plans to continue the stocking.

Recommendation TR-SC9b: Enclose the water supply to Tucannon Hatchery from the Tucannon River from the river diversion to the existing intake pipe below Rainbow Lake. Reconfigure Rainbow Lake intake so it continues to fill with Tucannon River water so recreational fishery may continue. Configure plumbing to the hatchery so that, in an emergency, Rainbow Lake could be used for backup water. **Response: See TR-SC9 above.**

Issue TR-SC10: Rainbow Lake is used as an emergency reservoir for Tucannon Fish Hatchery; however, its capacity has been reduced due to the accumulation of silt. *Silt accumulation in Rainbow Lake is also a potential harbinger for disease, including IHNV, parasite hosts and bacteria, posing a fish health risk to the fish reared on-station at Tucannon Hatchery.*

Recommendation TR-SC10: Dredge the accumulated silt from Rainbow Lake. **Response: WDFW agrees and has identified this action as part of its long-term capital projects needs and for supplemental funding under LSRCP.**

Issue TR-SC11: The Lower Snake River Compensation Plan office is reviewing the ownership status of water rights associated with all co-manager-operated facilities, which divert water for fish culture. *Although ownership of several of the facilities has been transferred to the Service, the appropriate documentation to transfer the water rights may not have been filed in the respective state agency, which administers water rights. Moreover, facility staff may not consistently or adequately record water use to ensure documentation of beneficial use in support of its water right(s) and as required by state law. Adequate documentation and reporting are required to maintain the right to divert water.*

Recommendation TR-SC11: Work with the Lower Snake River Compensation Plan office to ensure water diverted to the Tucannon Hatchery and Curl Lake Acclimation Pond for fish culture is measured and reported correctly. Water use information needs to be maintained by the Service's Region 1 Engineering, Division of Water Resources. **Response: The WDFW currently monitors water withdrawals using standard hatchery procedures for Washington. Those data are available and can be provided to the LSRCP if needed.**

Research, Monitoring, and Accountability

Issue TR-SC12a: Smolt productivity for natural-origin spring Chinook is poor in the Tucannon River, which limits adult returns. *Multiple issues may be contributing to poor survival, including disease, predation by introduced species (e.g., brown trout), hydroelectric dams, and habitat constraints. Predation and habitat limitations may profoundly impact survival; however, control of these issues is limited. WDFW is currently performing a size at release study. Findings of this study may prove beneficial for increasing survival in association with predation and habitat limitations. Regarding disease constraints: Endemic parasites can significantly limit juvenile survival, especially if the stock has not developed an innate resistance. Natural-origin spring Chinook may have some innate resistance to endemic parasites, particularly myxosporideans. However, the rearing of this stock on well water at Lyons Ferry FH and/or Tucannon FH would not select for fish with an inherited resistance for parasites endemic to Tucannon River. The Tucannon Hatchery juveniles, in particular those exposed to river water, may present an opportunity to assess endemic parasites that could be limiting the natural production of spring Chinook. The parasite*

Nucleospora salmonis has been detected in a limited sampling of the spring Chinook juveniles at the Tucannon FH. This parasite debilitates the immune system of salmonids and is implicated in losses of juveniles in other Snake River programs. Currently, sampling for myxosporidean parasites is limited to M. cerebralis monitoring in the rainbow trout once every three years.

Issue TR-SC12b: If Tucannon River stocks carry an endemic parasite, stray fish could serve as vectors of the parasite to other basins*.*

Recommendation TR-SC12: Test for parasites, including *N. salmonis*, *C. shasta* and other myxosporideans, in Tucannon Hatchery juveniles (rainbow trout and acclimated steelhead, spring Chinook) and adults returning to the Tucannon River. Consider rearing spring Chinook from egg through smolt stage exclusively on Tucannon River water as a means to test for endemic parasites that may be infecting Tucannon River natural-origin fish. Alternatively, a net pen of Chinook salmon fry in Curl or Rainbow Lakes could serve as sentinel fish for monitoring of parasites. If fish parasites are found in the Tucannon River, consider managing spring Chinook in the Tucannon River to enhance innate resistance to endemic parasites. This could include collecting natural-origin adults and rearing their progeny at Tucannon Hatchery on river water with some potential to significant mortality during the development of resistant offspring. **Response: Additional testing for other pathogens such as *Nucleospora sp.* should be accomplished since past efforts have been sporadic and localized. However, *Nucleospora sp*. surveillance using PCR testing is expensive with cost at $ 30.00 per sample and will depend on available funds and laboratory facilities. The co-managers will continue to consider fish health risks, and implement sampling and testing as necessary.**

Issue TR-SC13: Spring Chinook have been observed at the Lyon Ferry hatchery trap outfall. *To date, the trap at Lyons Ferry has not been operated to collect spring Chinook; therefore, the origin of these fish has not been determined.*

Recommendation TR-SC13: Spring Chinook observed at the Lyons Ferry outfall should be collected to determine their origin. Spring Chinook identified as Tucannon spring Chinook could be used as last-resort "backfills" to make-up for broodstock shortages resulting from the trapping of spring Chinook in the Tucannon River. However, the collection of broodstock anywhere other than the Tucannon River should be considered a "last resort" and generally discouraged (see Broodstock Choice and Collection above (Issue and Recommendation TR-SC2). **Response: WDFW will implement experimental trap operation at LFH, utilizing PIT tag detection capabilities at the hatchery to assess the presence of Tucannon fish, along with other upriver origin Chinook, in the population willing to enter the ladder. All fish will be directly returned to the river, and results reported to all interested co-managers.**

Issue TR-SC14: Recruit per spawner(R/S) for naturally spawning Tucannon spring Chinook is less than one (R/S<1.0), and a significant number of hatchery fish are spawning each year. *The reproductive success of hatchery and natural fish passed upstream and spawning naturally are unknown.*

Recommendation TR-SC14: Conduct a pedigree analysis to determine and compare the reproductive success of hatchery and natural-origin Tucannon spring Chinook passed upstream of the weir. If possible, use archived scale (or tissue) samples to conduct this study, particularly in view of Recommendation TR-SC2b. Results of this type of study would help in the decision in the proportion of hatchery and natural fish passed upstream to spawn naturally. **Response: The co-managers will discuss the applicability of this approach, and the necessary sample size for results to be informative with WDFW's Conservation Biology/Genetics unit. WDFW is interested in conducting a pedigree study, but CTUIR does not support this action.**

Issue TR-SC15a: Tucannon spring Chinook reportedly have a high degree of straying upstream of Lower Granite Dam. *Approximately 57.1% of the returning PIT tagged hatchery-origin spring Chinook and 50.0% natural-origin PIT tagged spring Chinook were detected at Lower Granite Dam. This straying may be posing a demographic risk to the spring Chinook population in the Tucannon River (by reducing SARs back to the Tucannon River) for both hatchery and natural-origin fish and a genetic risk to naturally spawning populations upstream of Lower Granite Dam. Habitat limitations such as flooding of the lower Tucannon River by the pool behind Lower Monumental Dam may reduce attraction water and contribute to straying by both hatchery and natural-origin fish. The hatchery program does not appear to be the cause of straying because both hatchery and natural-origin spring Chinook from the Tucannon River stray upstream of Lower Granite Dam at approximately the same rate.*

Issue TR-SC15b: Preliminary stray information is based upon very few recoveries of PIT tagged fish. *The PIT tag level was 1,000 hatchery and 1,000 natural smolts. PIT tagging was increased in brood year 2005 to 5,000 total hatchery-origin fish as part of the size at release study.*

Recommendation TR-SC15*:* Continue to investigate the degree of homing and straying and the potential causes. Increase the PIT tagging level to approximately 10,000 -origin smolts. Pit-tag all natural-origin smolts captured during smolt trap operations (≈3,000 smolts per year). **Response: Co-managers agreed to increase PIT tagging beginning in 2010 to 15,000 hatchery fish and up to 3,000 natural fish to attempt to answer this question. The goal would be to tag up to 25,000 hatchery-origin spring Chinook if funding were available (See 10.7). WDFW has proposed a radio telemetry study of Tucannon spring Chinook in the Snake River near the mouth of the Tucannon River and above Lower Granite Dam, as well as a evaluation of the potential to improve homing by applying a chemical drip for imprinting to the Tucannon River.**

Education and Outreach

See the Lyons Ferry Fall Chinook section for Education and Outreach issues and recommendations regarding Lyons Ferry FH.

Issue TR-SC16: The Tucannon Hatchery displays and handouts are outdated. *The existing Tucannon Hatchery displays were installed in the 1980's-early 90's when the facility was constructed.*

Recommendation TR-SC16: Update the displays and handouts so that they accurately reflect the current status of salmon and steelhead in the Snake River and the associated hatchery programs at Tucannon Hatchery. **Response: WDFW will work with the LSRCP program to plan and implement updates and improvements as recommended.**

Issue TR-SC17: The information available to the public regarding the Tucannon Hatchery and its associated programs is inadequate. *The LSRCP web site lacks information about the hatchery for the public. Additionally, WDFW does not currently manage a web page for Tucannon Hatchery.*

Recommendation TR-SC17: Information regarding the harvest and conservation benefits of the programs at Tucannon Hatchery should be made available by the Service and WDFW in a format for public consumption (e.g., simple brochures, interactive web pages, etc.). For example, fishery benefits provided by the program for each hatchery could be updated annually on the LSRCP web site and provided in a brochure at the hatchery. If the LSRCP web site is the primary source of information for the program, any WDFW page for Tucannon Hatchery should be linked to this site. **Response: WDFW will work with the LSRCP program to plan and implement updates and improvements as recommended.**

The Independent Scientific Review Panel (ISRP) conducted their categorical review (retrospective report) of the LSRCP spring Chinook artificial production and associated monitoring and evaluation programs in the Snake River Basin. They provided their findings and recommendations in May of 2011. Their findings included the following:

Finding 1: Fish performance in the prespawn, hatchery, and presmolt acclimation phases was documented and appears to be adequate… Pre-spawn mortality of adults has been greatly reduced (<10%) by holding the fish at LFH. Eyed egg-to-smolt survival from 2005 to 2008 has exceeded 90%. The number of smolts produced has approached the 132,000 goal but is well below the revised 225,000 goal designed to meet mitigation losses at existing SAS (smolt to adult survival to mouth of Columbia River) rates. There was some information presented to indicate that smolt survival may improve by releasing larger smolts. Disease issues were not a major impediment.

Finding 2: Although fish culture performance was within expected standards, survival of hatchery fish as measured by smolt to adult survival to mouth of the Columbia River (SAS) and to the SnakeBasin (SAR) was not. Although SARs met the 0.87% goal in 1997, SARs over the most recent 5-year period has ranged from approximately 0.10-0.30%. Natural SARs were several times higher than hatchery SARs.

Finding 3: The program was operating well below expectations in terms of mitigation goals. At current mean survival rate of 0.21%, it would theoretically take more than 500,000 smolts to meet the mitigation goal of 1,152 fish.

Finding 4: Released smolts were showing erratic and low survival rates. Measures of these survival rates and other life history aspects (size, age at return, etc.) seems appropriate, although the information provided was not sufficient to provide much insight as to why overall survival was so low.

Finding 5: The ecological and genetic impacts of the programs on wild fish are shown primarily through comparisons of life history characteristics between hatchery and wild fish. The percentage of precocious males may reduce adult returns. Adult hatchery fish had a younger age composition and earlier migration timing than wild fish.

Finding 6: Information was provided on the possibility of residualization and male precocity from the increasingly large smolt releases and potential effect on wild fish. Residualization (mini-jacks) is an issue deserving more study. Effects of mini-jacks on SARs should be evaluated.

Outlook and Recommendations by ISRP

Under existing habitat conditions, the long-term outlook for successfully meeting project area mitigation objectives is not favorable. While fish culture performance was within standards expected for salmonids in general, the low SARs indicate that existing approaches for rearing and releasing smolts do not result in fish capable of returning as adults to the Columbia River and Lower Granite Dam in numbers sufficient for meeting existing LSRCP mitigation goals. Although releasing more and larger smolts may provide returns closer to goals, the much lower SARs for hatchery fish than wild fish are causes for concern (and even the wild fish are not replacing themselves in most years). Releasing larger smolts may also increase residualization of the incidence of mini-jacks. The lack of adult replacement along with the bimodal (bi-seasonal) emigration timing of wild fish suggests that their historical life history may have involved some of the stock rearing to smolt size in the Tucannon River, but another segment, and perhaps the larger portion, emigrating early and rearing in the Snake River mainstem for several months or more prior to smoltification. The reduction in this life history (low survival in response to mainstem modifications) may be the cause of wild fish remaining below replacement in most years. Proposed instream habitat improvements may improve survival of natural fish to some extent. Field evaluation of potential density dependence should be included in the evaluation of this effort.

The ISRP also made overall recommendations for spring Chinook programs in the Snake River Basin that included the urgent need for analyses of abundance and productivity in supplemented populations. They concluded that "The supplementation projects as they are currently conducted with high proportions of hatchery fish in the hatchery broodstock and on the natural spawning grounds are likely compromising the long-term viability of the populations. Evaluation of most supplementation projects would benefit from a more thorough comparison with life-stage specific productivity of salmon from unsupplemented reference streams. All programs should evaluate the potential influence of density-dependent effect and investigate why density-dependence was occurring at such low population levels in those streams where it has been observed. In other words, is the capacity of spawning and/or rearing habitat restricting production of smolts when additional adults reach the spawning grounds?" They also recommended "Take action wherever needed to rapidly establish natural populations that are viable. The LSRCP needs to integrate information on the status of the natural populations into adaptive management of what can or should be done within hatchery programs to enhance the natural populations." **Response: WDFW has recently initiated the process to compare abundance and productivity of the Tucannon spring Chinook population with appropriate reference or control streams to evaluate the effects of supplementation. Further evaluation of density-dependent effects and carrying capacity in the Tucannon River is planned, along with substantial investments in habitat improvements within the Tucannon watershed.**

1.16.2) Potential Alternatives to the Current Program

Alternative 1a: Increased use of natural origin adults in hatchery broodstock **- (preferred Alternative)**

This alternative includes many aspects of our current hatchery program, as well as maximizing the spawners in the best habitat as described in alternative 1b, but it shifts to 100% natural origin adult Chinook in the hatchery broodstock when returns to the hatchery trap are expected to exceed 349 natural origin fish (NOR). Some specifics of this alternative are shown below, but other details will be worked out among the co-managers and described in the adult management plan as a supplement to this HGMP.

Broodstock collection goals would expand from the current 50% natural origin fish (NOR) to 100% when adult NORs at the Tucannon Hatchery weir are 350 or more (170 total broodstock needed for full program). Under this plan 50% or more of NORs at the trap at moderate and large returns would be passed upstream. Hatchery broodstock comprised entirely of NORs approaches or maintains agency PNI goals of 0.67, while allowing hatchery adults to spawn naturally upstream of the weir. This change would enable co-managers to achieve their different adult management goals without imposing a potential conflict over the need to remove hatchery fish at the weir.

The priority for escapement (regardless of fish origin) upstream of the weir would be 800 spawners (after pre-spawning mortality) before phasing in Tribal harvest (beyond ceremonial and subsistence levels) and other adult management actions (i.e. increase of natural spawning, transfer of hatchery fish to Asotin Creek, and implementing non-tribal fisheries). The triggers for fisheries (beyond C&S) and other management actions would be coordinated and submitted as a supplement to the HGMP within nine months of issuance of the Section 10 permit. This supplement would include the intent to phase in the transfer of a modest level of hatchery fish to Asotin Creek to expand the range of Tucannon spring Chinook, reduce risk to maintenance of this population, and to assist in meeting ESA recovery and co-manager restoration goals. Non-tribal fisheries would also be phased in, but tribal fisheries and expansion of natural spawning and distribution (including Asotin Creek) would be higher priorities than non-tribal fisheries.

The minimum adult abundance threshold (MAT) of 750 natural origin spawners recommended from the ICTRT and described in the newly revised salmon recovery plan for SE WA (SRSRB 2011) would be a primary goal that guides adult management, but hatchery broodstock collection and achieving adequate spawning levels (regardless of hatchery or wild fish origin) in the best habitat upstream of the Tucannon Hatchery weir are the highest priorities, respectively.

Alternative 1b: Maximize spring Chinook escapement into the best habitat:

The purpose of this alternative is to maximize the number of Tucannon River spring Chinook into the best spawning and rearing habitat. This will improve distribution of spawners from the Little Tucannon River upstream to at least Sheep Creek and enrich the productivity of the rearing area with marine derived nutrients. Recent genetic analysis comparing wild Tucannon River spring Chinook from 1986 (before the hatchery program began) to hatchery supplemented Chinook in 2008 found no genetic divergence from the original population. However, the lack of detection of a genetic difference over time applies only to the small number of loci examined, and may not adequately reflect undocumented genetic changes that may have occurred. The long-term goal however, is to pass mostly naturally produced fish upstream when escapement levels permit doing so.

Based on the minimum viable population abundance threshold (MAT = recovery goal) of 750 natural origin adults, as an interim goal we would need at least 500 natural origin adults upstream of the Tucannon adult trap based on historical proportions of approximately two-thirds (500 adults) upstream of the trap and one-third downstream (250).

1) If the pre-season estimated number of adults returning to the Tucannon adult trap is $\leq$ 250 fish: Collect up to 170 broodstock regardless of origin due to the historic low parent-to-progeny survival of naturally produced fish from the Tucannon River. All collected broodstock will be PIT tagged. This will enable us to return collected fish back to the river in case the run is larger than originally estimated and we took too many fish from the early part of the run.

2) If the pre-season estimated number of adults returning to the Tucannon adult trap is 250-800 adults (H+W): – Collect every other natural origin adult (up to 50% or 85 fish) and 85 hatchery origin adults for the broodstock (Additional jacks can be collected up to their proportion of the run with an upper limit of 15% of the broodstock). All collected broodstock will be PIT tagged to enable the return of fish back to the river in case too many fish from the early part of the run are collected. The target goal is at least 500 adults above the trap, but we intend to exceed that by 25% to account for pre-spawning mortality (note: additional escapement would be required to meet spawning goals depending on Tribal fisheries that may occur above the weir). This estimated 625 adults total (hatchery and natural fish combined) released upstream plus 170 captured for broodstock, equals a goal of approximately 800 adults captured at the adult trap. Adding the ~33% of adults that spawn below the trap (262 adult fish) provides a total return to the Tucannon River of 1,057 fish.

3) If the pre-season estimated number of adults returning to the Tucannon adult trap is > 800 – The broodstock goal is the same as #2 except that as total returns increase, more natural origin fish would be passed upstream to fill the spawning habitat. Excess fish above the 1,057 total return goal could be used for:

    a) Adult outplants in Asotin Creek.
    b) Fishing opportunities.
    c) Additional smolt production for use in Asotin Creek (only if additional space can be provided at Lyons Ferry Hatchery or elsewhere.

Alternative 2: Stepping stone approach using computer models:
This approach would utilize data derived from the AHA Scenario Manager for use with the In-Season Implementation Tool (ISIT). In-season updates of select biological parameters would be entered into ISIT and the computer program would direct fish managers as to the best course of action to maximize Proportion of Natural Influence (PNI).

The two hatchery components of the stepping stone approach would be a conservation (integrated) program for above the adult trap and a mitigation (segregated) program for below. Under the conservation hatchery program the goal would be to produce approximately 105,000 yearling smolts from the collection of approximately 60 to 80 adult broodstock (minimum 50% natural origin). These smolts would be marked with coded-wire tag only. Under the hatchery mitigation program, the goal would be to produce approximately 120,000 yearling smolts from the collection of approximately 90 hatchery adults. Released fish would be marked with CWT and an adipose clip. This would allow for harvest or removal at the Tucannon Hatchery trap to limit the proportion of hatchery fish spawning naturally in the upper Tucannon River.

Alternative 3: Stepping stone approach with dam construction downstream of the entire spawning area (*HRT Alternative 3*).
The current mean pHOS of 47% exceeds the HSRG guideline of pHOS < 30% for integrated hatchery programs. The U.S. Fish and Wildlife Service's Hatchery Review Team (HRT) believes this could explain why recruit-per-spawner (R/S) is < 1.0, and the past management practice of allowing all hatchery origin fish not retained for broodstock to spawn naturally upstream of the weir is a strategy that is not achieving desired management goals.

The HRT recommends discontinuing passing hatchery spring Chinook upstream of the hatchery weir and managing that portion of the naturally spawning population as a natural population reserve. Monitor and evaluate R/S ratios for the natural population for at least one full generation (5-6 years) to determine whether the value of R/S increases with a different management strategy. A second generation of not passing hatchery origin fish upstream should be investigated to determine whether the population upstream of the weir can achieve a level of self-sustainability (R/S > 1.0).

Investigate the feasibility of constructing a permanent dam/weir in the lower Tucannon River, downstream from all natural spawning areas. Such a dam/weir would also facilitate management of steelhead. The HRT concluded the demographic risks of drastically reducing the supplementation component of the program upstream of the weir were minor compared to the potential genetic and demographic benefits of such actions – because the supplementation component could be reinstated at any time. Surplus hatchery fish trapped at the dam/weir but not retained for broodstock could be provided to the tribes for subsistence or to food banks. A selective fishery downstream from the dam/weir could also be possible in high return years.

Construction of a dam/trap in the lower river under this alternative would be very costly. Permission would need to be granted from a landowner or a land purchase would need to be made. There is no guarantee that a trap would work as designed. Fish may avoid the trap and not be able to return to suitable over-summer holding and spawning areas and may be forced to hold in water that could reach lethal temperatures during summer. Also, the trap may not be 100% efficient, especially during high flows, defeating the purpose. Further, there is the potential that a trap in the lower river could cause a catastrophic population collapse of the Tucannon

River steelhead, fall Chinook, and spring Chinook populations, depending on the location of the weir/trap. Bull trout and Pacific lamprey movement may also be affected in the lower river. The HRT is ignoring the fact that the natural environment that the Tucannon spring Chinook adapted and evolved to has changed dramatically (i.e., hydroelectric dams, land use, climate change, etc.) and that this may be the reason for the lower natural origin recruit-per-spawner ratios. The HRT suggests that it would be a simple matter to just re-start the hatchery supplementation program if this option does not work, however that may not be the case if there is a catastrophic population collapse (as in 1995). Also, unless marking protocols ensured that strays were externally identifiable, trapping would be ineffective in removing strays. Note: The tribes have indicated that they would not support removing hatchery fish, or controlling their numbers from the spawning grounds.

Alternative 4: Rear Tucannon spring Chinook full-term at the Tucannon Fish Hatchery (*HRT Alternative 2*)
The alternative would maintain current program goals and strategies, but would relocate all rearing activities to the Tucannon Fish Hatchery. This is not feasible at this time due to high water temperatures and lack of adequate well water. This would require a new well and reorganization of other existing programs.

Alternative 5: Based on PIT tag recoveries of both natural and hatchery origin adults, a high proportion (~25%) of Tucannon spring Chinook appear to be bypassing the Tucannon River and are detected at Lower Granite Dam. Methods to capture Tucannon River spring Chinook in the Snake or increase escapement into the Tucannon River may be needed if efforts to increase adult fidelity to the Tucannon River are ineffective.

1. Conduct a radio telemetry study to help determine why Tucannon origin fish are bypassing the Tucannon River.
2. Increase PIT tags in Tucannon Spring Chinook to 25,000 to improve sample size to determine the magnitude of bypassing and enable collection of Tucannon origin fish at Lower Granite Dam using a sort by code.
3. Continue to emphasize the need for the Army Corps of Engineers to install a PIT tag array in the ladder at Little Goose Dam, or at both ladders at Lower Monumental Dam, to provide better data on Tucannon spring Chinook behavior.
4. Examine the possibility of using a chemical attractant to improve homing behavior of Tucannon River spring Chinook, and implement this action if feasible to improve homing.

Alternative 6a: Reinitiate the captive brood program at a reduced level (safety-net program), in conjunction with the existing supplementation program, to ensure adequate broodstock during low run years (2008 FCRPS BiOp RPA 41).
The 2008 Biological Opinion includes RPA #41 for the Tucannon River spring/summer Chinook safety-net supplementation program. This includes funding the capital construction, operation, and monitoring and evaluation costs to implement a program that builds genetic diversity using local broodstock and a

sliding scale for managing the composition of natural spawners comprised of hatchery origin fish. During low run years, having captive brood fish on hand as a safety net program would help to meet egg-take goals. If a safety net program was re-started, excess safety net broodstock could be spawned for planting fish in Asotin Creek (see 6b below). However, the captive brood program was specifically kept short in duration to limit potential adverse genetic effects on the endemic population. The program was originally initiated only as a "stop-gap" measure to halt the population decline due to a period of low run sizes. In addition, returns of adults from the captive brood program to date have been poor compared to the conventional hatchery program. For these reasons, the WDFW does not generally support this action. If the Tucannon Fish Hatchery were determined to be the location for a safety net program, new wells would need to be drilled and rearing vessels constructed.

Alternative 6b: Utilize Tucannon spring Chinook safety net fish in excess of Tucannon program goals for Asotin Creek spring Chinook re-introduction. (*HRT Alternative 5*) (2008 FCRPS BiOp RPA 41)
Habitat improvement projects that have been conducted on Asotin Creek may lead to increased production and survival. The historic spring Chinook population in Asotin Creek is considered functionally extirpated, although some spawning has been documented in recent years, which would make it available for a possible re-introduction effort. Expanding into the Asotin Creek Basin would provide another source of spring Chinook should problems occur in the Tucannon, and could increase the overall abundance of this unique Snake River population. The Major Population Group (MPG) for the lower Snake River includes only the Tucannon and Asotin populations; both must be viable for ESA recovery of this MPG (or the Tucannon population must be highly viable). Tucannon spring Chinook are the most appropriate stock for Asotin Creek reintroduction based on a recent genetic evaluation of spring Chinook sampled from Asotin Creek (Blankenship and Mendel 2010). However, use of Tucannon spring Chinook in Asotin Creek should occur only after specific details are described and agreed to by the co-managers in the adult management plan that is scheduled to be developed in association with this HGMP. Tucannon River spring Chinook is a listed species and the annual returns are often is not large enough to be used as a founding population for a different watershed. However, during good return years transferring hatchery adults from the Tucannon River into Asotin Creek is a reasonable option for adult management in the Tucannon River and reintroduction into Asotin Creek. This action is the WDFW preferred safety net approach, which would substantively improve spatial diversity and population abundance within the lower Snake MPG.

Alternative 7: Develop an additional Tucannon spring Chinook program that is maintained with returns to Lyons Ferry Hatchery. (*HRT Alternative 6*)
Develop a Tucannon spring Chinook program at Lyons Ferry Hatchery where adults are collected and juveniles released. The programs purpose would be a conservation reserve as an alternative to a captive brood program under the assumption that SARs for Tucannon spring Chinook released from Lyons Ferry would be better than fish released from Tucannon Hatchery. The existing program

of fish releases from Tucannon would continue. Over the long-term, if this program were successful, it would assist with providing harvest benefits in the Snake River project area. Efforts are currently underway to evaluate spring Chinook trapping and PIT tag detections at Lyons Ferry Hatchery beginning on May 1st for each of three years beginning in 2010.

Response: The preferred alternative in 1a described above would be refined as the adult management plan is completed as a supplement to this HGMP. The current production program, and the preferred alternative, described in this HGMP are consistent with the production and marking plans as defined in US vs. OR.

1.16.3) Potential Reforms and Investments

Reform/Investment 1: Increased use of natural origin adults in hatchery broodstock and maximizing spring Chinook in best available habitat alternatives – Only minor changes to the current program would be needed. Some additional cost would be incurred in transporting fish to Asotin Creek if this was implemented as part of this alternative (dependent on an adult management plan to supplement this HGMP) - $.

Reform/Investment 2: Stepping stone program using computer programs – Additional time would be needed to input data into the models to keep them current - $.

Reform/Investment 3: Stepping stone program with dam construction – Land may need to be purchased and the cost of construction and operation of a new trap/weir in the lower river would be very high - $$$$$$.

Reform/Investment 4: Rear spring Chinook full term at Tucannon Fish Hatchery – Conduct a feasibility study at Tucannon Fish Hatchery to see if additional water was available and outline facility changes. New wells would need to be drilled and Tucannon Fish Hatchery would need to be modified - $$$$$.

Reform/Investment 5: Bypassing problem –

1. Radio telemetry – $$.
2. Increase PIT tagging to 25,000 tags – $$.
3. PIT tag array at Little Goose Dam – $$$ to $$$$.
4. Evaluation of the potential, and plan development, for use of chemical drip to improve homing - $
5. Chemical drip evaluation and possible trial implementation - $ to $$.

Reform/Investment 6: Safety-net program – Asotin Creek re-introduction - If this action consists solely of transferring adults to Asotin Creek it may require only operational costs to haul adults - **$**. However, it could also include holding adults until just before spawning and then releasing them into Asotin Creek to spawn – that would take space at the hatchery and new tanks may be needed - **$$**. If this action includes taking extra broodstock, spawning them and rearing progeny for release into Asotin Creek, it would require additional tanks for rearing fish at LFH, where tanks have already been constructed for the captive brood program and costs could be only operational if those tanks are not used for other fish production - $$ to $$$. If the additional production is located at Tucannon Fish Hatchery, new wells would have to be drilled and a rearing area would need to be constructed - $$$$ to $$$$$.

Reform/Investment 7: – Lyons Ferry and Tucannon Fish Hatchery may need to be modified to accommodate holding additional fish. Additional funding for transportation from Lyons Ferry, or PIT tagged Tucannon Chinook from Lower Granite Dam, would be needed to transfer spring Chinook into Asotin Creek. A new acclimation and release facility on Asotin Creek may need to be constructed - $$$ to $$$$.

Reform/Investment 8: Trapping or detecting PIT tags at Lyons Ferry Hatchery adult sorting area – Modifications to Lyons Ferry Hatchery may be needed to construct and operate a PIT tag detector in the sorting tube or to hold additional adults. PIT tagging may need to be increased - $$ to $$$.

Reform/Investment 9: Implement use of Moist Air Incubators (MAI) at Lyons Ferry Hatchery - The WDFW is recommending change to MAIs to reduce water needed for incubation and to enable chilling of the eggs to improve consistency of fish size at ponding for improved feeding and growth - $.

Reform/Investment 10: Increase adult holding area at the Tucannon Hatchery trap or implement video counting, as appropriate. – On some days during large run years adults become crowded in the adult trap at the Tucannon Hatchery. Implementation of video counting may be a solution during some days, but it may compromise the mark-recapture population estimation efforts. Expansion of the trap area may be necessary to reduce crowding on large return days at Tucannon Hatchery, especially on weekends with few staff available for processing fish - $$$.

For Reference:

$	<$50,000
$$	$50,000-<$100,000
$$$	$100,000-<$500,000
$$$$	$500,000-<$1,000,000
$$$$$	$1,000,000-<$5,000,000
$$$$$$	Over $5,000,000

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

The WDFW was issued Section 10 Permits (#1126 – research activities on the Tucannon and Asotin Creek and #1129 – hatchery propagation for Tucannon spring Chinook) in the past as required when working with ESA protected populations. Those permits have since expired (Permit #1126 expired June 30, 2003 and Permit #1129 expired Dec. 31, 2003). This HGMP has been previously submitted as the application for a new Section 4 (d) Permit for this program (Dec. 19, 2003).

WDFW also has USFWS Consultation with NMFS for LSRCP actions and the NMFS FCRPS Biological Opinion, and a statewide Section 6 Consultation with the USFWS for interactions with Bull Trout. Further, WDFW has written HGMPs to cover all stocks/programs produced at LFC.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

WDFW has estimated natural and hatchery-origin spring Chinook escapement into the Tucannon River since 1985 (Table 5). The largest escapement to date was seen in 2009 when an estimated 1,862 fish returned (Gallinat and Ross 2010), of which 750 were natural-origin. The lowest return on record was in 1995, when an estimated total of 54 fish were believed to escape into the system, 21 of which were natural-origin. Tag recoveries from fish spawned at the hatchery, and recovered from the spawning grounds on the Tucannon River, show the population to be made up of 3-5 year old individuals (all 1-year freshwater age and 2-4 year ocean age). Rarely have 6-year old individuals been identified in the population. The dominant age of return for both natural and hatchery origin is four years (65-75%). Three-year old fish occur more in the hatchery population (mean 1985-2008 broods = 23%), with natural-origin fish from the same period at 3%. The hatchery environment, with warmer water temperatures and abundant food supply, allows for faster growth that results in earlier maturation. Sex ratios vary between years but generally average 1:1 for most years.

Fish enter the Tucannon River primarily from late April through early July. Since 1985, redds have been observed as high as rkm 85 (Gallinat and Ross 2009), and as low as rkm 12.7 (Gallinat and Ross 2007). Juveniles have been documented as low as rkm 22 (WDFW Unpublished data). Spawning begins in late August and can continue into the first week of October. Hatchery and natural fish appear to enter and spawn in the river at the same time. About 70% of the run is captured at the Tucannon adult trap each year.

Generally, juvenile spring Chinook rear successfully in the Tucannon above rkm 39 (Marengo). Though they can be found in lower sections of the Tucannon River, their survival is likely limited by potentially lethal summer rearing temperatures and predators (e.g. smallmouth bass, northern pikeminnows, white pelicans, etc). Between rkm 39 and 84, rearing conditions are generally good and should improve due to conservation and stream rehabilitation efforts in recent years (reduced stream temperatures, and improved channel complexity). The majority of juveniles spend one year in the Tucannon River before out-migrating as smolts.

The majority of smolts leave the Tucannon River between early March and late May; however, a fall migration has also been documented (Mendel et al. 1993). Natural smolt size varies (80-135mm), and appears to vary annually in relation to total fish production in the river (Gallinat 2010). Natural production of smolts has varied between 75 and 61,000 fish based on smolt trapping estimates (Gallinat and Ross 2009).

Hatchery smolt size has also varied over the years. The current goal is for release at 15 fish/lb or 30.0 g/fish, however WDFW is conducting a size at release study to examine if a 9 fish/lb or 50 g/fish goal would increase survival. Hatchery spring Chinook smolts have been released at a variety of locations over the years (rkm 58-78) to determine optimum release location (Bumgarner et al. 1996). Currently, all hatchery smolts are volitionally released from Curl Lake Acclimation Pond (rkm 66).

Spring Chinook in Asotin Creek are limited but they are linked and affected by Tucannon spring Chinook both by naturally produced and hatchery fish, and hatchery Tucannon spring Chinook may be transferred to Asotin Creek in the future. Spring Chinook enter Asotin Creek in May through at least early to late July, and they spawn and rear in the upper portion of the mainstem Asotin Creek and the North Fork Asotin Creek. The majority of juveniles spend one year in Asotin Creek before out-migrating as smolts or transitional emigrants. Emigrants move downstream in fall and spring, with the vast majority migrating in spring.

- Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.

Tucannon River natural and hatchery origin spring Chinook are part of the listed Snake River Spring/Summer Chinook ESU. Each is currently used in the hatchery supplementation program. Natural spring Chinook, and hatchery spring Chinook from the Lyons Ferry Hatchery program, that return to Asotin Creek are also part of the listed Snake River Spring/Summer Chinook ESU. Tucannon River natural and hatchery origin fish will be directly affected by broodstock collection activities and proposed efforts to transfer hatchery Chinook into Asotin Creek would also affect the Tucannon hatchery adults and jacks. The Tucannon spring Chinook hatchery broodstock collection and production program action is deemed necessary at this time for continuation of the stock in the Tucannon River.

- Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

The supplementation program will incidentally affect Tucannon River bull trout, summer steelhead and fall Chinook, plus steelhead and bull trout in Asotin Creek or other areas where Tucannon spring Chinook may be straying (or reintroduced) upstream of Lower Granite Dam . Beneficial effects include increased primary productivity from marine derived nutrients deposited within the basin due to increased adult Chinook abundance. Juvenile hatchery and natural origin spring Chinook may compete for food and space with naturally rearing bull trout and summer steelhead of the same size. However, as a positive benefit to bull trout and summer steelhead, any hatchery reared smolts released into the system, or additional natural production of juvenile spring Chinook in the Tucannon River (and Asotin Creek) from the hatchery program, may serve as prey. Bull trout and summer steelhead are also captured in the adult traps at TFH in Asotin Creek during the same period when spring Chinook are captured. All bull trout and summer steelhead captured will be immediately released after sampling. Trapping/sampling/handling of bull trout has been authorized by USFWS under a Section 6 Cooperative Agreement with WDFW. Trapping/sampling/handling of summer steelhead in the Tucannon River will be authorized by NMFS under an HGMP for Tucannon River Endemic summer steelhead. Bull trout, summer steelhead, and fall Chinook may also be captured during smolt trapping operations in the lower river. Trapping/sampling/handling of summer steelhead and Chinook in Asotin Creek has been authorized by NMFS under an annual research/monitoring 4d permit. Strict protocols are followed to minimize handling effects on fish.

2.2.2) <u>Status of ESA-listed salmonid population(s) affected by the program.</u>

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

In 1992, NMFS listed Snake River spring/summer Chinook salmon as "endangered", and then re-classified them as "threatened" in 1995. Tucannon River and Asotin spring Chinook are part of the Snake River spring/summer ESU and Lower Snake MPG. The Tucannon River natural population is currently below replacement level (FCRPS BiOP analysis) and the Asotin population is considered functionally extirpated (SRSRB 2011). As such, stochastic events pose significant genetic risk to the Tucannon population because of low absolute population numbers and its limited distribution. Based on the minimal viable population recovery goal of 750 natural origin fish (over an 10-year geometric mean) we would need at least 500 natural origin fish upstream of the Tucannon Fish Hatchery adult trap based on historical proportions of approximately two-thirds (500 fish) upstream of the trap and one-third downstream of the trap (250). Average natural escapement has been 331 spawners/year since 1985, with an estimated range of 3-750 fish. Average hatchery escapement has been about 257 spawners/year since 1988, with an estimated range of 19-1,112 fish (Table 5).

Bull Trout

Spawning ground surveys conducted within the Tucannon River Basin have suggested a variable to recently declining population of bull trout since 1991 (WDFW District 3 Fish Management Files- Dayton, Washington). Resident, fluvial and ad-fluvial segments of the population are all believed to be present (Martin et al. 1992; Faler et al. 2006). Bull trout also exist in Asotin Creek and they are considered at critically low abundance levels. Based upon the population status of the species, and risk factors affecting the likelihood for its continued existence, the USFWS determined that Columbia River basin bull trout warrant protection under the ESA as a distinct population segment (DPS). Individual basin population status (including the Tucannon River) is currently under revision and review by the USFWS. A draft lower Snake River Bull Trout Recovery Plan was prepared in 2002 and again in 2005.

Summer Steelhead

The Tucannon River summer steelhead population is part of the Snake River ESU and Lower Snake MPG. Washington Department of Fish and Wildlife has estimated natural steelhead escapement into the Tucannon River since 1987 through the use of redd counts. The largest natural-origin escapement was seen in 1988 when an estimated 525 fish spawned (WDFW 1999). Numbers have decreased steadily since 1990 and the spawning population was estimated at only 71 individuals in 1996 and 31 in 2000.

Tucannon summer steelhead was classified as depressed because of chronically low escapement by WDFW (SASSI 1993). The population is likely at a “critical” population threshold because it is chronically depressed. The population is believed to be below replacement in most years, and stochastic events pose significant genetic risk to the population because of low absolute population numbers. Washington established an interim escapement goal in the 1993 SASSI document of 1,200 spawners. Present escapement is far below that goal. The ICTRT considers the Tucannon steelhead to be an intermediate population with a Minimum Abundance Threshold (MAT) for population viability of 1,000 fish. Recent escapements have been far below MAT and may fall below critical minimum viability level (250 natural fish) for most years.

The Asotin summer steelhead population is also part of the Snake River ESU and the Lower Snake MPG. The Washington Department of Fish and Wildlife has estimated natural steelhead escapement into Asotin Creek at an adult weir and trap in the lower basin since 2005. The natural-origin population estimates have varied from a low of 284 in 2007 to a high of 1,411 in 2010 (Crawford, et al. 2011). Most hatchery fish have been removed at the weir since 2008. Additional components of this population include steelhead in Alpowa, George, Tenmile, Couse and Almota creeks. Alpowa Creek has been monitored with an adult steelhead trap since 2008 with wild steelhead return estimates of 75 in 2008 to 307 in 2010. Hatchery spawners in Alpowa Creek have been common and comprised 26-54% during the three years of monitoring.

The ICTRT considers the Asotin Creek steelhead to be a basic population with a Minimum Abundance Threshold (MAT) for population viability of 500 fish. Recent escapements have been near or above MAT, especially if the other tributaries with Asotin population steelhead included.

Fall Chinook

Natural origin fall Chinook in the Tucannon River and Asotin Creek are listed as “threatened” under the ESA as part of the Snake River ESU. Since 1987, the WDFW has estimated 16-254 fall Chinook salmon redds per year in the lower 21 rkm of the Tucannon

River. Occasional fall Chinook redds have been found in lower Asotin Creek in recent years. Many of the carcasses recovered in the Tucannon River have been unmarked, and therefore are of unknown origin. Fall Chinook from outside the Snake River Basin (i.e., Umatilla and Bonneville Hatchery fall Chinook) are known to stray into the Snake River Basin in some years. Carcass recoveries from the Tucannon River indicate spawners are a conglomeration of hatchery returns, primarily from Lyons Ferry hatchery and some fish from other basins and hatcheries, sometimes representing up to 95.5% (in 1996) of the fish sampled. However, once these fish spawn in the Tucannon River or Asotin Creek, progeny that survive become listed as “threatened” under the ESA, unless the progeny can be genetically determined to be from non-Snake River origin fish. By mandate of the Act, the managers are therefore obligated to protect this listed species and improve their critical habitat to the fullest extent possible. Fall Chinook in the Tucannon River and Asotin Creek contribute to the overall population abundance in the Snake River, which is close to meeting ICTRT viability abundance in most recent years.

- 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.

Return per spawner ratios (R/S), and survival by various life stages have been calculated for natural and hatchery-origin Tucannon River spring Chinook salmon as part of the LSRCP evaluation program (Table 6). Naturally reared spring Chinook are currently below the replacement level at their current levels of spawner abundance with a geometric mean R/S ratio of 0.58. Hatchery reared fish are currently above replacement with a geometric mean R/S ratio of 1.64 (Gallinat and Ross 2009). No similar information is available for spring Chinook in Asotin Creek because of the population is considered functionally extirpated.

Table 6. Survival of natural and hatchery origin spring Chinook salmon from the Tucannon River.								
	Natural Origin				**Hatchery Origin**			
Brood Year	**R/S**	**% Egg-parr survival**	**% parr-smolt survival**	**% Egg-smolt survival**	**R/S**	**% Egg-parr survival**	**% parr-smolt survival**	**% Egg-smolt survival**
1985	0.69	10.6	46.6	4.9	5.00	90.3	96.4	87.1
1986	0.90	13.1	56.7	7.4	3.59	94.3	86.7	81.8
1987	0.49	10.4	55.6	5.8	2.27	83.8	92.4	77.4
1988	1.73	15.2	54.3	8.3	5.11	82.6	97.0	80.1
1989	0.57	14.4	51.2	7.4	1.99	77.5	95.8	74.2
1990	0.15	13.2	57.4	7.6	0.36	70.9	95.5	67.7
1991	0.02	19.0	54.7	10.4	0.35	84.6	95.9	81.1
1992	0.35	14.2	49.2	7.0	0.99	97.0	57.8	56.1
1993	0.47	12.9	57.1	7.4	2.27	86.3	95.6	82.5
1994	0.17	7.1	55.0	3.9	0.49	82.2	97.9	80.4
1995	0.55	0.0	0.0	0.3	4.56	74.5	97.4	72.6
1996	0.51	1.2	56.7	0.7	3.61	68.5	94.9	65.0
1997	5.47	13.2	64.0	8.4	2.03	20.6	81.6	16.8
1998	7.63	8.7	65.2	5.6	9.36	84.5	94.1	79.5
1999	1.32	12.3	51.2	6.3	0.27	94.1	91.3	86.0
2000	1.87	13.8	44.9	6.2	2.15	95.6	82.8	79.2
2001	0.27	6.1	60.1	3.6	1.20	95.0	84.0	79.8
2002	0.23	6.7	83.8	5.7	1.29	89.5	81.6	73.0
2003	0.47	9.1	56.2	5.1	0.95	89.9	56.3	50.6
2004	0.83	6.0	68.3	4.1	1.36	91.8	52.4	48.1
2005		5.8	83.1	4.8		93.9	98.7	92.6
2006		---	---	10.7		90.9	94.8	86.2
2007		---	---	3.0		94.1	97.9	92.1
2008						95.1	94.0	89.4
2009						90.4		
Geometric Mean	0.58	8.5	47.6	4.8	1.64	82.1	86.8	71.0

- 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.

Estimated natural and hatchery-origin spawning spring Chinook salmon in the Tucannon River from 1985-2008 has been calculated (Table 7) based on weekly spawning ground surveys, carcass collection, and adult trap information. The data are compiled from the LSRCP annual reports for Tucannon River Spring Chinook Hatchery Evaluations. The redd counts for spring Chinook in Asotin Creek has ranged from a high in 1973 of 13 to two or zero from 1985 through 2001 and since then has ranged from 3-13 (SRSRB 2011).

Table 7. Estimates of natural and hatchery reared Tucannon River spring Chinook salmon on the spawning grounds from the Tucannon River, 1985-2009.				
Run Year	**Natural Origin**	**Hatchery Origin**	**Percent Natural**	**Percent Hatchery**
1985	569	0	100.0	0.0
1986	520	0	100.0	0.0
1987	481	0	100.0	0.0
1988	294	10	96.7	3.3
1989	269	7	97.5	2.5
1990	433	178	70.9	29.1
1991	219	171	56.2	43.8
1992	336	228	59.6	40.4
1993	254	182	58.3	41.7
1994	62	8	88.6	11.4
1995	11	0	100.0	0.0
1996	105	31	77.2	22.8
1997	78	68	53.4	46.6
1998	37	14	72.5	27.5
1999	2	105	1.9	98.1
2000	70	169	29.3	70.7
2001	658	236	73.6	26.4
2002	308	589	34.3	65.7
2003	205	161	56.0	44.0
2004	349	131	72.7	27.3
2005	240	77	75.7	24.3
2006	104	57	64.6	35.4
2007	144	106	57.6	42.4
2008	492	564	46.6	53.4
2009	661	1015	39.4	60.6

- Provide the most recent 12-year (e.g. 1988-2000) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

See Table 7 above.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.

Broodstock Trapping: Listed spring Chinook adults (Tucannon River natural and hatchery-origin) will be trapped and collected for broodstock from April through September, which constitutes a direct take of listed fish (Take Table A). Natural and hatchery-origin adults will be trapped, handled, and passed upstream during trapping operations which may lead to injury and/or mortality of listed fish. In the near future some hatchery spring Chinook may be removed at the TFH trap and transferred to Asotin Creek, either after having been held at LFH until nearly ripe, or relocated to Asotin Creek immediately. Details regarding this action will be described in the adult management plan that will supplement this HGMP within nine months of issuance of the Section 10 permit. The THF trap is entirely fenced to prevent unauthorized access. A hanging plastic curtain was installed at the Tucannon adult trap by hatchery staff during the winter of 2008 to inhibit salmon and steelhead from bypassing the adult trap during high flows.

Bull trout and summer steelhead are indigenous to the Tucannon River, and indirect takes of bull trout and summer steelhead are anticipated through the broodstock collection program. Any bull trout or summer steelhead encountered at the adult trap will be sampled (length, DNA, scales) and then passed immediately upstream, with minimal delay. Trapping and sampling of bull trout has been authorized by USFWS in accordance with a Section 6 Cooperative Agreement for the Endangered and Threatened Fish and Wildlife Program – Washington.

<u>Spawning, Rearing and Releases:</u> Spawning of the adults, egg incubation, and rearing/release of spring Chinook for 18 months from September through the second week of April has a potential for lethal take of these listed spring Chinook. Mortality can occur in association with fish culture activities and conditions which affect fish health and development, from handling procedures, fertilization procedures, water temperature, water quality, water flow, feeding success, marking, and transport. Further, the release of hatchery-origin Tucannon River spring Chinook may incidentally affect (take) other listed salmonids in the Tucannon River by displacement or competition.

<u>Monitoring and Evaluation:</u> Contact with listed summer steelhead may occur during spawning ground surveys in the Tucannon River or in Asotin Creek (August-October). Adult trapping for broodstock and adult enumeration at the Tucannon Fish Hatchery will sample spring Chinook, steelhead and bull trout. Snorkeling, cast netting, smolt trapping, and PIT tagging programs may take listed spring Chinook. Each of these activities is described in more detail below.

Spawning Ground Surveys: Takes associated with spawning ground surveys (Take Table B) will occur in the form of “observe/harass” and from occasional carcass recovery of spawned adults. Spawning surveys for spring Chinook are conducted from late August through early October. Surveys are conducted in the Tucannon River once or twice a week, with the intent to estimate spawning escapement. However, spawning surveys in Asotin Creek occur only once or twice each fall (September through October) and include the North Fork of Asotin and the mainstem Asotin downstream from the forks to near Headgate Park. Surveys in the Tucannon River cover the entire range of spring Chinook spawning (King Grade rkm 34.1 to Sheep Creek rkm 84.2). Additional surveys are sometimes conducted below King Grade but have seldom indicated any spawning activity. Each survey section is about 4.8-6.4 kilometers in length. During each survey, surveyors look for redds, record and mark their location, and look for live and dead fish. During the peak of the spawning activity (around mid-September) additional surveys are walked to collect snouts from spawned-out carcasses for CWT recovery. Carcasses provide additional data for run and age composition, study group analysis, and DNA samples. Properly conducted surveys are not expected to result in any direct or indirect mortality.

Cast Netting: Cast netting is a method utilized by WDFW, in conjunction with snorkeling, to evaluate the level and origin of precocial parr on the Tucannon spring Chinook spawning grounds. Recently, other hatchery evaluation programs have discovered a high incidence of precocial parr on spring Chinook spawning grounds that were occurring as a direct result of the hatchery program (Larsen et al. 2004). WDFW utilizes cast nets to minimize disturbance to the habitat and lessen potential harm to the fish and eggs other sampling methods (i.e., seining, electrofishing, hook and line fishing, etc.) might cause. A snorkeler observes the juvenile fish underwater and directs the cast netting crew where to throw the net. The fish are captured alive, sampled for length, origin, and age, and released back into the water. Takes occur in the form of “observe/harass” during snorkeling and “capture/handle, and release” during cast netting (Take Table B). Properly conducted surveys are not expected to result in any direct or indirect mortality.

Snorkeling: Snorkel surveys have been terminated in recent years because of concerns about the degree of bias in the estimates that result. However, snorkel surveys may be initiated again if methods to reduce bias are found or a specific need for the juvenile data is described. Takes in the form of “observe/harass” occur during snorkel surveys (Take Table B). Snorkel surveys may occur between July-September, and are conducted to monitor distribution and abundance of juvenile spring Chinook in the Tucannon River. Surveys are generally conducted with two people, both starting at the lower end of an index site. Each snorkeler moves upstream counting about ½ of the river. The total number of fish is then recorded and the site length and width are measured for total surface area. Total time to complete an index site varies, but is generally less than 15 minutes. We have no estimate of the degree of harm, injury, or mortality to listed fish associated with snorkeling activities, but it is believed to be negligible. Based on observations during snorkeling, the fish observed move slightly when the snorkelers pass, but quickly re-establish themselves near their original location.

Electrofishing: Electrofishing surveys have also been terminated in recent years. However, electrofishing surveys may be reinitiated in the future if methods/techniques are developed to reduce bias, and a specific purpose of the data is described. Incidental takes of listed spring Chinook in the Tucannon River may occur during electrofishing surveys (Take Table B). Electrofishing surveys may occur from July through August, and are usually conducted to monitor distribution and abundance of natural-origin steelhead. Spring Chinook captured during electrofishing surveys will be used to provide a secondary estimate to compare with the snorkel estimates. Electrofishing surveys will also allow limited data on fish length, weight, and condition factor during the summer months.

Electrofishing surveys are conducted using a modified Smith-Root backpack electroshocker with upgraded, state of the art electronic components. Use of a programmable output waveform electroshocker has decreased the incidence of injury to small fish. Guidelines established by NMFS and WDFW will be followed when conducting surveys. Pertinent environmental information during surveys (conductivity and temperature for each site) will be recorded.

PIT Tagging: Takes of listed natural and hatchery-origin spring Chinook will occur during PIT tag studies (Take Table B). Tagging will occur at the Tucannon Hatchery prior to transfer to Curl Lake or at Curl Lake when fish are actively migrating. Tagging will also occur at the Tucannon River smolt trap (described in the next section). Tagging of listed hatchery-reared fish with PIT tags will provide information on downstream migration performance (relative survival, migration speed, and timing) from release points in the Tucannon River. Tagging will also be conducted to examine movements through the dams as adult fish have been shown to bypass the Tucannon River during their return (Gallinat and Ross 2009). Tagging procedures follow established protocols used throughout the Columbia and Snake River basins by WDFW and other agencies when PIT tags are utilized. Mortality of PIT tagged fish has been 1% or less.

Smolt Trapping: Takes of out-migrating listed spring Chinook (natural and hatchery-origin) will occur at WDFW's smolt trap (Take Table B) located on the mainstem Tucannon River (rkm 3). The trap will be operated from October to early July each year to capture natural and hatchery-origin spring Chinook, natural fall Chinook, and natural and hatchery-origin summer steelhead. Smolt trapping enables WDFW staff to estimate natural smolt production from the basin, and evaluate performance of hatchery releases. Some of the natural and hatchery fish captured will be measured, weighed and released. Small groups of captured fish (natural or hatchery-origin) will receive a partial caudal fin clip for identification and transported back upstream about one kilometer and released to calculate trap efficiency. Most fish will be counted and released immediately back to the stream to continue their out-migration. During peak out-migration, fish may be held in live boxes for two to three hours before release (mark/recapture trial, or PIT tagged). At other times of year the trap may be checked only once a day. Delayed migration will result for fish captured in the trap, and delayed mortality as a result of injury may also result.

- 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.

Operation of the adult trap to capture spring Chinook from April to October will result in the direct take of listed spring Chinook salmon, although mortalities due to trapping are expected to be low (Table 8). Operation of the adult trap during that time will also indirectly take listed bull trout and summer steelhead. Trap operations have the potential to prevent or delay upstream migration of a small number of bull trout or summer steelhead. The adult trap may also cause indirect mortalities as a result of handling fish to remove them from the trap. Mortalities are expected to be less than 5% of the total spring Chinook, bull trout, or summer steelhead trapped. Previous trap operations have not documented any direct delay of bull trout or steelhead. A hanging plastic curtain was installed at the adult trap during the winter of 2008 to inhibit salmon and steelhead from bypassing the adult trap during high flows. If a fish jumps they should be stopped by the curtain and fall back into the water. Once the adult management plan is completed and submitted to supplement this HGMP it may include capture and reintroduction of spring Chinook adults and jacks into Asotin Creek. The transfer of hatchery fish into Asotin Creek is likely to increase mortality because of handling stress, but the increased mortality is expected to be low (less than 5 fish).

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

WDFW has operated the adult trap site (~rkm 59) continually from May to October since 1990 (Table 8). Prior to 1990, the trap was operated from late April to early July to collect broodstock for the hatchery. Direct mortalities associated with trapping have been very low.

Table 8. Number of trapped natural and hatchery-origin adult spring Chinook captured at the Tucannon River adult trap (rkm 59) from 1986-2009.

Run Year	Natural Origin	Natural Mortalities	Hatchery Origin	Hatchery Mortalities	Total Trapped	Total Mortalities
1986	247	0	0	0	247	0
1987	209	0	0	0	209	0
1988	267	0	9	0	276	0
1989	156	0	102	0	258	0
1990	252	0	216	1	468	1
1991	109	0	202	0	311	0
1992	242	8	305	3	547	11
1993	191	0	257	0	448	0
1994	36	0	34	0	70	0
1995	10	0	33	0	43	0
1996	76	1	59	4	135	5
1997	99	0	160	0	259	0
1998	50	0	43	0	93	0
1999	1	0	139	1	140	1
2000	28	0	177	17	205	17[a]
2001	405	0	276	0	681	0
2002	168	0	610	0	778	0
2003	84	0	151	0	235	0
2004	311	0	155	0	466	0
2005	131	0	114	3	245	3[a]
2006	61	0	78	3	139	3[b]
2007	112	0	112	6	224	6[a]
2008	114	0	386	1	500	1[a]
2009	390	0	835	7	1,225	7[a]

- [a] Stray hatchery fish that were killed outright.
- [b] Two were stray hatchery fish that were killed outright. The remaining mortality was a Tucannon origin fish that died due to trapping.

-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 (e.g. capture, handling, tagging, injury, or lethal take).

See "Take" Tables A and B at back of document.

- 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.

While WDFW has tried to foresee all possible mortalities for hatchery and evaluation activities described within this HGMP, it is possible that certain situations may arise either in broodstock trapping, or evaluation projects that take levels may be exceeded. In the event WDFW can foresee that a particular take level will be exceeded, it will contact NOAA Fisheries immediately to apprise them of the problem. NOAA Fisheries and WDFW will formulate a plan that will minimize any further takes. Should a take level be unexpectedly exceeded, WDFW will immediately halt the operation (i.e., broodstock trapping, smolt trapping, etc.) that caused the mortalities. Consultations will begin immediately with NOAA Fisheries to see if an agreed upon solution to the mortalities can be utilized so activities may continue.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

Lyons Ferry Complex is part of the LSRCP Program and the production of spring Chinook is part of legally required mitigation provided to the state of Washington under the LSRCP Program. According to the Artificial Production Review (APR-1999), the Power Council stated "Management objectives such as for harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important." WDFW believes they have taken such actions with the proposed program outlined in this HGMP to be consistent with the Policy Recommendations in the APR. Tucannon River Spring Chinook production is also mandated under the U.S. v. Oregon Management Plan.

Further, in 2009, Washington's Fish and Wildlife Commission adopted their "Policy on Hatchery Reform". Its purpose was: To advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. Hatchery reform is the scientific and systematic redesign of hatchery programs to help recover wild salmon and steelhead and support sustainable fisheries. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. Washington Fish and Wildlife Commission Policy: POL-C3619

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

This HGMP would be consistent with the following cooperative and legal management agreements. Where changes to agreements are likely to occur over the life of this HGMP, WDFW is committed to amending this plan to be consistent with the prevailing legal mandates.

- *U.S. v. Oregon 2008-2017 Management Agreement*.
- *Lower Snake River Compensation Plan* - goals as authorized by Congress direct actions to mitigate for losses that resulted from construction and operation of the four Lower Snake River hydropower projects.
- *WDFW Wild Salmonid Policy* - Fish and Wildlife is directed by State and Departmental management guidelines to conserve and protect fish populations within Washington, and use of an endemic broodstock to minimize staying of hatchery fish is preferred.
- *Fisheries Management and Evaluation Plan* (FMEP) - has been submitted to NOAA Fisheries for ESA consultation for all fisheries in SE WA, except spring Chinook. NOAA Fisheries has required that spring Chinook be removed from the draft FMEP and discussions continue for development of the spring Chinook FMEP. Fishery management objectives within the draft FMEP and this HGMP will be consistent.
- *Snake River Salmon Recovery Plan* **–** The Governor of the State of Washington committed WDFW to cooperate and partner with regional governments to develop a science based and community supported strategy for salmon recovery. A draft plan was completed in December 2006 and revised in 2011. WDFW will continue to work with regional governments to recover salmon and steelhead populations in the Snake River Basin.

3.3) Relationship to harvest objectives.

The LSRCP, as a mitigation program, defined replacement of adults “in place” and “in kind” for appropriate state and tribal management purposes. In addition, WDFW has identified the maintenance of abundant naturally spawning populations and harvest as valuable management goals (WDFW Wild Salmonid Policy, 1997). WDFW’s intentions would be to harvest a high proportion of the hatchery returns from this program if the naturally produced component of the population was meeting or exceeding ESA abundance targets of 750 adults per year. WDFW has proposed two draft sliding scales for harvest to NOAA Fisheries, dependent on whether adipose clipped fish are present or not. A draft FMEP for spring Chinook non-tribal harvest in the Tucannon, Snake and Grande Ronde rivers will be developed by WDFW in 2011 and submitted to NMFS. Both the CTUIR and NPT have recently exercised their tribal fishing rights during years when runs were large enough the tribes were comfortable that they could support it. Harvest of returning hatchery fish is a high priority, but only when the population can support it.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Based on 1985-2004 brood year Coded-Wire-Tag (CWT) recoveries from the Regional Mark Information System (RMIS) database, harvest (sport, commercial, and treaty ceremonial) has accounted for less than 6% of the adult hatchery fish recovered annually. From 1975 through 2000 spring Chinook harvest was very limited or completely closed in most or all of the Columbia Basin. All sport fisheries within the Snake River are selective for hatchery-reared fish (denoted by lack of the adipose fin) and require release of natural-origin spring Chinook (intact adipose fin). The adipose fin clip was abandoned for Tucannon River spring Chinook starting with the 2000 brood year to decrease fishing mortality on this ESA listed population. Limited hooking mortality may occur as a result of sport fisheries on adults. Limited tribal fisheries by members of the CTUIR and NPT have periodically occurred in the Snake River and no tribal or commercial fisheries exist in the Snake River downstream of Little Goose Dam (from Little Goose Dam upstream has recently been opened to NPT anglers, but tribal fisheries in the Snake River have remained upstream of Lower Granite Dam, except for use of rod and reel). Recent tribal harvests in the Tucannon River have been under 10 fish per year and would be considered ceremonial and subsistence levels.

3.4) Relationship to habitat protection and recovery strategies.

Limited comprehensive review of the ecological health of the Tucannon River watershed in relation to salmonid population status and recovery has been completed (Kuttle 2002, Tucannon Subbasin Plan 2004, and Snake River Salmon Recovery Plan in 2006 and 2011). Limiting factors such as water temperature, channel stability, sediment, and instream habitat are listed within this basin. State programs provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded actions must additionally meet Endangered Species Act listed species protection criteria developed through consultation with U.S. Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Protection Act (NEPA) review.

Most watershed restoration/improvement projects are funded by BPA through the Columbia Conservation District Tucannon Model Watershed Management Plan (1996) or through the State Salmon Recovery Board funding as guided by the Snake River Salmon Recovery Plan (SRSRP 2006, 2011). Efforts include fencing to ensure riparian vegetative recovery, improved fish passage at road crossings and diversions, reduced sediment production from roads and cropland, and screening of irrigation diversions. Taken together, habitat protection and improvement measures have, and will continue to improve habitat for and productivity of the basin’s spring Chinook population.

3.5) Ecological interactions.

The following sections describe ecological interactions that could occur from the program on native fishes (straying, predation, competition and disease).

Straying **-** Recently, WDFW documented a relatively high proportion of returning Tucannon River spring Chinook with PIT tags that bypass the Tucannon River and migrate upstream of Lower Granite Dam. The actual proportion and significance to the Tucannon spring Chinook population of adults migrating upstream of Lower Granite Dam is currently unknown because information to date is based on a small number of returning PIT tagged spring Chinook. The distribution and fate of Tucannon spring Chinook upstream of Lower Granite Dam is also mostly unknown, although a recent genetic analysis of spring Chinook adults captured in Asotin Creek indicated that most of those fish were likely from the Tucannon River population (Blankenship and Mendel 2010). These upstream migrants may be competing with native spring Chinook in their natal waters for holding and spawning areas, as well as for mates. They may genetically contribute to natural production and may affect the genetic characteristics in indigenous populations upstream of Lower Granite Dam. These stray Tucannon spring Chinook could also provide nutrients and improve stream productivity in the receiving tributaries once they die.

Predation **-** Predation requires opportunity, physical ability and predilection on the part of the predator. Opportunity only occurs when distribution of predator and prey species overlaps. This overlap must occur not only in broad sense but at a microhabitat level as well. As hatchery spring Chinook smolts migrate downstream, avian, fish, and mammalian predators will likely prey on hatchery smolts. While not desired from a production standpoint, these hatchery fish provide an additional food source to natural predators that might otherwise consume natural-origin listed fish.

Predation by hatchery fish on natural origin smolts is less likely to occur than predation on fry (NMFS 1995). Salmonid predators are generally thought to prey on fish 1/3 or less their length (CBFWA 1996). Witty et al. (1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor.

Relative size differential of hatchery spring Chinook smolts (120-160 mm) compared to wild spring Chinook smolts (80-130 mm) and wild steelhead smolts (130-200 mm) should preclude any substantial predator/prey interaction among migrating fish.

Partitioning of habitat by migrating hatchery spring Chinook smolts and fry of Chinook and other salmonids minimizes direct interaction between groups. Bjornn and Reiser (1991) reviewed literature on habitat preferences of juvenile salmonids and concluded that newly emerged fry prefer shallow areas of low velocity (<10 cm/s) and larger fish occupy deeper and faster areas. Bull trout fry tend to rear in headwater spawning areas and thus avoid interaction with hatchery smolts that are released lower in the watershed.

Competition **-** The release, and subsequent return as adults, of spring Chinook will likely affect (positive and negative) the existence of ESA-listed populations of bull trout and summer steelhead. However, temporal and spatial overlap that could give rise to competitive or aggressive interactions for food and space will be minimized by the volitional release of smolts into the river. Smolts are expected to quickly emigrate from the system, thus interactions among the species will be minimized. Returning hatchery adults are expected to spawn concurrently with natural spring Chinook throughout their entire range in the Tucannon River. This will likely increase the abundance of juvenile spring Chinook throughout the basin and fill available habitat, a positive benefit for bull trout that may use them as a food source.

Hatchery spring Chinook smolts have the potential to compete with natural origin spring Chinook, natural origin steelhead, and bull trout juveniles for food, space, and habitat. The Species Interaction Work Group (SIWG, 1984) reported that potential impacts from competition between hatchery and natural fish are assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995). These impacts likely diminish as hatchery smolts disperse, but resource competition may continue to occur at some unknown, but lower, level as smolts move downstream through the migration corridor. Canamela (1992) concluded that the effects of behavioral and competitive interactions would be difficult to evaluate or quantify.

Steward and Bjornn (1990), however, concluded that hatchery fish kept in the hatchery for extended periods before release as smolts may have different food and habitat preferences than natural fish, and that hatchery fish will unlikely be able to out-compete natural fish. Further, hatchery-produced smolts emigrate seaward soon after liberation, minimizing the potential for competition with natural fish. Competition between hatchery-origin salmonids with wild salmonids in the mainstem corridor was judged not to be a significant factor (Witty et al. 1995). All production fish described in this program are released as smolts to minimize the likelihood for interaction, and adverse ecological effects to listed natural Chinook salmon juveniles, bull trout, and steelhead.

Disease - Hatchery operations potentially amplify and concentrate fish pathogens that could affect listed spring and fall Chinook, steelhead, and bull trout growth and survival. Because the hatchery produced spring Chinook are reared outside the watershed most of their life, disease impacts by this stock on Tucannon River salmonids are reduced. LFH is supplied with constant temperature well water; as a result, disease occurrence and the presence of pathogens and parasites are infrequent. When infestations or infections have occurred, they have been effectively treated. Further evidence for the relative disease-free status of this stock at Lyons Ferry is the low mortality that occurs during rearing following typical early life stage losses. Documentation of disease status in these stocks is accomplished through monthly and pre-liberation fish health examinations.

Documentation of the disease status of the adult broodstock is accomplished through annual fish health examinations of both spawning adults and pre-spawning mortality. Results of these examinations over the past years indicate a low prevalence and incidence of serious fish pathogens and parasites in these stocks. Procedures described for this viral disease later (See Section 8 and Section 9) limit the possibilities of outbreaks in the hatchery.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Tucannon spring Chinook adults are held and spawned, eggs hatched and juveniles reared through the fingerling stage at LFH. However, in the future, it is desired that the Tucannon Fish Hatchery will be modified to accommodate full rearing of the spring Chinook and endemic steelhead programs based on HRT recommendations. Lyons Ferry has eight deep wells that produce nearly constant 11°C (52° F), fish pathogen-free water. The hatchery is permitted to pump up to 53,000 gpm (118.1 cfs). High concentrations of dissolved Manganese (variable among the eight wells), and particulate Manganese Oxide, is suspected of limiting the density at which Chinook can be reared in raceways at LFH. While the water also has higher concentrations of other minerals (common in deep wells), no negative impacts on eggs or fish from these are known. Discharge from LFH complies with all NPDES standards and enters the Snake River and will not affect Tucannon River water quality.

Fingerlings are transported to TFH in October each year. Once the fish reach TFH, they are reared on a combination of well, spring, and river water. Maximum capacity of well, spring and river water at TFH is 1.76 cfs, 1.41 cfs, and 7.42 cfs, respectively. River water is used as the main mixture, which allows for a more natural winter temperature profile. However, well and spring water is mixed to keep temperatures above 4.4°C (40°F), to prevent Erythrocytic Inclusion Body Syndrome (EIBS), which has been documented as a problem in the past. Fish remain at TFH until they are pre-smolts.

Pre-smolts are transported to Curl Lake Acclimation Pond in mid-February for acclimation and volitional release. Water is removed from the Tucannon River under a permit for non-consumptive fish propagation purposes, with maximum withdrawal of 6 cfs. Spring Chinook taken to Curl Lake are acclimated for a minimum of three weeks before the outlet of the pond is opened to allow for volitional migration. Water temperatures while fish are acclimating range between 4.4-12.8°C (40- 55°F). Tucannon Fish Hatchery complies with all NPDES standards for pollution discharge.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Hatchery intake screens meet current NOAA Fisheries screening guidelines and effluent discharge is monitored, reported, and currently complies with NPDES standards.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Supplementation Program: Broodstock for the supplementation program are collected at the TFH adult trap (rkm 59) on the mainstem Tucannon River. The TFH adult trap was constructed in 1998 after floods in 1996 destroyed the previous trap. The new trap is a ladder system around the TFH water intake building. The ladder can be opened to allow unrestricted passage if necessary. WDFW believes that the adult trap with the hanging plastic fish excluder curtain to be about 90-95% efficient at capturing adults and jacks, but is highly dependent on springtime flows. WDFW is requesting expansion to the adult holding area or video counting because of the increased returns and crowding that occurs on large run years in the trap area.

Spring Chinook generally do not arrive at the trap before 1 May, but the trap will be in operation for documentation of natural-origin summer steelhead. While in operation, TFH personnel will check the trap daily for fish. The trap may be checked more than once a day if a large number of fish are expected to be captured. Captured fish are netted from the trap box, and either placed in a V-shaped trough or inside a dark bag which holds water in the lower one-third of the bag. The V-shaped trough has a calming effect on the fish so they can be easily sampled prior to being collected or passed upstream. Collected samples may include lengths, scales, or DNA tissue samples (fin or opercle punch), with sex and origin (natural, hatchery supplementation, hatchery captive broodstock) determined as well. Fish placed in the bag (broodstock collected) are then lifted out of the trap and placed immediately into the transport truck. All broodstock collected are transported to LFH for holding and spawning. Holding of broodstock at LFH has proven to be beneficial in decreasing the number of pre-spawning mortalities from when fish were held at TFH due to lower water temperatures. Mean pre-spawn mortality averaged 39% at TFH (1985-1991) but decreased to a mean of 3.8% when held at LFH (1992-present). Pre-spawning mortality is generally 0-10% each year at LFH (Gallinat and Ross 2009).

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Adult Salmon: All adult and jack salmon captured and hauled for broodstock from TFH are transported in a stainless steel, 500 gal tank on the back of a flatbed truck. The tank is equipped with supplemental oxygen and aerators. Transportation time to LFH is about 50 minutes. Up to 15 adults can be transported in the tank at one time. Adults also may be transported to Asotin Creek in the future.

Juvenile Salmon: Juvenile spring Chinook are immediately ponded to the outside raceways directly from the incubation stacks. They remain in the raceways until marking time. After marking in September, the fish are loaded into 2,000 gal transport trucks with oxygen and aerators and transferred back to TFH in October. Transport time is about 50 minutes to TFH from LFH. During February, fish are loaded into transport vehicles and moved to Curl Lake Acclimation Pond. Transport time is about 15 minutes.

5.3) Broodstock holding and spawning facilities.

Broodstock captured at the TFH adult trap are hauled to LFH where they are placed in an adult holding raceway (3.1x 1.8x 24.4 m) that receives constant temperature well water. WDFW has documented that holding fish at LFH significantly reduced pre-spawning mortality (See Section 5.7).

The adult holding raceways are enclosed over the middle one-third of the raceway length by the spawning building, where spawning occurs. Within the spawning building, the gametes are collected from supplementation broodstock. After origin has been confirmed for the supplementation fish, crosses occur, and the fertilized eggs are then taken up to the incubation building.

5.4) Incubation facilities.

The Chinook salmon incubation rooms at LFH are designed to accept and incubate eggs from individual females through the eyed stage. The incubation rooms receive constant 11^{o} C well water and have vertical tray incubation stacks. Individual incubation vessels allow for documenting fecundities and fertilization success. WDFW is requesting a change from the Heath tray incubators to a moist air incubation system that will allow chilling the eggs and improving consistency in fish size from multiple egg takes. Incubating eggs are treated with formalin every other day at 1,667 ppm (37% formalin) for 15 minutes to control fungus. After development to the eyed-egg stage, the eggs are shocked and Evaluation Staff remove the dead eggs. Substrate (layered plastic screening material) is added to the trays, and eggs from each female are placed back in its original tray. Eggs are allowed to hatch and sac fry rear in the trays, or troughs until yolk absorption is complete.

5.5) Rearing facilities.

LFH: When the incubating fry have completely absorbed their yolk sac, they are ponded in standard raceways at LFH (3.1 x 1.1 x 30.5 m). Each raceway is supplied with 500-1,000 gal/min of well water at constant temperature. Raceways are cleaned weekly by brushing screens and vacuuming pond floors. Fry are initially fed 8 or more times per day. Feeding frequency, percent body weight per day and feed size are adjusted as fish increase in size in accordance with good fish husbandry and program goals.

TFH: Depending on the number of fish transferred to TFH, fish will be placed in a 4.6 x 35.1 m raceway, two 3.1 x 24.4 m raceways and in circular ponds (~12.2 m diameter).

a. Acclimation/release facilities.

Curl Lake Acclimation Pond is a 0.85 hectare natural bottom lake, with a mean depth of 2.7 m (pond volume estimated at 22,203.3 m^3), and is supplied with a maximum of 0.17 cms (m^3/sec) (6 cfs or ~2,690 gal/min) river water. Smolts are volitionally released from Curl Lake. Fish are put in Curl Lake during mid-February each year, and allowed 3-4 weeks of acclimation before the outlet of the pond is opened, allowing for volitional migration. Once the pond outlet screens are pulled, fish have about 4-5 weeks when they can leave the pond at any time. Generally, most of the fish don't exit the pond until April. During the final week of release, dam boards in the pond outlet are slowly removed to lower the pond. This generally encourages all remaining fish to leave.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

Since the program inception in 1985, WDFW has documented significant mortality to fish in primarily two areas of the hatchery practices, 1) broodstock holding, and 2) incubation of eggs. Both of these have been addressed (explained below) throughout the program and mortality is no longer an issue in these areas. Bird predation at LFH was a significant concern in the past but all the ponds and raceways are now netted to exclude avian predators.

Broodstock pre-spawning mortality: Prior to 1992, collected broodstock for the supplementation program were held and spawned at TFH. Pre-spawning mortality averaged 25% for natural fish and 63% for hatchery-origin fish. Since 1992, broodstock have been held at LFH, with pre-spawning losses averaging only 4% for both natural and hatchery-origin fish. Holding broodstock at LFH is the preferred action and will continue for the duration of the program.

Egg loss during incubation: A water chiller at LFH was installed and operated between 1991 and 1999. Mechanical problems plagued the water chiller from its initial operation, with constant repairs needed to keep it operating effectively. As such, many times during any given incubation year, eggs could experience large, sudden changes in water temperature that likely influenced overall survival. In particular, in 1997, the water chiller was fixed just prior to putting eggs in the incubation stacks. The maintenance made the chiller perform better than ever documented and as such produced much colder water than expected. This was unknown and unchecked by hatchery and evaluation staff prior to putting eggs in the stacks. The result was an 80% loss to eye-up on the entire 1997 brood year. However, even prior to that year, egg loss was elevated. Since use of the chiller ceased, egg loss to eye-up in the last two years was only 1.5%. The use of the water chiller at LFH in the future is not planned at this time. Costs to keep it operating and the dangers associated with the egg loss do not warrant its use.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Strict operational procedures as laid out by Integrated Hatchery Operation Team (IHOT 1993) are followed at LFH. Where possible, remedial actions identified in a 1996 IHOT compliance audit are implemented. Staff is available to respond to critical operational problems at all times. Water flow and low water alarm systems, and emergency generator power supply systems to provide incubation and rearing water to the facilities are installed at LFH and TFH. Fish health monitoring occurs monthly, or more often, as required in cases of disease epizootics. Fish health practices follow PNWFHPC (1989) protocol.

5.9) Maintenance Requirements.

Annual Maintenance:

- Annual servicing of the rotating screen at Rainbow Lake ($1,340)
- Curl Lake vegetation management ($450)
- Annual dredging of Rainbow Lake intake covered under the current WDFW general HPA permit (Aug. 1-15) ($3,150)
- Vehicle maintenance; tanker trucks, parts, fuel, equipment, etc. ($2,500)
- Pond brooms ($150)
- Snow removal ($750)
- Annual fire pump/fire protection maintenance for Tucannon Hatchery ($600)

Non-recurring Maintenance (next 5 years):

- A moist air incubator to chill egg development. Fish quality is compromised via reduced feeding regimen as a result of available density and growth criteria. A more structured rearing and development cycle would occur if eggs were chilled – extending the incubation period and compressing the rearing cycle. ($35,000)
- Replace all existing electrical components at the Marmes pump station at Lyons Ferry with a new digital, solid-state, soft-start and run system. Current analog system is outdated with potential failures existing. Fish survival at the hatchery may be jeopardized. CTA is consulting on this recommendation with the Lower Snake River Compensation Program. Also, an electrical filtering system is being recommended to shield future dirty power feed issues to the pump station. Preliminary cost estimates to improve the entire system are projected between $250,000 - $500,000 (Also included in the Snake River fall Chinook and Lyons Ferry on-station Steelhead HGMP's.)
- Rainbow Lake Intake fish jump reduction panels and structure repair and/or replacement ($3,500)
- Curl Lake dredging – remove years of sediment that is compromising lake depth and potential fish health issues. ($25,000)
- Rainbow Lake dredge and rehabilitation ($300,000 - $400,000)
- Rebuild Rainbow Lake outlet screen ($20,000)
- Miscellaneous stop logs for intake, fish ladder and raceways ($2,900)
- Predator netting for the East and West raceways and A-pond ($10,000)
- New trash pump ($750)
- Roof for the adult trap ($6,500)
- Pump maintenance as needed ($15,000)
- New feed blower for Curl Lake ($10,000 - $15,000)
- New fish culture equipment ($3,500)

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.

ESA listed natural and hatchery-origin adults and jacks captured at the Tucannon River adult trap will be used for the supplementation broodstock on an annual basis.

Supporting information.

6.2.1) History.

Prior to 1985, artificial production of spring Chinook in the Tucannon River was nearly nonexistent, with only two fry releases in the 1960's (WDFW et al. 1990). In August 1962 and June 1964, 16,000 Klickitat (2.3 g fish or 197 fish/lb) and 10,500 Willamette (2.6g fish or 175 fish/lb) spring Chinook stock, respectively, were released by the Washington Department of Fisheries into the Tucannon River. The out-planting program was discontinued after a major flood destroyed the rearing ponds in 1965. Neither of these releases is believed to have returned any significant number of adults. Hatchery mitigation (supplementation) smolt releases into the Tucannon River under the LSRCP began in 1987. The hatchery broodstock originated from natural origin adults and jacks beginning in 1985, with no hatchery fish used in the broodstock until 1989. Since 1989, the broodstock has consisted of natural and hatchery-origin fish. Hatchery fish used in the broodstock are determined to be of Tucannon River origin by reading a CWT or by presence of a visible implant elastomer tag.

For the captive broodstock program, sac fry were collected from the 1997-2002 supplementation brood years. The sac fry were likely descendents of both natural origin and hatchery origin parents.   The captive brood program ended with the final release of progeny (2006 BY) in 2008.

6.2.2) Annual size.

The current supplementation program requires the collection of 170 adults (natural or hatchery origin) to produce 225,000 smolts (LSRCP goal). This number takes into account pre-spawning loss, and losses anticipated in the hatchery to the smolt stage.

6.2.3) Past and proposed level of natural fish in broodstock.

<u>Supplementation Program:</u>

In the beginning years of the spring Chinook supplementation program, between eight (1985) and 127 (1988) natural origin adults were collected to create the hatchery mitigation broodstock. High pre-spawning mortality forced managers to collect more fish to reach program goals. Beginning in 1992, broodstock were held at LFH in the cooler, pathogen free well water, which significantly reduced pre-spawning mortality, and the need for broodstock was reduced. From 1992-2005, WDFW attempted to collect 100 fish annually (equal numbers of natural and hatchery-origin fish) for broodstock. From 2006 to the present WDFW has attempted to collect 170 fish (85 natural origin) for broodstock. Under the preferred alternative, WDFW would shift to 100% natural origin broodstock once predicted natural origin Chinook returns at the Tucannon Hatchery trap is expected to exceed at least 350 adults. The specific details of the threshold needed before 100% natural origin (e.g. would the threshold for going to 100% NOR be at 350 natural origin Chinook at the trap, or slightly higher?) broodstock would be included in the adult management plan that WDFW and the co-managers provide to NMFS in early 2012.

In some past years, shortage of fish in the run, and shortage of natural fish forced WDFW to collect all fish (natural or hatchery-origin) that returned to the TFH adult trap. For example, in 1995 this amounted to 43 total fish, of which only 10 were natural origin.

6.2.4) Genetic or ecological differences.

To date, WDFW has no evidence that the hatchery supplementation fish, natural-origin fish, or captive broodstock fish are genetically different from one another (Hawkins and Fry 2005; Kassler and Hawkins 2008; Kassler and Dean 2010). The spring Chinook program in the Tucannon River has been in operation for about 5 generations, and no genetic change has been detected . Given the short-term nature (one generation - five brood years) of the captive brood program, it will not likely cause any genetic or ecological changes in the natural population.

6.2.5) Reasons for choosing.

Natural origin spring Chinook are optimally adapted for survival in the Tucannon River. Washington Department of Fish and Wildlife and the co-managers believe they will be most capable of surviving, returning to, and effectively spawning in the Tucannon River. Also, all ESA concerns will be satisfied because they are of Tucannon River origin.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Continued use of natural-origin adults from the Tucannon River for broodstock, in conjunction with the supplementation adults will help ensure the genetic legacy of Tucannon spring Chinook will persist. Genetic risks associated with the continued production of hatchery fish should be reduced if the broodstock management protocols suggested are followed. With the exception of the first five program years, hatchery broodstock have been, and will continue to be collected over the entire run timing to the best of our abilities. Further, given the short-term length of the captive broodstock program, genetic and ecological risks to the natural population should have been minimized.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Supplementation Program: Only natural or hatchery adults and jacks of Tucannon River origin will be collected for the hatchery supplementation program (strays will be removed if externally identifiable). Jacks can be collected up to their proportion of the run with an upper limit of 10% of the hatchery broodstock.

7.2) Collection or sampling design.

Trapping operations occur at the Tucannon River adult trap (rkm 59). The goals of broodstock trapping include fulfilling broodstock needs to meet supplementation program goals (272,000 green eggs, or 225,000 smolts released at 15/lb) and incorporate wild-origin fish into the hatchery broodstock while eliminating strays from the population. Most Tucannon River wild and hatchery origin fish not needed for broodstock would be passed above the TFH adult trap for natural spawning, or used for reintroduction into Asotin Creek as determined by the sliding scale adult Chinook management plan that will supplement this HGMP. The TFH adult trap efficiency and fall back rate would be determined.

Approximately 70% of the run is captured at the TFH adult trap annually. Broodstock are collected at a rate of 1:1 to 1:3 (collected: passed) during the early part of the run depending upon predicted run size. Collection rates during the run may change to ensure fish are collected for broodstock throughout the duration of the run. All passed fish are opercle punched to determine trap efficiency and fallback rate. Spring Chinook will generally not arrive at the trap before 1 May, but the trap will already be in operation for documentation of summer steelhead. Trapping will continue throughout the spawning period (through September).

7.3) Identity.

All hatchery fish have a permanent mark to distinguish them from natural origin fish. During previous years, spring Chinook smolts were identified by lack of the adipose fin and having CWT in the snout. Due to low escapement, the adipose fin clip was abandoned starting with the 2000 BY to help prevent potential harvest of this listed species in down river sport fisheries. Presently, supplementation fish are marked with an elastomer mark behind the eye and tagged with CWT in the snout. Captive brood progeny were marked with CWT or agency-only wire. The elastomer marks allow hatchery personnel operating the adult trap to distinguish between conventional supplementation and captive brood origin fish, experimental hatchery releases (size at release study), and hatchery strays.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The annual supplementation collection goal is for 170 adults collected throughout the duration of the run. Additional jack salmon can be collected up to their proportion of the run with an upper limit of 10% of the hatchery broodstock. The current goal is for 50% of the hatchery broodstock to be natural origin adults. However, under the proposed preferred alternative the target for natural origin Chinook in the broodstock would be at 100% if more than 350 natural origin Chinook were expected at the hatchery weir.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available: See Table 9.

Table 9. Number of natural and hatchery-origin spring Chinook collected from the Tucannon River for the supplementation program, 1985-2009.

Year	Natural Origin	Hatchery Origin
1985	22	0
1986	116	0
1987	101	0
1988	116	9
1989	67	102
1990	60	75
1991	41	89
1992	47	50
1993	50	47
1994	36	34
1995	10	33
1996	35	45
1997	43	54
1998	48	41
1999	1	135
2000	12	69
2001	52	54
2002	42	65
2003	42	35
2004	51	41
2005	49	51
2006	36	53
2007	54	34
2008	42	92
2009	89	88

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Sex can be hard to determine during the early part of the run. If the number of females collected for broodstock is greater than needed to reach program goals, priority will be to return those excess fish back to the river to spawn naturally after any fishery seasons have closed. Currently, all fish captured in the adult trap and not collected for broodstock are given an opercle punch and passed upstream, but an adult management plan proposed for development within nine months of issuance of the Section 10 permit may include transfer of some hatchery fish into Asotin Creek. Spawned adults used as broodstock for the program will be returned to the Tucannon River for nutrient enrichment. Carcass distribution will require the approval of WDFW's pathologist to ensure proper disease control measures.

Recent returns of jacks (1-ocean age males) and jills (1-ocean age females) to the program have been significantly above historic levels. This appeared to be a basin wide issue in 2009. The co-managers have expressed the desire to minimize the potential ecological and genetic effects of such a large number of young age fish into the spawning population and propose to remove hatchery origin jacks (based on fork length) at the TFH trap. Hatchery jacks would be removed from the run, with sufficient jacks released upstream of the trap to mimic the proportion of jacks in the natural population. Jacks removed would be utilized in the prioritized order shown below.

Beneficial uses of any spring Chinook that return to the project area will be maximized, possibly beyond those that will be finalized in the adult management plan that includes use or returning spring Chinook for hatchery broodstock, tribal and non-tribal harvest, or for reintroduction out-plants with hatchery adults and jacks into Asotin Creek, as follows (in priority):

a. Distribute excess fish to local food banks and tribal members (amount based on demand and logistical feasibility)

b. Euthanize excess fish and either distribute carcasses for nutrient enhancement or bury the carcasses if needed to prevent the spread of waterborne fish diseases (all fish not utilized by a above).

7.6) Fish transportation and holding methods.

Adults are transported in tank trucks with re-circulation aeration and/or oxygenation. Hauling time from the Tucannon trap site to LFH is approximately 45 minutes, depending on road conditions. A hauling guideline of no more than one adult per 10 gallons of water will be applied, but because of the ESA listing for these fish a lower rate of adults per gallons will likely be used.

7.7) Describe fish health maintenance and sanitation procedures applied.

Collected adults are injected in the dorsal sinus at transfer with Oxytetracycline and erythromycin, and females are re-injected with erythromycin during sorting (approximately 30 days after collection).

Monthly fish health inspections occur at LFH and TFH. Because of very low numbers of adults held in broodstock raceways, raceway cleaning is unnecessary. Fish may be treated with a suite of approved chemicals to control fungus, parasites and bacterial diseases, as prescribed by WDFW fish health specialists. Treatments for fungal infections are applied as formalin drips in the raceways.

7.8) Disposition of carcasses.

All Tucannon River broodstock carcasses will be returned to the Tucannon River for nutrient enrichment if broodstock are free of disease and approval by the WDFW Fish Health Specialist is granted.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Broodstock will be collected from throughout the natural run period to provide for random selection of adults from the entire adult population, prevent run timing divergence of the hatchery-reared population from the natural population, and provide for natural fish escapement into the habitat to spawn. Development of an adult management plan in 2012 is expected to include transfer of some hatchery spring Chinook into Asotin Creek when runs into the Tucannon are relatively large. The transfer of Chinook into Asotin Creek expands the distribution, reduces risk of extinction of the Tucannon population and should help meet the highly viable population status needed for this sole population in the lower Snake River MPG.

During broodstock trapping, measures will be taken to ensure the trap holding area is free of sharp objects that may cause injury to fish. Steps will also be taken to adjust attraction water entering the trap to discourage jumping of the fish captured. The trap is located behind a secure fenced area. All fish handled (either to be passed or collected) are first placed in a V-shaped box containing water, with the head area covered with a rubber strip. This produces a calming effect on the fish that can then be sampled (scales, fork length, sex, external condition, identifying marks, etc.) without the use of anesthetic.

In 2005, an automated brail system was installed in the TFH trap. This brail allows hatchery staff to raise the trap holding-area floor from above. As the floor rises and effective water depth reduced, fish move to submerged rubber-lined holding troughs, located in the floor itself. Staff is then able to quickly secure and place fish in the above-mentioned V-shaped box for sampling. This modification has dramatically reduced stress to trapped fish, as staff no longer must “chase” adults, but rather quickly place them in the sampling box from the holding troughs. This system works well for all trapped adults, including summer steelhead and bull trout.

Disease control efforts at LFH (in accordance with PNWFHC and IHOT standards) will effectively control expansion of species specific or general salmonid diseases.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

All males and females that have been collected for broodstock will be examined weekly during the spawning season to determine ripeness, and all fish will be spawned when ripe. Fish are anesthetized using MS-222 to determine degree of ripeness.

8.2) Matings.

Mating occurs in a 2x2 factorial cross to increase the effective population size and ensure the highest likelihood of fertilization (Busack and Knudsen 2007). Jacks may be included at a rate of up to 10%.

8.3) Fertilization.

At times, the small number of fish ripe on individual days limits spawning options. Males (including jacks) are usually limited to primary status on one half the eggs from two females. Where insufficient males are available to meet these criteria, males can be used as primary more than twice. In those circumstances, males will be used no more than four times as primary spawners (egg equivalent = 2 females). After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution.

8.4) Cryo-preserved gametes.

Semen has been cryo-preserved in past years and remains an option to increase diversity during low run years.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Broodstock collection protocol will ensure that adults represent a proportional temporal distribution of the natural population. A 2x2 factorial mating scheme has been, and will be applied to reduce the risk of loss of within-population genetic diversity. The goal is to use natural by hatchery crosses to infuse genetic material from fish adapted to the natural environment. Jack contribution to hatchery broodstock is maintained at levels of less than 10%.

SECTION 9. INCUBATION AND REARING

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Table 10 includes the egg survival information at LFH since broodstock collection began in 1985.

Table 10. History of egg loss for Tucannon River stock spring Chinook, 1985-2009.

Brood Year	Eggs Taken	% Loss to eye-up
1985	14,843	8.2
1986	187,958	2.0
1987	196,573	14.4
1988	182,438	16.3
1989	133,521	19.9
1990	126,334	33.7
1991	91,275	12.8
1992	156,359	1.8
1993	168,366	9.2
1994	161,707	6.0
1995	85,772	23.5
1996	117,287	17.3
1997	144,237	76.3
1998	161,019	11.5
1999	113,544	2.0
2000	128,980	2.0
2001	184,127	1.2
2002	169,364	3.6
2003	140,658	5.3
2004	140,459	4.5
2005	161,345	3.2
2006	123,629	5.4
2007	124,543	3.9
2008	193,324	2.6
2009	323,341	7.5

9.1.2) Cause for, and disposition of surplus egg takes.

Number of eggs collected from adults trapped in the supplementation program could exceed program needs. Eggs in excess of program needs will be retained to ensure the goal is met in case of unexpected loss from BKD or other unexpected circumstances. LFH staff will work with the WDFW fish health specialist to ensure appropriate measures are taken to disinfect eggs and proper prophylactic treatments are conducted to prevent disease outbreaks. Excess eggs will be hatched and reared in accordance to space and funding constraints (see section 1.11.2). A contingency plan for excess eggs and fish will be developed as part of the LFH annual operation plan.

9.1.3) Loading densities applied during incubation.

Tucannon natural and hatchery spring Chinook fecundities vary by age and origin. Natural-origin females average 3,487 and 4,394 for age-4 and age-5 females, respectively. Hatchery-origin females average 3,067 and 3,671 for age-4 and age-5 females, respectively. Fecundities of age 3, 4, and 5 captive broodstock were 1,265, 1,664 and 1,852 eggs/female, respectively. The evaluation program has identified fecundity as an important biological component to measure for the spring Chinook program. Therefore, each female's eggs are incubated individually to document fecundity.

With the Heath incubation stacks, up to 5,000-6,000 eggs can be put in each tray. Since fecundity is generally less than that, individual incubation is not a problem.

9.1.4) Incubation conditions.

Incubation, as with rearing, occurs with 11^{0}C well water. The incubation buildings are fitted with back-up pumps to maintain flow through the troughs and Heath stacks in emergency situations. Flow monitors will sound an alarm if flow is interrupted. Incubation (IHOT) protocols will be followed where practical.

9.1.5) Ponding.

Currently, after eggs have hatched and the fry have buttoned-up, fish are taken out of the incubation stacks and placed in outside rearing raceways. Fish are immediately begun on a starter diet, with all mortalities removed each day from the pond. Fish remain in the outside raceways the entire time they are at LFH. Splitting into other raceways may occur, but will depend on densities. Low density rearing (LFH guidelines are for early rearing densities generally not to exceed 0.2 $lbs/ft^{3)}$ to reduce BKD is being initiated at LFH. Limited pond space at TFH does not allow low density rearing there.

9.1.6) Fish health maintenance and monitoring.

Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs are removed after shocking, and dead sac-fry are removed during ponding procedures. A fish health specialist makes at least monthly visits to each hatchery, and more if required to diagnose and recommend treatments for disease.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood

for adverse genetic and ecological effects to listed fish during incubation.

At LFH, eggs are incubated in well water to ensure maximum egg survival and minimize potential loss from disease. Eggs are also treated with formalin to control fungus. The hatchery incubation room is protected by a separate low water alarm system and an automatic water reuse pumping system, and for the use of wells separate from the hatchery's main well field.

9.2) Rearing:

9.2.1) Provide survival rate data by hatchery life stage for the most recent twelve years (1988-00), or for years where dependable data are available (Table 11).

Table 11. Survivals for Tucannon River spring Chinook reared at LFH and TFH.

BY	Eggs Taken	% Eyed Egg Mortality	Number of Parr	% Egg-Parr Survival	Number of Smolts	% Egg-Smolt Surv.
1985	14,843	8.2	13,401	90.3	12,922	87.1
1986	187,958	2.0	177,277	94.3	153,725	81.8
1987	196,573	14.4	164,630	83.8	152,165	77.4
1988	182,438	16.3	150,677	82.6	146,200	80.1
1989	133,521	19.9	103,420	77.5	99,057	74.2
1990	126,334	33.7	89,519	70.9	85,500	67.7
1991	91,275	12.8	77,232	84.6	74,058	81.1
1992	156,359	1.8	151,727	97.0	87,752	56.1
1993	168,366	9.2	145,303	86.3	138,848	82.5
1994	161,707	6.0	132,870	82.2	130,069	80.4
1995	85,772	23.5	63,935	74.5	62,272	72.6
1996	117,287	17.3	80,325	68.5	76,219	65.0
1997	144,237	76.3	29,650	20.6	24,186	16.8
1998	161,019	11.5	136,027	84.5	127,939	79.5
1999	113,544	2.0	106,880	94.1	97,600	86.0
2000	128,980	2.0	123,313	95.6	102,099	79.2
2001	184,127	1.2	174,934	95.0	146,922	79.8
2002	169,364	3.6	151,531	89.5	123,586	73.0
2003	140,658	5.3	126,400	89.9	71,154	50.6
2004	140,459	4.5	128,877	91.8	67,542	48.1
2005	161,345	3.2	151,466	93.9	149,466	92.6
2006	123,629	5.4	112,350	90.9	106,530	86.2
2007	124,543	3.9	117,182	94.1	114,681	92.1
2008	193,324	2.6	183,925	95.1	172,897	89.4
2009	323,341	7.5	292,291	90.4		

9.2.2) Density and loading criteria (goals and actual levels).

LFH raceway rearing density index criteria for spring Chinook generally should not exceed 0.15 lbs/ft^3 for fish >100 fpp to help ensure healthy fish. Early rearing (immediate post ponding) densities can be higher (see **9.1.5**). When the spring Chinook are reared in rearing ponds (Curl Lake), densities can be 10% of the raceway maximum.

9.2.3) Fish rearing conditions

At Lyons Ferry, raceways are supplied with pathogen free, oxygenated well water from the hatchery's central degassing building. Approximately 1,000 gpm of water enters the north raceway and 650 gpm enters the south raceway. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are vacuumed to remove accumulated uneaten feed and fecal material. Feeding is by hand presentation. In 2005, netting was installed on the south raceways at LFH to minimize bird predation and disease transfer by predators. Predation losses in spring Chinook reared in these raceways should be reduced, and the potential for disease transfer from other stocks through predator transfer should be completely eliminated as a result of this improvement.

At Tucannon Hatchery**,** raceways are supplied with oxygenated well or river water from the hatchery's central degassing building. Approximately 1,000-gpm (2.2 cfs) water enters raceway A, 400 gpm (0.9 cfs) enters raceways E and W and 200 gpm (0.45 cfs) enters the round ponds. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Feeding is by hand presentation.

At Curl Lake Acclimation Pond, water is supplied directly from the Tucannon River. A maximum of 6 cfs can be drawn from the river to the pond, though rarely is more than 5 cfs used. Based on the river water temperature, oxygen levels range between 11-14 ppm. Density indexes within Curl Lake are very low with a DI of 0.005 lbs/ft^3 assuming a maximum 300,000 fish at 15 fpp. Fish are fed by truck mounted feed blower.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Growth rate information for the Tucannon River spring Chinook stock for the 2006 and 2007 brood years are found in Table 12.

Table 12. Tucannon River Spring Chinook Stock Growth – 2006 and 2007 brood years.		
	2006 BY	**2007 BY**
Month	**Fish/Lb**	**Fish/Lb**
November	1,600	1,600
December	670-1,300	642-1,155
January	277-326	308-411
February	153-175	190-225
March	101-111	118-125
April	83-85	74-78
May	68-71	53-56
June	53-54	43-47
July	39-40	35-39
August	35	30-36
September	27-28	24-33
October	18-25	18-28
November	17-21	15-21
December	16-21	14-20
January	13-18	14-20
February	13-18	13-18
March	N/A	N/A
April	8-12	8-12

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Table 12.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing.

Fry/fingerling will be fed an appropriate commercial dry or moist salmon diet. Fry are started at 2-3% B.W./day and reduced to 0.5-1.1% to slow growth rate when fish are approximately 250 fpp. Feed conversion is expected to fall in a range of 1.1 – 1.4 pounds fed to pounds produced.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway vacuuming to remove uneaten feed and fecal material. Equipment is disinfected between raceways and/or between species at the hatchery.

With low numbers of adult Tucannon spring Chinook and low prevalence of BKD in the population; BKD segregation has not been employed with the Tucannon spring Chinook. Adult pre-spawning injection and a single feeding of erythromycin along with "good" fish culture practices are the methods employed to control BKD. It has been recommended from the HRT to discontinue prophylactic treatment for BKD. The discontinuation of prophylactic erythromycin is not advised by the WDFW Fish Health Specialist.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Program goal for the supplementation program will be to release fish between 1 March and 25 April at 15 fish/lb but a size at release study is currently being conducted. Pre-liberation samples will visually note smolt development based on degree of silvering, presence/absence of parr marks. No gill ATPase activity or blood chemistry samples to determine degree of smoltification, or to guide fish release timing is anticipated.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Raceways for rearing are concrete. The walls and bottoms are of nearly natural coloration and texture, and promote natural looking fish. All fish are held at Curl Lake Acclimation Pond (a natural gravel substrate pond) prior to volitional release.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

Professional and technical personnel trained in fish cultural procedures operate Lyons Ferry Complex facilities. Facilities are state-of-the-art to provide a safe and secure rearing environment through the use of alarm systems, backup generators, and water gravity systems to prevent catastrophic fish losses.

All smolts will be volitionally released from Curl Lake Acclimation Pond and will occur on river water to provide acclimation/imprinting time and begin the conversion to natural feed sources present in river water.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels

Beginning in 2006, the smolt production goal for Tucannon River spring Chinook was increased to 225,000 yearling smolts (Table 13). Excess fish may be released as smolts, fingerlings, or fed fry depending upon hatchery space limitations and funding constraints.

Table 13. Fish release goals.						
Age Class	**Maximum Number**	**Goal**	**Size (fpp)**	**Release Date**	**Location**	**Stock**
Eggs						
Unfed Fry						
Fry						
Fingerling						
Yearling	247,500	225,000	15	15 March – 25 April	Curl Lake Acclimation Pond	Supplementation
Adults	TBD, pending development of sliding scale management plan by managers	TBD			NF Asotin	Tucannon hatchery adults

10.2) Specific location(s) of proposed release(s).

As currently described in the Annual Operation Plan for LFC, all Tucannon River stock spring Chinook smolts will all be released into the Tucannon River from Curl Lake Acclimation Pond. Curl Lake is located at rkm 66 on the Tucannon River. Other releases of spring Chinook (Tucannon stock) may occur into other areas of the watershed, but will have to be decided upon in agreement by the co-managers. Should sufficient hatchery origin adults return to trigger the transfer action expected to be identified in the adult management plan for the Tucannon spring Chinook program (sliding scale adult management plan by the co-managers expected within nine months of issuance of the Section 10 permit), WDFW and the co-managers have proposed using Tucannon River hatchery spring Chinook for re-introduction into Asotin Creek (North Fork).

Stream, river, or watercourse: Tucannon River
Release point: rkm 66
Major watershed: Tucannon River
Basin or Region: Snake River Basin

Or

Stream, river, or watercourse: North Fork Asotin Creek
Release point: rkm 22

Major watershed: Asotin Creek
Basin or Region: Snake River Basin

10.3) Actual numbers and sizes of fish released by age class through the program.

Hatchery origin spring Chinook have been released as yearling smolts annually into the Tucannon River as part of the supplementation and captive brood programs (Tables 14 and 15). The current annual smolt production goal is 225,000 smolts at 15 fish/lb (fpp) or 30 g/fish, though release size has varied over the years (Table 14). The co-managers have supported and WDFW is currently conducting a size at release study to determine if releasing larger smolts (9 fish/lb or 50 g/fish) will increase smolt-to-adult return survival rates.

Table 14. Number and size of spring Chinook released from the conventional hatchery supplementation program into the Tucannon River since 1987.

Brood Year	Release Year	Release Dates	Release Method[a]	Number of Fish	Pounds of Fish	Average Size (fpp)
1985	1987	4/06-4/10	H-Acc	12,922	2,172	6.0
1986	1988	3/07 & 4/13	H-Acc	152,725	15,173	10.0
1987	1989	4/11-4/13	H-Acc	152,165	16,907	9.0
1988	1990	3/30-4/10	H-Acc	145,146	13,195	11.0
1989	1991	4/01-4/12	H-Acc	99,057	11,007	9.0
1990	1992	3/30-4/10	H-Acc	85,737	7,798	11.0
1991	1993	4/06-4/12	H-Acc	74,064	4,830	15.0
1992	1993	10/22-10/25	Direct	57,316	1,592	36.0
1992	1994	4/11-4/18	H-Acc	83,409	5,957	14.0
1993	1995	3/15-4/15	Mixed	138,848	9,569	14.0-15.0
1994	1996	3/16-4/22	Mixed	130,069	8,120	13.3-17.7
1995	1997	3/7-4/18	Mixed	62,144	3,541	16.6-18.8
1996	1998	3/11-4/18	Mixed	76,219	4,820	15.8-16.4
1997	1999	3/11-4/20	Curl Acc	24,186	1,550	15.6
1998	2000	3/20-4/26	Curl Acc	127,939	10,235	12.5
1999	2001	3/19-4/25	Curl Acc	97,600	9,207	10.6
2000	2002	3/15-4/23	Curl Acc	102,099	6,587	15.5
2001	2002	5/6	Direct	21,043	171	123.4
2001	2003	4/01-4/21	Curl Acc	146,922	11,389	12.9
2002	2004	4/01-4/20	Curl Acc	123,586	10,563	11.7
2003	2005	3/28-4/15	Curl Acc	71,154	5,603	12.7
2004	2006	4/3-4/26	Curl Acc	67,542	5,040	13.4
2005	2007	4/2-4/23	Curl Acc	149,466	18,683	8.0
2006	2008	4/08-4/22	Curl Acc	52,735	6,278	8.4
2006	2008	4/08-4/22	Curl Acc	53,795	4,638	11.6
2007	2009	4/13-4/22	Curl Acc	55,480	7,023	7.9
2007	2009	4/13-4/22	Curl Acc	59,201	4,853	12.2
2008	2010	4/2-4/12	Curl Acc	86,203	12,493	6.9
2008	2010	4/2-4/12	Curl Acc	86,694	7,539	11.5

[a]H-Acc = hatchery acclimated.
Direct = direct stream release.
Mixed = a mixture of different methods.
Curl Acc = Curl Lake acclimated.

Table 15. Number and size of spring Chinook released from the captive brood hatchery supplementation program into the Tucannon River since 2002.

Brood Year	Release Year	Release Dates	Release Method[a]	Number of Fish	Pounds of Fish	Average Size (fpp)
2000	2002	3/15-4/23	C-Acc	3,055	343	8.9
2001	2002	5/6	Direct	20,592	124.8	165
2001	2003	4/01-4/21	C-Acc	140,396	10,100	13.9
2002	2004	4/01-4/20	C-Acc	44,784	3,393	13.2
2003	2005	3/28-4/15	C-Acc	130,064	9,706	13.4
2004	2006	4/3-4/26	C-Acc	132,312	8,648	15.3
2005	2007	4/2-4/23	C-Acc	90,056	12,170	7.4
2006	2008	4/08-4/22	C-Acc	78,176	9,896	7.9

[a]Direct = direct stream release.
Curl Acc = Curl Lake acclimated.

10.4) Actual dates of release and description of release protocols.

Supplementation fish have been generally released as smolts in March and April, with only a few small groups released as pre-smolts (Table 14). Fish have been released by a combination of methods including direct stream releases, acclimated and forced releases, and acclimated and volitional releases (Table 14).

10.5) Fish transportation procedures, if applicable.

During October of each year, progeny produced are transported from LFH to TFH. Fish are then reared until the following February, and transported again to Curl Lake Acclimation Pond. Transportation time between LFH and TFH is approximately 45 minutes. Transportation time to Curl Lake Acclimation Pond from TFH is about 15 minutes and densities would be less than one pound per gallon for transferring juveniles to Curl Lake or adults to Asotin Creek.

10.6) Acclimation procedures.

All of the fish will be acclimated at the Curl Lake Acclimation Pond. During the middle of February, all fish will be transported from TFH and acclimated for at least three weeks in Curl Lake. Following acclimation, the outlet to the pond will be opened and fish will be allowed to volitionally leave the pond until about 20-25 April (seven weeks). During the final couple of weeks of release, the pond is gradually lowered which encourages remaining fish to leave the pond. Curl Lake is supplied with Tucannon River water, which will provide acclimation to the chemistry and temperature regime of the Tucannon River Basin.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All hatchery fish are permanently marked to distinguish them from natural origin fish. Tucannon spring Chinook are marked with CWT (size at release study fish will have a visible implant elastomer tag - VIE). The VIE is being used to distinguish Tucannon supplementation fish from captive brood progeny and hatchery strays. WDFW fishery managers are considering proposing marking a portion of annual production with an adipose clip to allow for non-tribal harvest. This proposal for marking will be discussed with co-managers and included in the details of adult management sliding scale to allow non-tribal harvest as a beneficial use during good returns to the Tucannon River. Specifics concerning the adult returns that would allow for non-tribal harvest are expected in the adult management planning document due to NMFS in within nine months of issuance of the Section 10 permit. Adipose clipping a portion of the hatchery production would require agreement under US v OR, but without adipose clips on returning hatchery adults it may not be possible to offer non-tribal fisheries during good run years in the Tucannon River.

PIT tagging may be increased to 25,000 to examine the potential hydrosystem effect of Tucannon River spring Chinook bypassing the Tucannon River and crossing Lower Granite Dam. This increased tagging should help determine where the spring Chinook go after crossing Lower Granite Dam and could be used as a means of collecting/returning fish by using a sort by code for Tucannon fish at the dam.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Monitoring of fish numbers, growth and mortality at the hatcheries will provide reasonably accurate estimates of the number of fish on hand throughout their rearing life. The preferred action would be to release surplus fish as (in order of preference) yearling smolts, fingerlings, or fed fry, given hatchery rearing space limitations and funding constraints at that time. Excess fish will be released into the Tucannon River Basin, targeting river reaches that had population densities below carrying capacity, although surplus production is expected to be small. An alternative would be to use surplus fish for reintroduction of spring Chinook into Asotin Creek. This alternative would require details for inclusion of transfers to Asotin Creek to be specified in an adult management plan or additional production plan that would supplement this HGMP. The adult management plan is to be developed and delivered to NMFS within nine months of issuance of the Section 10 permit.

10.9) Fish health certification procedures applied pre-release.

IHOT does not require a pre-release exam, which includes sampling fish for viral, bacteria, and specific parasites. No isolations of viral pathogens have occurred in salmon and steelhead smolts for fish reared on well or spring water (BPA fish health monitoring project – WDF, WDFW, and USFWS viral sampling of fall Chinook at LFH). Therefore, viral sampling is of little value.

10.10) Emergency release procedures in response to flooding or water system failure.

Under conditions requiring release of fish at TFH or Curl Lake Acclimation Pond, in response to a water system failure, all fish would be immediately released into the Tucannon River. Should an emergency occur at LFH, every attempt would be made to haul fish to the Tucannon River. However, the distance to the river and priority of other fish stocks on hand at LFH may require the immediate release of Tucannon River spring Chinook stock fish into the Snake River.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

The standard release strategy will consist of volitionally releasing smolts. Most will orient to the river for a short time (1-10 days) and then emigrate.

Predation by hatchery fish on natural-origin smolts is less likely to occur than predation on fry (NMFS 1995). Salmonid predators are generally thought to prey on fish 1/3 or less their length (CBFWA 1996). Witty et al. (1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally-produced fish survival in the Columbia River migration corridor.

The Species Interaction Work Group (SIWG 1984) reported that potential impacts from competition between hatchery and natural fish are assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995). These impacts likely diminish as hatchery smolts disperse, but resource competition may continue to occur at some unknown, but lower, level as smolts move downstream through the migration corridor. Steward and Bjornn (1990), however, concluded that hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearling salmonids) may have different food and habitat preferences than natural fish, and that hatchery fish will be unlikely to out-compete natural fish. Hatchery-produced smolts emigrate seaward soon after liberation, minimizing the potential for competition with natural fish (Steward and Bjornn 1990). Competition between hatchery-origin salmonids with wild salmonids in the mainstem corridor was judged not to be a significant factor (Witty et al. 1995).

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program. (See Table 16).

Table 16. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring and the associated performance indicator that it addresses. (Taken from Galbreath et al. 2008).

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
Abundance	Adult Escapement to Tributary	Number of adults (including jacks) that have escaped to a certain point (i.e. - mouth of stream). Population based measure. Calculated with mark recapture methods from weir data adjusted for redds located downstream of weirs and in tributaries, and maximum net upstream approach. Provides total escapement and wild only escapement. [Assumes tributary harvest is accounted for]. Uses TRT population definition where available	YES
	Fish per Redd	Number of fish divided by the total number of redds. Applied by: The population estimate at a weir site, minus broodstock and mortalities and harvest, divided by the total number of redds located upstream of the weir.	YES
	Female Spawner per Redd	Number of female spawners divided by the total number of redds above weir. Applied The population estimate at a weir site multiplied by the weir derived proportion of females, minus the number of female prespawn mortalities, divided by the total number of redds located upstream of the weir. Correct for mis-sexed fish at weir for 1 above.	YES
	Index of Spawner Abundance - redd counts	Counts of redds in spawning areas in index area(s) (trend), extensive areas, and supplemental areas. Reported as redds and/or redds/km.	YES
	Spawner Abundance	In-river: Estimated number of total spawners on the spawning ground. Calculated as the number of fish that return to an adult monitoring site, minus broodstock removals and weir mortalities and harvest if any, subtracts the number of female pre-spawning mortalities and expanded for redds located below weirs. Calculated in two ways: 1) total spawner abundance, and 2) wild spawner abundance, which multiplies by the proportion of natural origin (wild) fish. Calculations include jack salmon. In-hatchery: Total number of fish actually used in hatchery production. Partitioned by gender and origin.	YES

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
	Hatchery Fraction	Percent of fish on the spawning ground that originated from a hatchery. Applied in two ways: 1) Number of hatchery carcasses divided by the total number of known origin carcasses sampled. Uses carcasses above and below weirs, 2) Uses weir data to determine number of fish released above weir and calculate as in 1 above, and 3) Use 2 above and carcasses above and below weir.	YES
	Ocean/Mainstem Harvest	Number of fish caught in ocean and mainstem (tribal, sport, or commercial) by hatchery and natural origin.	YES
	Harvest Abundance in Tributary	Number of fish caught in tributaries (tribal, sport) by hatchery and natural origin.	PARTIAL
	Index of Juvenile Abundance (Density)	Parr abundance estimates using underwater survey methodology are made at pre-established transects. Densities (number per 100 m2) are recorded using protocol described in Thurow (1994). Hanken & Reeves estimator.	NO
	Juvenile Emigrant Abundance	Gauss software is (Aptech Systems, Maple Valley, Washington) is used to estimate emigration estimates. Estimates are given for parr pre-smolts, smolts and the entire migration year. Calculations are completed using the Bailey Method and bootstrapping for 95% CIs. Gauss program developed by the University of Idaho (Steinhorst et al. 2004).	YES
	Smolts	Smolt estimates, which result from juvenile emigrant trapping and PIT tagging, are derived by estimating the proportion of the total juvenile abundance estimate at the tributary comprised of each juvenile life stage (parr, presmolt, smolt) that survive to first mainstem dam. It is calculated by multiplying the life stage specific abundance estimate (with standard error) by the life stage specific survival estimate to first mainstem dam (with standard error). The standard error around the smolt equivalent estimate is calculated using the following formula; where X = life stage specific juvenile abundance estimate and Y = life stage specific juvenile survival estimate: $Var(X \cdot Y) = E(X)^2 \cdot Var(Y) + E(Y)^2 \cdot Var(X) + Var(X) \cdot Var(Y)$	YES
	Run Prediction	This will not be in the raw or summarized performance database.	YES

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
Survival – Productivity	Smolt-to-Adult Return Rate	The number of adult returns from a given brood year returning to a point (stream mouth, weir) divided by the number of smolts that left this point 1-5 years prior. Calculated for wild and hatchery origin conventional and captive brood fish separately. Adult data applied in two ways: 1) SAR estimate to stream using population estimate to stream, 2) adult PIT tag SAR estimate to escapement monitoring site (weirs, LGR), and 3) SAR estimate with harvest. Accounts for all harvest below stream. *Tributary to tributary SAR* estimates for natural and hatchery origin fish are calculated using PIT tag technology as well as direct counts of fish returning to the drainage. PIT tag SAR estimates are calculated by dividing the number of PIT tag adults returning to the tributary (by life stage and origin type) by the number of PIT tagged juvenile fish migrating from the tributary (by life stage and origin type). Overall PIT tag SAR estimates for natural fish are then calculated by averaging the individual life stage specific SAR's. Direct counts are calculated by dividing the estimated number of natural and hatchery-origin adults returning to the tributary (by length break-out for natural fish) by the estimated number of natural-origin fish and the known number of hatchery-origin fish leaving the tributary. Variance around the SAR estimate is calculated as follows, where X = the number of adult PIT tagged fish returning to the tributary and Y = the estimated number of juvenile PIT tagged fish at first mainstem dam: $$Var\left(\frac{X}{Y}\right)=\left(\frac{EX}{EY}\right)^2\cdot\left(\frac{Var(Y)}{(EY)^2}\right)$$	YES
	Progeny-per- Parent Ratio	Adult to adult calculated for naturally spawning fish and hatchery fish separately as the brood year ratio of return adult to parent spawner abundance using data above weir. Estimates of this ratio for fish spawning and produced by the natural environment must be adjusted to account for the confounding effect of spawner density on this metric. Two variants calculated: 1) escapement, and 2) spawners.	YES
	Recruit/spawner (R/S)(Smolt Equivalents per Redd or female)	Juvenile production to some life stage divided by adult spawner abundance adjusted for the confounding effects of spawner density. Derive adult escapement above juvenile trap multiplied by the pre-spawning mortality estimate. Adjusted for redds above juv. trap. *Recruit per spawner* estimates, or *juvenile abundance (can be various life stages or locations) per redd/female*, is used to index population productivity, since it represents the quantity of juvenile fish resulting from an average redd (total smolts divided by total redds) or female. Several forms of juvenile life stages are applicable. We utilize only: 1) juvenile abundance (parr, presmolt, smolt, total abundance) at the tributary mouth,	YES

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
	Pre-spawn Mortality	Percent of female adults that die after reaching the spawning grounds but before spawning. Calculated as the proportion of “25% spawned” females among the total number of female carcasses sampled. (“25% spawned” = a female that contains 75% of her egg compliment).	PARTIAL
	Juvenile Survival to first mainstem dam	Life stage survival (parr, presmolt, smolt, subyearling) calculated by CJS Estimate (SURPH) produced by PITPRO 4.8+ (recapture file included), CI estimated as 1.96*SE. Apply survival by life stage to first mainstem dam to estimate of abundance by life stage at the tributary and the sum of those is total smolt abundance surviving to first mainstem dam. Juvenile survival to first mainstem dam = total estimated smolts surviving to first mainstem dam divided by the total estimated juveniles leaving tributary.	YES
	Juvenile Survival to all Mainstem Dams	*Juvenile survival to first mainstem dam and subsequent Mainstem Dam(s)*, which is estimated using PIT tag technology. Survival by life stage to and through the hydrosystem is possible if enough PIT tags are available from the stream. Using tags from all life stages combined we will calculate (SURPH) the survival to all mainstem dams.	NO
	Post-release Survival	Post-release survival of natural and hatchery-origin fish are calculated as described above in the performance measure “Survival to first mainstem dam and Mainstem Dams”. No additional points of detection (i.e., screw traps) are used to calculate survival estimates.	NO
Distribution	Adult Spawner Spatial Distribution	Extensive area tributary spawner distribution. Target GPS redd locations or reach specific summaries, with information from carcass recoveries to identify hatchery-origin vs. natural-origin spawners across spawning areas within populations.	YES
Distribution	Stray Rate (percentage)	Estimate of the number and percent of hatchery origin fish on the spawning grounds, as the percent within MPG, and percent out of ESU. Calculated from 1) total known origin carcasses, and 2) uses fish released above weir. Data adjusted for unmarked carcasses above and below weir.	YES
Distribution	Juvenile Rearing Distribution	Chinook rearing distribution observations are recorded using multiple divers who follow protocol described in Thurow (1994).	NO
Distribution	Disease Frequency	Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely sample fish for disease and will defer to them for sampling numbers and periodicity	PARTIAL
Genetic	Genetic Diversity	Indices of genetic diversity – measured within a tributary) heterozygosity – allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST).	YES
Genetic	Reproductive Success (Nb/N)	Derived measure: determining hatchery:wild proportions, effective population size is modeled.	NO
Genetic	Relative Reproductive Success (Parentage)	The survival or productivity of offspring of hatchery spawners relative to offspring of wild spawners from the same basin.	NO

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
	Effective Population Size (Ne)	Derived measure: the number of breeding individuals in an idealized population that would show the same amount of dispersion of allele frequencies under random genetic drift or the same amount of inbreeding as the population under consideration.	PARTIAL
Life History	Age Structure	Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery origin conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries. Juvenile age is determined by brood year (year when eggs are placed in the gravel) Then age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	YES
	Age–at–Return	Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive brood adult returns. Accessed via scale method, dorsal fin ray ageing, or mark recoveries.	YES
	Age–at-Emigration	Juvenile Age is determined by brood year (year when eggs are placed in the gravel) Then Age is determined by life stage of that year. Methods to age Chinook captured in screw trap are by dates; fry – prior to July 1; parr – July 1-August 31; presmolt – September 1 – December 31; smolt – January 1 – June 30; yearlings – July 1 – with no migration until following spring. The age class structure of juveniles is determined using length frequency breakouts for natural-origin fish. Scales have been collected from natural-origin juveniles, however, analysis of the scales have never been completed. The age of hatchery-origin fish is determined through a VIE marking program which identifies fish by brood year. For steelhead we attempt to use length frequency but typically age of juvenile steelhead is not calculated.	YES
	Size-at-Return	Size distribution of spawners using fork length and mid-eye hypural length. Raw database measure only.	YES
	Size-at-Emigration	Fork length (mm) and weight (g) are representatively collected weekly from natural juveniles captured in emigration traps. Mean fork length and variance for all samples within a lifestage-specific emigration period are generated (mean length by week then averaged by lifestage). For entire juvenile abundance leaving a weighted mean (by lifestage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery.	YES

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
	Condition of Juveniles at Emigration	Condition factor by life stage of juveniles is generated using the formula: K = $(w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	YES
	Percent Females (adults)	The percentage of females in the spawning population. Calculated using 1) weir data, 2) total known origin carcass recoveries, and 3) weir data and unmarked carcasses above and below weir. Calculated for wild, hatchery, and total fish.	YES
	Adult Run-timing	Arrival timing of adults at adult monitoring sites (weir, PIT array) calculated as range, 10%, median, 90% percentiles. Calculated for wild and hatchery origin fish separately, and total.	YES
	Spawn-timing	This will be a raw database measure only.	YES
	Juvenile Emigration Timing	Juvenile emigration timing is characterized by individual life stages at the rotary screw trap. Emigration timing at the rotary screw trap is expressed as the percent of total abundance over time while the median, 0%, 10, 50%, 90% and 100% detection dates are calculated for fish at first mainstem dam.	YES
	Mainstem Arrival Timing (Lower Monumental)	Unique detections of juvenile PIT-tagged fish at first mainstem dam are used to estimate migration timing for natural and hatchery origin tag groups by lifestage. The actual Median, 0, 10%, 50%, 90% and 100% detection dates are reported for each tag group.	YES
Habitat	Physical Habitat	TBD	NO
	Stream Network	TBD	NO
	Passage Barriers/Diversions	TBD	NO
	Instream Flow	USGS gauges and also staff gauges	YES
	Water Temperature	Temp logger at screw trap	YES
	Chemical Water Quality	TBD	
	Macroinvertebrate Assemblage	TBD	
	Fish and Amphibian Assemblage	Observations through rotary screw trap catch and while conducting snorkel surveys.	PARTIAL
In-Hatchery Measures	Hatchery Production Abundance	The number of hatchery juveniles of one cohort released into the receiving stream per year. Derived from census count minus prerelease mortalities or from sample fish-per-pound calculations minus mortalities. Method dependent upon marking program (census obtained when 100% are marked).	YES

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
	In-hatchery Life Stage Survival	In-hatchery survival is calculated during early life history stages of hatchery-origin juvenile Chinook. Enumeration of individual female's live and dead eggs occurs when the eggs are picked. These numbers create the inventory with subsequent mortality subtracted. This inventory can be changed to the physical count of fish obtained during CWT or VIE tagging. These physical fish counts are the most accurate inventory method available. The inventory is checked throughout the year using 'fish-per-pound' counts. Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to ponded fry, fry to parr, parr to smolt and overall green egg to release) Derived from census count minus prerelease mortalities or from sample fish- per-pound calculations minus mortalities. Life stage at release varies (smolt, presmolt, parr, etc.).	YES
	Size-at-Release	Mean fork length measured in millimeters and mean weight measured in grams of a hatchery release group. Measured during pre-release sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (smolt, presmolt, parr, etc.).	YES
	Juvenile Condition Factor	Condition Factor (K) relating length to weight expressed as a ratio. Condition factor by life stage of juveniles is generated using the formula: $K = (w/l^3)(10^4)$ where K is the condition factor, w is the weight in grams (g), and l is the length in millimeters (Everhart and Youngs 1992).	YES
	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female. Measured as the number of eggs per female calculated by weight or enumerated by egg counter.	YES
	Spawn Timing	Spawn date of broodstock spawners by age, sex and origin, Also reported as cumulative timing and median dates.	YES
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F1s. Does not include prespawn mortality.	YES
	Hatchery Broodstock Prespawn Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	YES
	Female Spawner ELISA Values	Screening procedure for diagnosis and detection of BKD in adult female ovarian fluids. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum.*	YES
	In-Hatchery Juvenile Disease Monitoring	Screening procedure for bacterial, viral and other diseases common to juvenile salmonids. Gill/skin/ kidney /spleen/skin/blood culture smears conducted monthly on 10 mortalities per stock	YES
	Length of Broodstock	Mean fork length by age measured in millimeters of male and female broodstock spawners. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for aging.	YES

Performance Measure		Definition	Performance Measures Currently Completed (Yes, No, Partial)
	Prerelease Mark Retention	Percentage of a hatchery group that have retained a mark up until release from the hatchery. Estimated from a sample of fish visually calculated as either “present” or “absent”	YES
	Prerelease Tag Retention	Percentage of a hatchery group that have retained a tag up until release from the hatchery - estimated from a sample of fish passed as either “present” or “absent”. (“Marks” refer to adipose fin clips or VIE batch marks).	YES
	Hatchery Release Timing	Date and time of volitional or forced departure from the hatchery.	YES
	Chemical Water Quality	Hatchery operational measures included: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities; ammonia (NH_3) nitrite (NO_2)	PARTIAL
	Water Temperature	Hatchery operational measure (Celsius) - measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	PARTIAL

Use the above information to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate these parameters will be determined by implementation plans, budgets, and assessment priorities.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The LSRCP program, as part of the ongoing mitigation program, has provided funding for Monitoring and Evaluation. Recent reviews by the HSRG and HRT, as well as the most recent NOAA Biological Opinion and Salmon Recovery Plan, recommended altered or new monitoring and evaluation actions be taken to more fully address concerns about this hatchery program and this natural population. To that end, following are possible or initiated actions that could help managers understand the performance and effects of this program on the Tucannon spring Chinook population:

1. **Increase PIT Tagging to 25,000 and monitor adult returns to the Tucannon and Lower Granite Dam** – Issue TR-SC15b – The preliminary determination of straying above Lower Granite Dam was based upon very few recoveries of PIT tagged fish. It is recommended that hatchery PIT tagging be increased to 25,000. This should provide adequate numbers of detections to provide information on juvenile survival to Snake and Columbia River dams, monitoring adult return timing, run prediction verification,

and information on straying above Lower Granite Dam. Recent construction of a PIT tag array in the lower Tucannon River would provide information on the number of fish actually entering the river. WDFW staff are available and committed to this effort that is funded through LSRCP and directly from BPA- **$ to $$.**

2. **Conduct a Radio Telemetry Study (3 yrs) –** Issue TR-SC15a - Preliminary analysis of adult return PIT tag data suggests that a large portion of Tucannon spring Chinook adults bypassed the Tucannon River and went above Lower Granite Dam. The reason for this is unclear but it may be a hydrosystem effect. A radio telemetry study would allow study of the behavior of Tucannon origin fish (bank orientation, final destination, etc.) as they near the mouth of the Tucannon River to help determine the amount of searching or the likely cause of this phenomenon, which could severely limit recovery of this population. A telemetry study could also determine the distribution and fate of the Tucannon spring Chinook upstream of Lower Granite Dam. This study would be less expensive if it can be linked with USACE funded radio telemetry studies at mainstem dams because fixed site receivers would likely be in place and monitored under the USACE study. This project may be contracted as a graduate student study - **$$.**
3. **Examine Carrying Capacity and Productivity of the Tucannon River** - An examination of redd counts versus smolt production needs to be made to estimate the carrying capacity of the Tucannon River for rearing and smolt production. This may help determine why natural production has such poor parent-to-progeny survival ratios and if it is related to habitat, genetics, or some other factor. WDFW staffing would need to increase to conduct this study (considered as part of biological data analyst position) - **$$.**
4. **Conduct a Pedigree Analysis** (4 yrs) – Issue TR-SC14 – WDFW proposes conducting a pedigree analysis (relative reproductive success study) to determine and compare the reproductive success of hatchery and natural origin Tucannon River spring Chinook passed upstream of the weir. This would require a new smolt trap at or near the Tucannon adult trap. Results of this type of study would help in the decision on the proportion of hatchery and natural fish passed upstream to spawn naturally. CTUIR does not support this study. Additional staff funding would be needed to implement this study, particularly for genetic analysis - **$$$.**
5. **Develop and Implement an Asotin Creek Reintroduction Plan based on the Safety-Net RPA–** 2008 FCRPS BiOp RPA #41 – The 2008 Biological Opinion includes an undefined Tucannon River spring/summer Chinook safety-net program. CTUIR would prefer continuation of the captive brood program as the safety net approach, but WDFW prefers reintroduction into Asotin Creek as the safety net for the Tucannon population by broadening their distribution and total abundance. During low run years, having captive brood on hand through a safety-net program would help meet egg take goals on the Tucannon. However, during large return years the hatchery staff would have excess hatchery adults or jacks available for transport from the Tucannon River trap for reintroduction efforts in Asotin Creek. Also, excess hatchery production (smolts) could potentially be used for reintroduction into Asotin Creek but that would require additional space at LFH and funding is needed for the completion of a plan for use of excess hatchery production in Asotin Creek, as well as implementation of that plan. Costs for the safety net program includes funding the capital construction, operation, and monitoring and evaluation costs to implement the program. Safety-Net

Program that transfers hatchery spring Chinook adults from the Tucannon River to Asotin Creek could be done with currently available staff and monitoring efforts, but additional funding may be needed for transportation - **$** to **$$**. Development of a Reintroduction Plan with excess hatchery production may require some additional funding for staff to participate**- $.** Implementation of the plan to use hatchery production of smolts for Asotin Creek would require additional facilities and operational costs at Lyons Ferry Hatchery, plus additional staff time for monitoring and evaluation efforts annually**- $$ to $$$.**

6. **Evaluate feasibility of using chemical imprinting to improve homing to the Tucannon River.** A literature review and development of a plan for using a chemical or hormone drip to try and improve imprinting and homing is needed within the next two or three years**- $**. This may require additional staff time or a contract for a consultant to do this plan development. After the telemetry and enhanced PIT tag studies have been conducted for 2-4 years, if the problem remains at an unacceptable rate (possibly over 15%) of returning adults bypassing the Tucannon River, implement and evaluate the preferred alternative of the chemical imprinting plan to improve homing of spring Chinook into the Tucannon River. WDFW would need additional staff time as part of the WDFW proposed biological analyst position to carry out this action - **$$$**
7. **Install and operate an additional smolt trap higher in the basin but below the Tucannon Fish Hatchery.** This is needed to evaluate survival, distribution, movements, and timing within the Tucannon mainstem to help determine the life stage and location of the mortalities and limitations on this population during the freshwater phase of their life cycle. This information would also be required for use with the pedigree study mentioned above and for evaluating the freshwater production effects of habitat programs within the Tucannon River. WDFW would likely need additional staff and another smolt trap to implement this action **$$**
8. **Compare Tucannon River population performance (e.g. recruits per spawner and adult abundance) to reference populations (e.g. Wenaha spring Chinook) that do not include hatchery programs.** This is needed to help evaluate the effects of the hatchery program on restoring the Tucannon spring Chinook population and it has been recommended by the ISRP review of the LSRCP spring Chinook programs. WDFW has initiated this effort, but may need additional staff assistance to be able to complete this effort - **$.**
9. **Evaluate density dependence limitations on Tucannon spring Chinook productivity in the Tucannon River to evaluate the effects of the hatchery supplementation program.** This is needed to help evaluate the effects of the hatchery program on restoring the Tucannon spring Chinook population and it has been recommended by the ISRP review of the LSRCP spring Chinook programs. WDFW has initiated this effort, but may need additional staff assistance to be able to complete this effort - **$.**
10. **Complete comprehensive evaluation of progeny-to-parent and SAR for all fish, including those that cross Lower Granite** utilizing one or more reference populations and compare with conventional values in the Tucannon River. WDFW has initiated this effort, but may need additional staff assistance to be able to complete this effort - **$.**
11. **Complete in-season predictions and tracking of adult returns to the Tucannon using PIT tags.** Use tags returning to the Columbia and Snake Basins for assessment

of adult losses and return timing, as well as to improve prediction capabilities for adult management and future fisheries. WDFW would likely need additional staff time to implement this action (could be part of proposed bio-analyst position) - **$**.

12. **Study the feasibility of rearing Tucannon spring Chinook full term at Tucannon Hatchery.** The study would utilize a portion of existing production (approximately 25,000) and would use existing PIT tags available either from LSRCP or BPA. WDFW would likely need additional staff time to implement this action (could be part of proposed bio-analyst position) - **$**.

For Reference:

$	<$50,000
$$	$50,000-<$100,000
$$$	$100,000-<$500,000
$$$$	$500,000-<$1,000,000
$$$$$	$1,000,000-<$5,000,000
$$$$$$	Over $5,000,000

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

1. Juvenile sampling at hatchery facilities will be conducted with accepted procedures to minimize stress and mortality from sampling. Sample sizes will be the minimum necessary to achieve statistically valid results for growth, tag retention and fish health.
2. Smolt trapping operations will ensure that holding time, stress and potential for injury of captured migrants is minimized. Marked groups for assessing trap efficiency will be the minimum necessary to achieve statistically valid results.
3. Adult trapping facilities will be monitored daily, or more often as necessary to prevent injury and unnecessary delay.
4. Spawning ground surveys will be conducted in such a manner to avoid scaring spawning fish off redds. Also, care will be taken when walking in areas with redds so eggs won't be accidentally crushed.
5. Only locations thought to have a large number of hatchery precocial parr will be cast netted to lessen impacts on natural origin parr.
6. If snorkel surveys are conducted, only the minimum number of sites necessary to achieve statistically valid results for population estimates will be sampled. Displacement of fish will be kept to a minimum by snorkeling on days when water clarity and visibility are high.
7. If electrofishing surveys are conducted, only the minimum number of sites necessary to achieve statistically valid results for population estimates will be sampled. If possible, surveys will be conducted when water temperatures are below stressful levels to fish. WDFW will follow NMFS and WDFW electrofishing guidelines by: not shocking near redds or spawning adults, use of approved electroshockers, having experienced crew members during all shocking surveys, using DC current (pulsed or direct where appropriate), recording temperature, conductivity and electroshocker settings, and providing a good environment for fish holding/sampling after capture.

SECTION 12. RESEARCH

*Provide the following information for any research programs conducted in **direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish**. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in **Table B**.*

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project

The ongoing LSRCP program research is designed to:

- Document hatchery rearing and release activities and subsequent adult returns.
- Determine success of the program in meeting mitigation and conservation goals and adult returns to the Snake River Basin; namely contribution to fisheries, and escapement of hatchery and wild Chinook to the Tucannon River.
- Provide management recommendations aimed at optimizing program effectiveness and efficiency.
- Provide management recommendations aimed at optimizing the beneficial effects of supplementation while minimizing potentially negative effects and interactions on ESA-listed populations.

12.2) Cooperating and funding agencies.

USFWS - Lower Snake River Compensation Program
BPA - Bonneville Power Administration
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation

12.3) Principle investigator or project supervisor and staff.

WDFW: Mark Schuck (Project Leader), Michael Gallinat (Principle Investigator), Lance Ross (Lead Technician), Temporary field technicians.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Same as described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

1) <u>*Monitoring hatchery/wild ratios in natural spawning streams*</u> - Adult spring Chinook will be captured and enumerated and either collected for broodstock or passed upstream at the

TFH adult trap. In addition, redd counts and carcass surveys will be performed on the Tucannon River and hatchery/wild ratios calculated. Fish that are collected for broodstock are hauled to LFH for future spawning. Length and weight data, scale samples, coded-wire tags, and tissue samples for genetic analysis are obtained from collected broodstock. Similar samples are collected from carcasses during spawning ground surveys on the Tucannon River. Genetic analysis will be performed to look for evidence that the hatchery and natural fish are genetically diverging. See section 2.2.3.

2) *Smolt trapping* – Juvenile natural-origin Chinook captured at the smolt trap will be anesthetized with MS-222 and measured and weighed. Non-lethal tissue samples may be removed for mark/recapture experiments or genetic analysis and the fish will be allowed to recover before release. Hatchery produced juveniles will also be sampled for comparison to natural fish. Juvenile Chinook may also be PIT tagged to assess juvenile emigration and adult return behavior.

12.6) Dates or time period in which research activity occurs.

1. April – late September/early October (adult trapping); late August – early October (hatchery and river spawning).
2. October – June/early July (smolt trapping).

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

At LFH, adult spring Chinook will be anesthetized with MS-222 before they are handled.

Smolt trapping - Most fish will be counted and released immediately back to the stream to continue their out-migration. During peak out-migration, fish may be held in live boxes for two to three hours before release (mark/recapture trials, or PIT tagged). At other times of year the trap may be checked only once a day. Fish will be hauled upstream in buckets or tubs for release to estimate trapping efficiency and population size. In addition, a portion of the naturally spawned fish may be PIT tagged to monitor downstream migration timing. Juvenile fish will be anesthetized with MS-222 prior to any handling. Delayed migration will result for fish captured in the trap, and delayed mortality as a result of injury may also result. Mortality of both natural and hatchery origin spring Chinook is expected to remain below 3% (based on previous records of smolt trapping in the Tucannon River from 1997-present).

12.8) Expected type and effects of take and potential for injury or mortality.

Injury due to capture, marking, and tissue sampling is inevitable. There may be an occasional direct loss due to capture and handling. We account for lethal takes that may occur during monitoring and evaluation activities (Tables A and B).

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take tables" (Tables A and B).

See “Take” Tables A and B.

12.10) Alternative methods to achieve project objectives.

One of our goals is population recovery and thus the maintenance of the historic genetic profile. If genetic monitoring finds divergence between the hatchery and natural populations we may need to change our broodstock spawning protocols (number and origin) in the hatchery and fish passage protocols (number and origin) at the Tucannon Fish Hatchery adult trap.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Fall Chinook salmon are encountered at the smolt trap and may be confused for subyearling spring Chinook. Unlisted coho salmon and mountain whitefish are also present in the Tucannon River and are encountered at the smolt trap. During smolt trapping, we expect to encounter listed spring/summer/fall Chinook juveniles, summer steelhead juveniles, and bull trout during sampling. However the numbers of mortalities are expected to be low (typically less than 50 per species). Mortalities are also expected to be low at the Tucannon adult trap as there has only been one unintentional spring Chinook mortality during the last twelve years (Table 8). Bull trout are also encountered at the adult trap but mortalities are rare.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(*e.g. “Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.”).*

Risk aversion measures:

- All fish (target and non-target species) are monitored and passed through the adult trap daily so as not to delay movement and decrease potential for mortality.
- The smolt trap is checked throughout the day and night during peak outmigration to decrease stress on the fish and the potential for mortality from debris and predation.
- Trained surveyors are used during spawning ground surveys to decrease the potential for damage to redds.
- Juveniles are allowed to recuperate and regain equilibrium after being anaesthetized before being released.

Handling of fish is kept to the minimum needed to collect the necessary data and provide valid estimates of abundance and survival.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP 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:_____________

<u>SECTION 15. PROGRAM EFFECTS ON OTHER (NON-ANADROMOUS SALMONID) ESA-LISTED POPULATIONS.</u> Species List Attached (Anadromous salmonid effects are addressed in Section 2)

Currently, there are 44 separate listings of Federal Status endangered/threatened species within the State of Washington. In the list below (Table 17), are all non-salmonid listed species and their current status ratings. Of the following species listed, only the plant species Spalding's catchfly is suspected to be found in the area where the Tucannon River Spring Chinook Program occurs. Species such as the gray wolf, the grizzly bear, the Canadian lynx, and the northern spotted owl were once likely found in the area, but their current existence is not verified. The geographic distributions of the other listed species were generally limited to the Cascade Mountain Range, the Selkirk Mountains in NE Washington, the Willamette Valley (Oregon), Puget Sound and Coastal areas.

Table 17. List of current ESA listed species (animal and plant) within the State of Washington.

Status Rating	Species
ANIMALS	
Endangered	Albatross, short-tailed (*Phoebastria (=Diomedea) albatrus*)
Threatened	Bear, grizzly – (*Ursus arctos horribilis*)
Threatened	Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)
Endangered	Caribou, woodland Selkirk Mtn. Population (ID, WA, B.C.) (*Rangifer tarandus caribou*)
Endangered	Curlew, Eskimo (*Numenius borealis*)
Endangered	Deer, Columbian white-tailed (*Odocoileus virginianus leucurus*)
Threatened	Lynx, Canada (lower 48 States DPS) (*Lynx canadensis*)
Threatened	Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*)
Threatened	Otter, southern sea (*Enhydra lutris nereis*)
Threatened	Owl, northern spotted (*Strix occidentalis caurina*)
Endangered	Pelican, brown (*Pelecanus occidentalis*)
Threatened	Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*)
Endangered	Rabbit, pygmy (*Brachylagus idahoensis*)
Threatened	Sea turtle, green (*Chelonia mydas*)
Endangered	Sea turtle, leatherback (*Dermochelys coriacea*)
Threatened	Sea-lion, Steller (eastern pop.) (*Eumetopias jubatus*)
Endangered	Sea-lion, Steller (western pop.) (*Eumetopias jubatus*)
Endangered	Whale, humpback (*Megaptera novaeangliae*)
Endangered	Whale, killer – Southern Resident DPS (*Orcinus orca*)
Endangered	Wolf, gray (Canis *lupus*)
PLANTS	
Threatened	Catchfly, Spalding's (*Silene spaldingii*)
Threatened	Checker-mallow, Nelson's (*Sidalcea nelsoniana*)
Endangered	Checkermallow, Wenatchee Mountains (*Sidalcea oregana var. calva*)
Endangered	Desert-parsley, Bradshaw's (*Lomatium bradshawii*)
Threatened	Howellia, water (*Howellia aquatilis*)
Threatened	Ladies'-tresses, Ute (*Spiranthes diluvialis*)
Threatened	Lupine, Kincaid's (Lupinus *sulphureus (=oreganus) ssp. Kincaidii (=var. kincaidii)*)
Threatened	Paintbrush, golden (*Castilleja levisecta*)
Endangered	Stickseed, showy (*Hackelia venusta*)

15.1) <u>List all ESA permits or authorizations for all non-anadromous salmonid programs associated with the hatchery program.</u>

Section 10 permits, 4(d) rules, etc. for other programs associated with hatchery program. Section 7 biological opinions for other programs associated with hatchery program.

See Section 2.1

15.2) <u>Description of non-anadromous salmonid species and habitat that may be affected by hatchery program.</u>

General species description and habitat requirements (citations).

Spalding's Catchfly

Much of the following has been compiled from: Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1964. Vascular Plants of the Pacific Northwest, Part 2: Salicaceae to Saxifragaceae. University of Washington Press, Seattle. 597 pp.

The Spalding's Catchfly is a long-lived, herbaceous perennial; 8-24 inches tall, typically with one stem, but can have several. Each stem bears 4-7 pairs of lance shaped leaves 2 to 3 inches in length. The light green foliage and stem are lightly to more typically densely covered with sticky hairs. The cream-colored flowers are arranged in a spiral at that top of the stem. The outer, green portion of the flower forms a tube, ~1/2 inch long with ten distinct veins running it's length. The flower consists of 5 petals, each with a long narrow "claw" that is largely concealed by the calyx tube and a very short "blade", or flared portion at the summit of the claw. Four (sometimes as many as 6) short petal-like appendages are attached inside and just below each blade.

The species begins to flower in mid- to late July, with some individuals still flowering by early September. Most other forbs within its habitat have finished flowering when *S. spaldingii* is just hitting its peak. A majority of individuals have developed young fruits by mid- to late August.

S. spaldingii occurs primarily within open grasslands with a minor shrub component and occasionally with in a mosaic of grassland and ponderosa pines. It is most commonly found at elevations of 1,900-3,050 feet, near lower tree line, with a preference for northerly-facing aspects. The species is primarily restricted to mesic (not extremely wet nor extremely dry) prairie or steppe vegetation that makes up the Palouse Region in SE Washington.

Local population status and habitat use (citations).

Within the State of Washington, *S. spaldingii*, has been confirmed to be found in Asotin, Lincoln, Spokane and Whitman counties, with a status listing of 'threatened". A total of 28 populations have been identified (FR# 1018-AF79, Vol 66, No. 196, p. 51598). This plant is threatened by a variety of factors including habitat destruction and fragmentation resulting from agricultural and urban development, grazing and trampling by domestic livestock and native herbivores, herbicide treatment and competition from nonnative plant species (Gamon 1991; Schassberger 1988). It is currently estimated that 98% of the original Palouse prairie habitat has been lost to the mentioned activities (Gamon 1991). Each of the populations documented are generally very small, and are currently quite fragmented, raising questions about their long-term viability.

Site-specific inventories, surveys, etc. (citations).

Site-specific findings in Columbia and Walla Walla counties are not available. However, it's possible that portions of the Walla Walla River Basin could contain the listed species. But it is not expected that the current Tucannon spring Chinook program as described would affect the listed species.

15.3) <u>Analysis of effects.</u>

Spalding's Catchfly
Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects).

To the best of our knowledge, the program as described in this HGMP will not have direct, indirect, or cumulative effects on the listed species. The surrounding habitat associated with this hatchery compensation program will not be altered, which would be the only source of "take" possible to the listed species. Interactions with spring Chinook will not occur.

Identify potential level of take (past and projected future).

None (past or projected future).

<u>Hatchery operations</u> - water withdrawals, effluent, trapping, releases, routine operations and maintenance activities, non-routine operations and maintenance activities (e.g. intake excavation, construction, emergency operations, etc.)

Operation of the Tucannon Fish Hatchery and adult trap will not affect (directly or indirectly) the existence of the listed species in the area. Habitat requirements for the species do not seem to apply. Activities at Lyons Ferry all take place on existing hatchery grounds. No new construction activities are planned for the program in either location that could impact the listed species. Effluent from LFH falls below state water quality standards guidelines, and is therefore not a concern.

<u>Fish health</u> - pathogen transmission, therapeutics, chemicals.

Not Applicable – pathogens would not be transmitted between the species (plant vs. animal).

<u>Ecological/biological</u> - competition, behavioral, etc.

Not Applicable - Non-overlapping habitats between the spring Chinook and the flower.

Predation -

Not Applicable - Hatchery spring Chinook do not prey on the flower.

Monitoring and evaluations - surveys (trap, seine, electrofish, snorkel, spawning, carcass, boat, etc.).

Not Applicable.

Habitat - modifications, impacts, quality, blockage, de-watering, etc.

Modifications to the surrounding hatchery areas are not planned at this time, so no loss of potential habitat to the listed species is expected.

15.4 Actions taken to mitigate for potential effects.

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

No actions are considered necessary at this time. Disturbance where Spalding's Catchfly may live will not occur over the course of the program.

15.5 References

Gamon, J. 1991. Report on the status in Washington of *Silene spaldingii* Wats. Report prepared for Washington State Department of Natural Resources by the Washington Natural Heritage Program, Olympia. 53pp.

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Table A. Estimated listed salmonid take levels of Tucannon River spring Chinook by hatchery activity.

Listed species affected: Spring/Summer Chinook ESU/Population: Snake River/ Tucannon River Activity: Broodstock collection, spawning, rearing, and release.				
Location of hatchery activity: Lyons Ferry Complex Dates of activity: Year Round Hatchery program operator: Jon Lovrak, Lyons Ferry Complex Manager				
	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	0	0	3,000	0
Collect for transport b)	0	0	400	0
Capture, handle, and release c)	0	0	3,000	0
Capture, handle, tag/mark/tissue sample, and released d)	0	247,500	3,000	1,500
Removal (e.g. broodstock) e)	0	0	400	0
Intentional lethal take f)	0	0	300	0
Unintentional lethal take g)	0	0	25	0
Other Take (specify) h)	0	0	0	0

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release (planned Asotin Creek reintroduction.)
c. Take associated with weir or trapping operations where listed fish are captured, handled, and released upstream or downstream.
d. Take occurring due to PIT tagging and/or bio-sampling of fish (length, weight, scales) 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.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

Table B. Estimated listed salmonid take levels by Research/Monitoring/Evaluation activity.

Listed species affected: Spring Chinook ESU/Population: Snake River/ Tucannon River Activity: Spawning, Snorkel, smolt trapping, cast netting, and electrofishing surveys				
Location of hatchery activity: Tucannon River _(Various locations) Dates of activity: Year Round___ Research/ Monitoring / Evaluation program operator: Michael Gallinat, Evaluations Biologist				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	50,000	4,000	3,000	0
Collect for transport b)	0	20,000 H; 5,000 W	0	0
Capture, handle, and release c)	0	100,000 H; 25,000 W	0	0
Capture, handle, tag/mark/tissue sample, and release d)	0	20,000 H; 5,000 W	30	0
Removal (e.g. broodstock) e)	0	0	0	0
Intentional lethal take f)	0	200 H; 125 W	0	0
Unintentional lethal take g)	0	1,500 H; 375 W	0	0
Other Take h)	0	50,000 H; 10,000 W	0	0

a. Contact with listed fish though snorkeling and spawning surveys.
b. Take (non-lethal) of juveniles/smolts captured and marked for smolt trap efficiency tests.
c. Take associated with smolt trapping operations, electrofishing, cast netting, and hook and line methods to estimate residuals, where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to bio-sampling (length/weight and scales) of fish collected through smolt trapping operations or electrofishing surveys prior to release.
e. Listed fish removed from the wild and collected for use as broodstock intentional mortality of listed fish during smolt trapping or electrofishing.
f. Intentional mortality of listed fish.
g. Unintentional mortality of listed fish, including loss of fish during transport during smolt trapping or holding after electrofishing.
h. Fish PIT tagged at the hatchery or smolt trap.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).

4. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.