HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Grande Ronde Basin Catherine Creek Spring/Summer Chinook Program**
Species or Hatchery Stock:	**Spring/Summer Chinook, Catherine Creek Stock**
Agency/Operator:	**Oregon Department of Fish and Wildlife**
Watershed and Region:	**Grande Ronde / Snake River / ColumbiaBasin / Oregon**
Date Submitted:	**December 2002**
Date Last Updated:	**May 2011**

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.
Lookingglass Hatchery Catherine Creek Spring/Summer Chinook Program

1.2) Species and population (or stock) under propagation, and Endangered Species Act

(ESA) status.
Catherine Creek Spring/Summer Chinook Salmon. *Oncorhynchus tshawytscha*

ESA status: Threatened (Snake River Spring/Summer)

CatherineCreek Population - (stock 201)

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) – Funding/oversight.
2. Confederated Tribes of the Umatilla Indian Reservation (CTUIR) – Co-managers and operators of acclimation and adult collection facilities.
3. NOAA – Program oversight and ESA permitting.
4. Bonneville Power Administration (BPA) – Funding.

1.4) Funding source, staffing level, and annual hatchery program operational costs.
The funding programs/sources are described in two components: Lower Snake River Compensation Plan and BPA Endemic Program.

LSRCP–The program is part of the federally mandated Lower Snake River Compensation Plan (LSRCP) mitigation program funded through the US Fish and Wildlife Service and designed to mitigate for fish losses at the Lower Snake River dams. The LSRCP spring/summer Chinook program in northeast Oregon includes Lookingglass Hatchery, integrated with the Grande Ronde BasinChinook program, Imnaha Basin program, and Captive Broodstock program.Hatchery Coordinator, Hatchery Manager, 4 hatchery technician positions, one three month technician position shared with Wallowa Hatchery, one Facilities Operations Specialist, and 2 seasonal laborer positions constitute the staffing at Lookingglass Hatchery. Annual operation and maintenance costs for the CatherineCreek portion of the FY 2007 program are estimated at $170,000.

Endemic Program (Conventional Broodstock)–This portion of the program is directed by NOAA to supplement Grande Ronde Chinook with stocks indigenous to the basin.

BPA funds CTUIR to operate the CatherineCreek and Upper Grande Ronde acclimation and adult collection facilities. Combined program staff is 3 full time and 4 seasonal CTUIR employees. Annual operation and maintenance costs are estimated at $537,000. BPA also funds M and E staff (3) with annual costs estimated at $190,000. Funds estimated to be spent on the CatherineCreek portion is estimated at $360,000.

BPA funds Oregon Department of Fish and Wildlife (ODFW) to integrate tribal and ODFW operations at Lookingglass Hatchery. Annual operation and maintenance costs at Lookingglass Hatchery are estimated at $70,000.

Captive Broodstock–Is a conservation measure in response to severely declining abundance of Chinook salmon in the GrandeRondeBasin.

This program was initiated in 1995 using smolts collected from the 1994 cohort. Smolts were reared to maturity, spawned, and the eggs incorporated in the LSRCP program. The CatherineCreek portion was discontinued with brood year 2005. ODFW will continue to evaluate the Captive Broodstock F_1 generation and monitor general hatchery performance under LSRCP funding. Future captive broodstock production is not included in this document.

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

1. <u>Early captive brood rearing, egg incubation, and juvenile rearing:</u>
Lookingglass Hatchery is located 19 miles north of the town of Elgin, Oregon, adjacent

to Lookingglass Creek (ODFW watershed code 080440000) and 2.2 miles above its confluence with the GrandeRondeRiver at about river mile 86. Elevation at the hatchery is 2,550 feet above sea level. Adult facilities consist of one adult trap, two adult concrete holding ponds (4,560 ft^3), each partitioned into two ponds, three adult circular holding tanks 1,100 $ft.^3$ (20'x 4'), and three small circular tanks (6' x 3'). Incubation is in 504 vertical incubator trays with a capacity of 2.52 million eggs (5,000 eggs per tray) to hatching. There are 28 deep Canadian troughs for early rearing with a capacity of 200 to 250 poundsof fish each. Three troughs are allocated for CatherineCreek stock. Final rearing is in 2 of 18 concrete raceways with 3,000 cubic feet of rearing space and one 20'x 4' (1,100 ft^3) circular tank from October to release. Final rearing density indices range from 0.17 to 0.24.

2. *Acclimation:*

- CTUIR operates the Catherine Creek Acclimation Facility at river mile 29 of Catherine Creek, Oregon (HUC 17060104, ODFW watershed Catherine Creek-code 0800529999).
- Acclimation occurs in four raceways. Raceway dimensions are approximately 8x86x3.0 (2,064 $ft.^3$) in size.

♦ **Other organizations involved and intent**

The U.S. Army Corps of Engineers funded initial planning, construction and operation of Lookingglass Hatchery. Currently, US Fish and Wildlife Service (LSRCP) funds operation and maintenance expenditures at Lookingglass Hatchery through an agreement with BPA. CTUIR and ODFW are co-managers of the CatherineCreek spring/summer Chinook salmon program.

1.6) Type of program.

Integrated Recovery: The Catherine Creek spring/summer Chinook salmon (ODFW stock ID 201) propagation program is funded through LSRCP and managed to contribute to adult return objectives of LSRCP, meet US v. OR production objectives, and contribute to recovery and sustainability of the natural population. The program contributes to sport, commercial, and tribal harvest opportunities in the mainstem Columbia and Snake rivers and potentially to CatherineCreek in years of abundant returns.

1.7) Purpose (Goal) of program.

The goal of this program is the restoration of spring/summer Chinook salmon in CatherineCreek using the indigenous stock and to mitigate for fish losses occurring as a result of the construction and operation of the four Lower Snake River Dams. The program mitigation goal for the GrandeRondeBasin is to return 5,720 hatchery adults to the Snake River above Ice Harbor Dam. The proportion of the CatherineCreek program is 970 adults and an estimated 0.65% smolt-to-adult survival rate. The target smolt production is 150,000.

Program specific goals for the CatherineCreek program include:

1. Prevent extinction of Catherine Creek spring Chinook population and ensure a high probability of population persistence well into the future, once causes of basin-wide decline have been addressed.

2. Restore and maintain viable naturally spawning populations of Chinook salmon in program streams.
3. Contribute to recreational, commercial and tribal fisheries in the mainstem Columbia River consistent with agreed abundance based harvest rate schedules established in the 2008 – 2017 U.S. v. Oregon Management Agreement.
4. Establish adequate broodstock to meet annual production goals.
5. Establish a consistent total return of Chinook salmon that meets the LSRCP mitigation goal of 970 hatchery adults in the Catherine Creek basin.
6. Re-establish historic tribal and recreational fisheries.
7. Minimize impacts of hatchery programs on other indigenous species.
8. Operate the hatchery program so that the genetic and life history characteristics of hatchery fish mimic those of wild fish, while achieving mitigation goals. Maintain genetic and life-history characteristics of the natural Chinook salmon population in Catherine Creek.

1.75) Recovery Plan Goals

Background

The program goal to restore a viable natural population of spring Chinook in Catherine Creek will be guided in part by the recovery plan being developed for the Snake River ESU of spring/summer Chinook. The primary units of the recovery plan are Major Population Groups (MPGs). The spring/summer Chinook that exist in the Imnaha and Grande Ronde basins represent one of these MPGs. For the ESU to achieve recovery, all MPGs must be viable. A determination of whether or not a MPG is viable is dependent on the status of the constituent populations. However, per ICTRT guidance, not all populations in a MPG must achieve low risk status before the MPG can be classified as viable. In the case of the Grande Ronde/Imnaha MPG, only five of the eight populations are associated with recovery plan actions that are expected to lead to low risk status. The Catherine Creek population is one of the five MPG populations that are intended to achieve low risk status.

Hatchery production is one of the strategies intended to support recovery of the Grande Ronde/Imnaha spring/summer Chinook MPG. Currently, all but two populations in the MPG, the Wenaha and Minam, are supplemented by hatchery production. Without the reproductive contribution these hatchery fish make to natural production, extirpation would possibly occur for several of these populations. Therefore, the recovery strategy includes the implementation of conservation hatchery programs with the intent to balance the adverse short-term impacts on diversity versus the long-term risk of population extirpation.

Recovery Plan Strategy

The number of natural origin adult (ages 4 and 5) spring Chinook spawning in Catherine Creek over that past ten years has been critically low, having geometric mean abundance of 107 fish (https://www.webapps.nwfsc.noaa.gov/apex/f?p=238:home:0). This represents 14.3% of the level necessary to meet the Minimum Abundance Threshold (MAT) of 750 adults established by the ICTRT for this population. As such, this population is at risk of demographic collapse which could lead to extirpation. The

strategy for this population was developed to address this immediate concern and relies on the use of hatchery fish to do so. In the short term, a hatchery broodstock, initiated from natural adults returning to the population, will be used to supplement the natural population and reduce its chances of demographic extinction. The long-term strategy is to use the hatchery program for gene banking and to generate fishery benefits through releases of hatchery smolts into limited portions of the basin or the continuation of releases at the current sites and management of hatchery fish through captures at the weir to manage their numbers on the spawning grounds relative to the number of natural origin spawners.

Recovery Plan Actions

- Based on monitoring surveys, estimate spawner distribution and abundance levels each year.
- Estimate the proportion of spawners each year that are hatchery fish.
- In the short-term the primary hatchery strategy objective will be to secure the genetic lineage of the Catherine Creek population so the best foundation for future recovery efforts is assured. This will be accomplished by three key actions. First, by the maintenance of the current hatchery broodstock that has been developed from natural origin adults returning to the Catherine Creek population. Second, the establishment of naturally reproducing population in Lookingglass Creek, using Catherine Creek broodstock as seed source. The original Lookingglass population has been extirpated and that lineage lost. Third, as one element of a program to develop and maintain a gene bank program for northeast Oregon Chinook, gametes from natural origin adults from the Catherine Creek population will be obtained for cryopreservation. The extent of these collections will depend, in part, on the number of gamete samples already in cryopreservation storage for this and other northeast Oregon populations.
- The short-term management of adults spawning in the Catherine Creek sub-basin upstream from the weir site and removal of broodstock to maintain the associated hatchery program will initially be based on the current 'sliding scale' protocol that has been agreed to among the fishery co-managers.
- In the event the abundance of natural origin spawners does not increase from current levels (0.14 of MAT) after a period of no more than two generations, the current hatchery strategy will be re-evaluated and changed if it appears there may be an alternative approach that has a better chance of achieving a different result or that will provide better long-term protection of this population's genetic resources.
- Once the population has emerged from its present critical population status and is sufficiently abundant to be classified as sub-vital (i.e., the 10-year geometric mean of natural origin spawners is greater than 0.30 of MAT), an evaluation will be performed to determine how best to use hatchery fish in order to promote a continued increase in the abundance of natural origin fish. This evaluation will be based on information collected for the population before and during the period of expansion to its current level and weigh the contribution of hatchery fish to this positive change.
- The development and implementation of a revised 'sliding scale' for spawner management similar to the Imnaha and Wallowa populations will be considered in the

event that the abundance of natural origin Chinook returning to this population achieve reaches a level corresponding to 0.30 of MAT (sub-vital).

- Once the geometric mean of natural origin spawners exceeds MAT, another investigation will be conducted using the most recently collected data to determine how best to increase the level of natural origin spawners further to broad sense recovery threshold of 2.0MAT (i.e., fundamental classification).
- Upon achieving the broad sense recovery threshold, naturally produced spring Chinook will be managed in a manner that is self-sustaining and without the need for the reproductive contribution of naturally spawning hatchery fish. It is assumed this condition will be achieved without adversely impacting agreements under U.S. v. Oregon. It is expected it will be possible to craft a solution that will eliminate the need to actively manage the fraction of hatchery fish spawning upstream of the Catherine Creek weir site for conservation purposes.
- Achievement of the broad sense recovery threshold would also trigger an assessment of the likelihood of achieving full ecological function for this population (i.e. 20.0 MAT). Consistent with the assessment finding, implement strategies that over the long-term may plausibility move the abundance of natural origin Chinook toward achieving this level.

1.8) Justification for the program.

The Catherine Creek population is at high risk of extinction (ICTRT 2007). The hatchery program provides adult Chinook for hatchery broodstock, limited recreational and tribal harvest within the Lower Snake River Compensation Plan mitigation area (Snake River and tributaries above Ice Harbor Dam), and fish for supplementation research. The program also provides fish for harvest in Columbia River fisheries. The program utilizes a Chinook hatchery stockendemic to Catherine Creek.

Comparison to the Viability Curve

The Catherine Creek spring Chinook salmon population is at *High Risk* based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 1, NMFS 2010).

Natural-origin spawners in the Catherine Creek spring Chinook salmon population have exhibited a substantial downward trend since 1980 (See Table 8). While estimated spawning in Catherine Creek peaked in 2001-2003, as did many other populations in this ESU, the relative increase during that period was lower than the corresponding levels for most

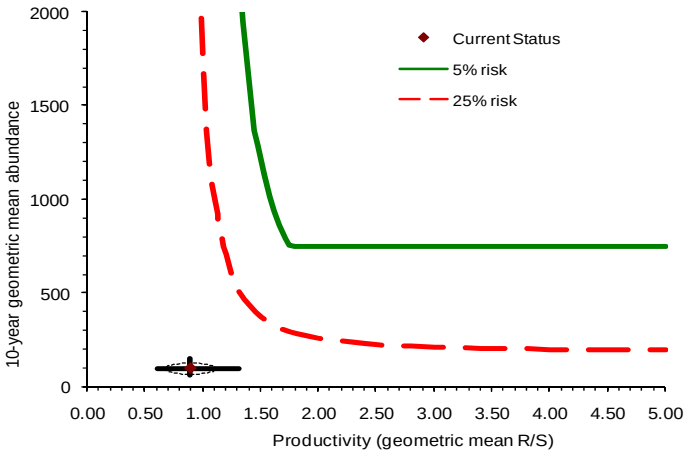

Figure 1. Catherine Creek spring Chinook salmon current estimate of abundance and productivity compared to ESU viability curve. Ellipse = 1 SE. Error bars = 90% CI(NMFS 2010).

other populations within the ESU. Carcass surveys indicated that a substantial proportion of spawners in this population were of hatchery-origin from 1985-1993 and were a mean of 61% hatchery origin from 2001-2010 . Prior to the 1993 return year, hatchery-origin spawners originated from non-local broodstock releases in the drainage. The program was transitioned to a local-origin broodstock in the mid-1990s. Non-local origin returns were actively removed at Lower Granite Dam during the transition period. Assuming that hatchery and natural-origin spawners contribute to production at the same rate, the estimated intrinsic population growth rate over the most recent twenty year period has been well below replacement (0.81, 30% probability of exceeding 1.0). The estimate of population growth rate is sensitive to the assumption regarding relative hatchery effectiveness at the average level of hatchery-origin spawner proportion observed for the Catherine Creek spring Chinook salmon population. Setting the relative hatchery effectiveness value to 0.00 to reflect the opposite extreme assumption results in an estimated average population growth rate of 0.93.

Overall Viability Rating

The overall viability rating for the Catherine Creek population does not meet viability criteria and is considered *High Risk* (Figure 2). The abundance and productivity rating is at *High Risk***.** The 10-year geometric mean of natural-originabundance is 107 which is only 14% of MAT level for this population's MAT of 750. The 20-year geometric mean productivity (0.89 R/S; Table 8) is significantly less than the 1.76 R/S required at the minimum abundance threshold and is in the low end of the high risk zone. The spatial structure and diversity rating is at *Moderate Risk* and there are numerous impairments that would need to be addressed to move the population to the low risk level.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	**M**
	Low (1-5%)	**V**	**V**	**V**	**M**
	Moderate (6 – 25%)	**M**	**M**	**M**	**HR**
	High (>25%)	**HR**	**HR**	**HR Catherine Creek**	**HR**

Figure 2. Catherine Creek spring Chinook salmon population risk ratings integrated across the four viable salmonid population (VSP) metrics. Viability Key: HV – Highly Viable; V – Viable; M – Maintained; HR – High Risk; Shaded cells - not meeting viability criteria (darker cells are at greater risk (NMFS 2010).

1.9) List of program "Performance Standards".

Legal Mandates- – Contribute to federal tribal trust responsibilities by providing adult spring/summer Chinook within the LSRCP mitigation area while minimizing adverse impacts to listed fish.

Performance Standard (1): Grande Ronde Basin Chinook production contributes to fulfilling tribal trust legal mandates and treaty rights.
*Indicator 1(a)**:*** Estimated number of program Chinook harvested in tribal fisheries by run year.
*Indicator 1(b):*Estimated number of Catherine Creek wild Chinook harvested in tribal fisheries by run year.
*Indicator 1(c):*Number of hatchery Chinook smolts released each year in the Catherine Creek.

Performance Standard (2): Program contributes to annual mitigation goals of LSRCP .
Indicator 2(a): Estimated total return to compensation area.
Indicator 2(b): Estimated annual harvest in LSRCP mitigation areas and annual escapement to the hatchery facility.
Indicator 2(c): Estimated number of recreational angler days in the Chinook fishery by run year.

Harvest
Performance Standard (3): Fish are produced in a manner enabling effective harvest while avoiding over-harvest of non-target fish.
Indicator 3(a): Estimated run year harvest and harvest related mortality for hatchery and natural fish, by fishery.
Performance Standard (4): Release groups are marked to enable determination of impacts and benefits in fisheries
Indicator 4(a): Number of recovered marked fish reported in each fishery produces accurate estimates of harvest.
Indicator 4(b): Verify that mark rate is 95% to 100% for all smolt release groups.

Performance Standard (5): Non-monetary societal benefits for which the program is designed are achieved.
Indicator 5(a): Number of recreational fishery angler days.

Hatchery Performance
Performance Standard (6): The hatchery program produces smolts at a higher efficiency than would be achieved in nature.
Indicator 6(a): Survival of Chinook, by life stage in the hatchery.

Performance Standard (7): Artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.
Indicator 7(a): Scientifically based monitoring and experimental design, with measurable objectives and hypotheses.

Performance Standard (8): Facility operation complies with applicable fish health and facility operation standards and protocols.
Indicator 8(a): Results of monthly fish health examinations.
Indicator 8(b): Annual reports indicating level of compliance with applicable standards and criteria.

Performance Standard (9): Releases do not introduce new pathogens into local

populations, and do not increase the levels of existing pathogens.
Indicator 9(a): Results of monthly fish health examinations.
Indicator 9(b): Certification of juvenile fish health immediately prior to release.
Indicator 9(c): Juvenile rearing density.
Indicator 9 (d): Results of adult fish health monitoring at Lookingglass Hatchery and in streams.

Performance Standard (10): Any distribution of carcasses or other products for nutrient enhancement meets appropriate disease control regulations and interagency agreements.
Indicator 10(a): Number and location of carcasses distributed for nutrient enrichment.
Indicator 10(b): Disease examination of all carcasses to be used for nutrient enrichment.
Indicator 10(c): Statement of compliance with applicable regulations and guidelines.

Performance Standard (11): Effluent from artificial production facilities will not detrimentally affect populations.
Indicator 11(a): Verify that hatchery effluent is in compliance with existing NPDES permit conditions and water quality standards.

Performance Standard (12): Juvenile production costs are comparable to or less than other regional programs designed with similar objectives.
Indicator 12(a): Total cost of program operation.
Indicator 12(b): Average cost of similar operations.

Performance Standard (13): Hatchery program is sustainable.
Indicator 13(a): Number of broodstock collected is sufficient to maintain the hatchery broodstock.
Indicator 13(b): Number of smolts released produces equivalent adults (R:S ratio).
Indicator 13(c): Returning adults do not stray into non-target spawning areas above an acceptable rate (5%).

Conservation Objectives - Conserve genetic and life history diversity of spring Chinook within the Grande Ronde River Basin consistent with recovery plan strategies and proposed actions.

Performance Standard (14): Broodstock collection does not reduce potential juvenile production in natural rearing areas.
Indicator 14(a): Number of natural spring Chinook retained for broodstock is consistent with weir management guidelines in Table 2.
Indicator 14(b): Percentage of natural-origin fish returning to the facility taken for broodstock is consistent with weir management guidelines in Table 2.

Performance Standard (15): Weir/trap operations do not result in significant stress, injury or mortality in natural populations.
Indicator 15(a): Adult trapping mortality rate for natural-origin fish does not exceed 5%.
Indicator 15(b): Adult trap is checked daily when in operation.
Indicator 15(c): Adult trap does not hinder upstream migration of adults.

Performance Standard (16): Juveniles are released after sufficient acclimation in the Catherine Creek facility to reduce handling stress and to maximize homing.

*Indicator 16(a):*Smolts are acclimated for 2-6 weeks prior to release.
Indicator 16(b): The number of marked spring Chinook returning to the Grande Ronde facilities is equal to or greater than 95% of reported escapement (i.e., < 5% straying).

Performance Standard (17): Patterns of genetic variation within and among natural-origin spring Chinook populations do not diverge as a result of artificial production programs.
Indicator 17(a): Compare genetic profiles and divergence of naturally produced adults from indicator areas within the Grande Ronde Basin over time.

Performance Standard (18): Escapement ofhatchery produced adults above the wier is consistent with weir management guidelines in Table 2.
Indicator 18(a): Proportion of hatchery and natural-origin fish in key natural spawning areas.

Performance Standard (19): Broodstock selection strategies effectively maintain genetic and life history characteristics in the hatchery population.
Indicator 19(a): Percentage of natural-origin fish in the broodstock is consistent with the weir management guidelines in Table 2.
Indicator 19(b): Timing of hatchery adult returns to the collection facilities and spawn timing mimic natural-origin Chinook returns.
Indicator 19(c): Genetic profile of natural-origin and hatchery Chinook in Grande Ronde Basin does not significantly diverge.
Indicator 19(d): Size and age composition of returning adults is consistent with natural-origin run.

Performance Standard (20): Broodstock collection does not significantly alter spatial and temporal distribution of naturally spawning spring Chinook populations
Indicator 20(a): Number of adult fish aggregating or spawning immediately below the adult weir does not exceed historical distributions and spawning activity.
Indicator 20(b): Natural-origin spring Chinook are captured and sorted by gender, and either retained, transported, or released according to annual run timing and run size.

Performance Standard (21): Hatchery supplementation benefits natural population abundance and productivity.
Indicator 21(a): Natural adult returns increase.
Indicator 21(b): Natural productivity (recruits-per-spawner) standardized for spawner density effects does not decrease.

Performance Standard (22): Spawning characteristics of hatchery salmon spawning in nature is similar to that of natural salmon. Spawning characteristics of natural salmon are not changed by introgression with hatchery salmon.
Indicator 22(a): Run and spawn timing of hatchery salmon is similar to that of natural salmon.
Indicator 22(b): Run and spawn timing of natural salmon do not change over time.
Indicator 22(c): Spawning distribution of hatchery salmon is similar to that of natural salmon.

Ecological Impacts

Performance Standard (23): Release numbers do not exceed habitat capacity for spawning, rearing, migration corridor, and estuarine and near-shore rearing.
Indicator 23(a): Smolts are released in March through April and are released into targeted locations to promote quick smolt emigration.
Indicator 23(b): Proportion of spawners comprimsed of no more than 10% precocious hatchery origin fish.
Indicator 23(c): Emigration behavior of hatchery smolts matches that of their wild counterparts.
Indicator 23(d): Releases of excess parr and adults are made to outlet streams.

Performance Standard (24):Water withdrawal and diversion structures used in operation of artificial production facilities will not prevent access to natural spawning areas, affect spawning behavior of listed natural populations, or impact juvenile rearing.
Indicator 24(a): Water withdrawals compared to applicable passage criteria.
Indicator 24(b): Water withdrawal compared to NOAA juvenile screening criteria.
Indicator 24(c): In stream flow between hatchery facility intake and out-fall are maintained in all facilities.
Indicator 24(d): Length of stream impacted by water withdrawal.

Performance Standard (25): Predation by artificially produced fish on natural produced fish does not significantly reduce numbers of natural fish.
Indicator 25(a): Size at, and time of juvenile release compared to size and timing of natural fish present.

Monitoring and Evaluation:

Performance Standard (26): Monitoring and evaluation occurs on an appropriate schedule and scale to assess progress toward achieving experimental objectives and evaluating the beneficial and adverse effects on natural populations.
Indicator 26(a): Monitoring and evaluation framework including detailed timeline.
Indicator 26(b): Annual and final reports.

Performance Standard (27): Release groups are marked to allow evaluation of effects on local natural populations.
Indicator 27(a): Visible mark (Ad-clip) in hatchery-origin release groups.

Listed below are the suite of Performance Measures modified from Beasley et al. 2008 used by the Catherine Creek program, and the assumptions that need to be tested for each standard.

Table 1. Standardized performance measures and definitions for status and trends and hatchery effectiveness monitoring. Modified from Beasley et al. 2008. Note: Performance Standard Indicators 7a and 26a, related to monitoring and evaluation, are appropriate for each Performance Measure.

Performance Measure	Definition	Performance Standard Indicators

Abundance	Adult Escapement to Tributary	Number of adults (including jacks) that have escaped to a certain point (e.g., 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 TRT population definition where available.	2a, b 3a
	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.	18a 20a 26b
	Female Spawners 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 prespawn female 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.	18a 20a
	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.	18a 20a 22c
	Population Level Spawner Abundance	In-river: Estimated total number of spawners on the spawning ground. Calculated as the number of fish that return to an adult monitoring site, minus broodstock removals, weir mortalities, harvest, number of prespawning 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 fish. Calculations include jack salmon. In-hatchery: Total number of fish actually used in hatchery production. Partitioned by gender and origin.	18a 20a 21a 22c 26b
Abundance	Population Level 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 calculated as in 1 above, and 3) Use 2 above and carcasses above and below weir.	14a, b 15a, b 18a 19a 20a, b 22c 27a
	Harvest Abundance in Tributary	Number of fish caught in tributary fisheries (tribal, sport, or commercial), identified as to-origin - hatchery or natural.	1a, b 2b
	Run Prediction	Predicted number of adults that will return to the population in a given spawn year. This estimate is modified as the run occurs and data become available. It is used to determine the number of adults to be collected for hatchery broodstock.	1a, b 2a, b 21a 22a, b 27a

Survival – Productivity	Smolt-to-Adult Return Rate (SAR)	Smolt-to-Adult Return (SAR) is the number of adults from a given brood year returning to the LSRCP area above Lower Granite Dam divided by the number of smolts that were released from that brood year 1-5 years prior. Smolt-to-Adult Survival (SAS) is similarly calculated to Bonneville Dam. Adult data are calculated two ways: using coded-wire-tag mark and recovery, and with PIT-tag detections at mainstem dam sites. SAR accounts for all harvest below the LSRCP area. The adult PIT tag detection probabilities at mainstem dams are assumed to be near 100 percent. The number (± 95 confidence intervals) of PIT-tagged juveniles arriving at Lower Granite Dam is estimated using SURPH 2.2 or PIT Pro 4.8 programs. The variance around the SAR estimate using PIT tags is then 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: $Var\left(\frac{X}{Y}\right)=\left(\frac{EX}{EY}\right)^2\cdot\left(\frac{Var(Y)}{(EY)^2}\right)$	1a, b, c 2a, b, c 3a 4a, b 13c
	Recruits-per-Spawner Ratio (R:S)	Adult to adultcalculated separately for naturally spawning fish and hatchery fish as the brood year ratio of returned adult to parent spawner abundance. For the natural salmon, R:S is standardized for spawner density. Two variants calculated: 1) escapement and 2) spawners.	2a, b 13a, b 21a, b
Survival – Productivity	Juvenile Survival to first mainstem dam (Lower Granite 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 Lower Granite Dam (LGD) to estimate of abundance by life stage at the tributary and the sum of those is total smolt abundance surviving to LGD. Juvenile survival to LGD = total estimated smolts to surviving to LGD divided by the total estimated juveniles leaving tributary.	6a 16a
	Juvenile Survival to all Mainstem Dams	*Juvenile survival to* first mainstem dam *and subsequent Mainstem Dam(s)* - estimatedusing 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.	6a 16a
	Post-release Survival	Post-release survival of natural and hatchery-origin fish is calculated as described above in the performance measure "survival to first mainstem dam and subsequent mainstem dams".	6a 16a
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.	14a 20a, b 22c 27a

	Stray Rate (percentage)	An estimate of the number and percent of hatchery-origin fish recovered in locations outside of the target stream or the direct migration path to the target stream. Calculated as the number of CWTs recovered in "stray areas" divided by the total number of CWTs recovered.	2a 4a, b 13c 16b 27a
	Disease Frequency	Natural fish mortalities are provided to certified fish health lab for routine disease testing protocols. Hatcheries routinely sample fish for disease and we defer to them for sampling numbers and periodicity.	8a, b 9a, b, d 10b 11a
Genetic	Genetic Diversity	Indices of genetic diversity - measured within a tributary (heterozygosity - allozymes, microsatellites), or among tributaries across population aggregates (e.g., FST).	14a, b 17a 18a 19a, b, c, d 22a, b, c
	Effective Population Size (N_e)	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	14a, b 19a
Life History	Age Structure	Proportion of escapement composed of adult individuals of different brood years. Calculated for wild and hatchery-origin conventional and captive broodstock adult returns. Assessed via scale or dorsal fin ray ageing, or mark recoveries.	4a, b 19c, d
	Age–at–Return	Age distribution of spawners on spawning ground. Calculated for wild and hatchery conventional and captive broodstock adult returns. Assessed via scale or dorsal fin ray ageing, or mark recoveries.	13a 17a 18a 19b, c, d 22a, b
	Size-at-Return	Size distribution of spawners using fork length and mid-eye hypural length. Data are obtained at weirs or during carcass surveys or at hatchery spawning.	13a
	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 life stage-specific emigration period are generated (mean length by week then averaged by life stage). For entire juvenile abundance leaving a weighted mean (by life stage) is calculated. Size-at-emigration for hatchery production is generated from pre release sampling of juveniles at the hatchery.	6a 25a
	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 1892).	6a 25a
	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.	19c, d 20b
Life History	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.	13a 15b 19b, c 22a, b, c
	Spawn-timing	Time that a female deposits her eggs in the gravel (as estimated by the recovery date of her carcass) or the date on which a female is spawned at the hatchery. These data are usually recorded weekly.	19b, c 22a, b, c

	Juvenile Emigration Timing	Juvenile emigration timing is characterized by individual life stages at the rotary screw trap and LGD. 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 LGD.	16a, b 23a, c
	Mainstem Arrival Timing	Detections of juvenile PIT-tagged fish at LGD are used to estimate migration timing for natural and hatchery-origin tag groups by life stage. 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 life stage divided by tributary abundance estimate by life stage). Daily products are added and rounded to the nearest integer to determine weighted median, 0%, 50%, 90% and 100% detection dates.	19b, c 22a, b, c
	Water Temperature	Various, mainly Hobo® and other temp loggers at screw trap sites and throughout the streams	11a
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).	3a 6a 13b 16a 21a, b, c, d 25a
	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. Estimated survival of various in-hatchery juvenile stages (green egg to eyed egg, eyed egg to hatch, hatch to ponded fry, fry to parr, parr to smolt and overall green egg to release).	6a 8a, b 13b
In-Hatchery Measures	Size-at-Release	Mean fork length measured in millimeters (mm) and mean weight measured in grams (g) of a hatchery release group. Measured during prerelease sampling. Sample size determined by individual facility and M&E staff. Life stage at release varies (Smolt, Presmolt, Parr, etc.).	6a 25a
	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 (g) and L is the length (mm) (Everhart and Youngs 1892).	6a 25a
	Fecundity by Age	The reproductive potential of an individual female. Estimated as the number of eggs in the ovaries of the individual female - calculated by weight or enumerated by egg counter.	4a, b 13a
	Spawn Timing	Spawn date of broodstock by age, sex and-origin. Also reported as cumulative timing and median dates.	19b
	Hatchery Broodstock Fraction	Percent of hatchery broodstock actually used to spawn the next generation of hatchery F_1s. Does not include prespawn mortality.	13a
	Hatchery Broodstock Prespawn Mortality	Percent of adults that die while retained in the hatchery, but before spawning.	13a

	Hatchery Broodstock Genetics	Fin clips of all hatchery broodstock are collected for genetic analysis. This is a Snake River Basin wide project to genotype each hatchery steelhead stock.	19c
	Female Spawner ELISA Values	Screening procedure for diagnosis and detection of BKD in adult female kidney tissue. The enzyme linked immunosorbent assay (ELISA) detects antigen of *R. salmoninarum* and indicates a current or previous infection, which is used to cull eggs from females that may have transmitted the bacterium to their offspring.	8a, b 9d
	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	8a, b 9a, b
	Size of Broodstock Spawner	Mean fork length (mm) and weight (g) by age of male and female broodstock. Measured at spawning and/or at weir collection. Is used in conjunction with scale reading for ageing and to calculate condition factor (K; see above).	15a 19d
	Prerelease Mark Retention	Percentage of a hatchery group that have retained a mark until release from the hatchery - estimated from a sample of fish as either "present" or "absent." ("Marks" refer to adipose fin clips or VIE batch marks)	4b 27a
	Prerelease Tag Retention	Percentage of a hatchery group that have retained a tag until release from the hatchery. Estimated from a sample of fish passed through a CWT detector or PIT tag detector. (All types of tags)	4b 27a
In-Hatchery Measures	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).	13c 16a 23a, b, c, d 25a
	Chemical Water Quality	Hatchery operational measures include: dissolved oxygen (DO) - measured with DO meters, continuously at the hatchery, and manually 3 times daily at acclimation facilities; ammonia (NH_3) and nitrite (NO_2).	8a, b 11a
	Water Temperature	Hatchery operational measure: temperature (° C) – measured continuously at the hatchery with thermographs and 3 times daily at acclimation facilities with hand-held devices.	8a, b 11a

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

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

Beasley et al. (2008) presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program.Essential 'Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates, and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.

Performance indicators that we use to evaluate the performance standards are presented in section 1.9. These performance measures are taken from Beasley et al. (2008). The performance indicators are broken into the categories of abundance, survival-productivity, distribution, genetic, life history, habitat, and in-hatchery groups. Within each of these groups are the specific indicator(s) and brief description of the definition/method(s).

1.10.1) "Performance Indicators" addressing benefits.
(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Evaluation of the Catherine Creek program utilizes the performance standards and associated performance indicators in Section 1.9 and Table 1, respectively. Table 1 will be utilized for addressing the project benefits and risks. In addition to yearly evaluations, every five years the Catherine Creek project performs a comprehensive review of the program to include adaptive management recommendations addressing the benefits and risks of the program. The recommendations will incorporate the findings from studies conducted on Catherine Creek and other hatchery programs that may lead to greater program benefits to the natural Catherine Creek population and attainment of mitigation level adult returns.

1.10.2) "Performance Indicators" addressing risks.
(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Evaluation of the Catherine Creek program utilizes the performance standards and associated performance indicators in Section 1.9 and Table 1, respectively. Table 1 will be utilized for addressing the project benefits and risks. In addition to yearly evaluations, every five years the Catherine Creek project performs a comprehensive review of the program to in include adaptive management recommendations addressing the benefits and risks of the program. These recommendations will incorporate the findings from studies conducted on Catherine Creek and other hatchery programs that may lead to a further reduction in program risks to the Catherine Creek population.

1.11) Expected size of program.

Per Table B1 of the 2008-2017 *United States v. Oregon* Management Agreement, the production goal for the Catherine Creek program is 150,000 smolts. However, the current production target, due to space constraints, is 130,000 smolts.Fish are produced at Lookingglass Hatchery, transferred to CTUIR operated acclimation facility for release in Catherine Creek.

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

Conventional Broodstock–Adult (ages four and five) collection is not expected to exceed 50 males and 50 females. Age composition and fecundity of adults varies from year to year. However, given expected program metrics for adult pre-spawning survival (95%), fecundity (3,800) and egg to smolt survival (85%), 100 adults (1:1 sex ratio) should be collected to produce approximately 150,000 smolts.

The Catherine Creek project utilizes an abbreviated sliding scale approach to determine the rate at which to select broodstock for the supplementation program (Table 2). Since the Catherine Creek program is intended to produce hatchery-reared progeny that are as similar to naturally spawned progeny, broodstock collection goals are regulated by the proportions of hatchery and naturally origin adult returns. As the number of natural fish increases the hatchery broodstock incorporates a higher fraction of natural fish.

As noted in Section 1.75, once the number of naturally produced fish achieve a level equal to 0.30 of MAT (225 fish), modifications to the sliding scale described in Table 2, will be considered such they will align more closely with the scales currently being used for the Imnaha and Lostine hatchery programs. Upon completion of this analysis, those changes deemed appropriate will be implemented. The five year review of the program described in Section 1.10 will be the process through which changes in the sliding scale will be proposed and identified for implementation.

Table 2. Management guidelines for Catherine Creek hatchery brood stock.

Estimated total adult escapement (hatchery plus natural) [a]	Ratio of hatchery to natural adults at the mouth	Maximum % of natural adults to retain for broodstock	% of hatchery adults to retain for broodstock [b]	% of adults released above the weir can be of hatchery origin	Minimum % of broodstock of natural origin	% Strays allowed above the weir [c]
<250	Any	40	40	d	d	≤5
251-500	Any	20 [d]	20	≤70	≥20	≤5
>500	Any	≤20	[e]	≤50	≥30	≤5

[a] Pre-season estimate of total escapement
[b] Conventional hatchery adults only, all captive brood adults released to spawn naturally or outplanted
[c] For hatchery adults originating from different gene conservation groups (Rapid River stock or strays from outside the Grande Ronde basin)
[d] 130,000 smolt production initially
[e] Not decision factor at this level of escapement, percentage determined by other criteria

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location (Table 3).

Life Stage	Release Location	Annual Release Level
Eyed Eggs	Hatchery –origin production only Lookingglass Cr., Indian Cr.	None anticipated; however, eyed eggs can be outplanted when surplus to smolt production goals.
Unfed Fry	Lookingglass Cr., Indian Cr.	There are no planned releases
Fry	Lookingglass Cr., Indian Cr.	There are no planned releases
Fingerling	Lookingglass Cr., Indian Cr.	There are no planned releases
Yearling	Catherine Creek	Maximum 150,000 (130,000 planned)
Adults	Lookingglass Creek or Indian Creek	Surplus hatchery adults can be used in Lookingglass Creek broodstock, harvest or spawning below the Lookingglass Creek weir. Up to 50 can be used in Indian Creek.

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

Table 4. Preliminary CTUIR data from Catherine Creek releases between 1998 and 2008 summarized by ODFW Fish Research staff.

Brood Year	Release Year	Release Type	*Number*	Return Years			Total Return	SAR Percent
				2001	**2002**	**2003**		
1998	2000	Conventional	0	-	-	-	-	-
		Captive	38,149	157	205	57	419	1.10
		Natural-Redds	34	46	190	192	428	
				2002	**2003**	**2004**		
1999	2001	Conventional	0	-	-	-	-	-
		Captive	136,833	19	200	19	230	0.174
		Natural-Redds	40	17	60	8	99	
				2003	**2004**	**2005**		
2000	2002	Conventional	0	-	-	-	-	-
		Captive	180,343	78	570	24	667	0.373
		Natural-Redds	34	2	45	6	90	
				2004	**2005**	**2006**		
2001	2003	Conventional	24,392	22	27	3	52	0.213
		Captive	105,292	39	89	1	99	0.123
		Natural	158	2	40	4	61	
				2005	**2006**	**2007**		
2002	2004	Conventional	70,071	21	140	5	165	0.237
		Captive	91,791	9	70	18	172	0.106
		Natural-Redds	167	3	109	32	120	
				2006	**2007**	**2008**		
2003	2005	Conventional	120,753	7	70	6	73	0.069
		Captive	68,827	1	71	8	83	0.116
		Natural-Redds	96	12	42	12	65	
				2007	**2008**	**2009**		
2004	2006	Conventional	23,216	6	35	1	39	0.181
		Captive	45,604	28	108	4	135	0.307
		Natural-Redds	74	6	77	27	90	
				2008	**2009**	**2010**		
2005	2007	Conventional	49,783	107	130		107	0.476
		Captive	21,647	4	25		4	0.307
		Natural-Redds	117	5	98		5	
				2009	**2010**	**2011**		
2006	2008	Conventional	116,882	426			426	
		Captive	0	-			-	
		Natural-Redds	59	52			52	
				2010	**2011**	**2012**		
2007	2009	Conventional	139,000					
		Captive	0					
		Natural-Redds	171					
				2011				
2008	2010	Conventional	111,000					
		Captive	35,000					
		Redds-101	Adults					

The median SAR for the hatchery program is 0.181%.

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

The LSRCP program completed Lookingglass Hatchery in 1982, however the first releases of Rapid River stock spring Chinook salmon occurred in 1980 (1978 brood) in

Lookingglass Creek. Rapid River and Carson origin fish were released in the early 1980s. The last Rapid River fish were released as parr in Lookingglass Creek in 2000. Currently, production from Lookingglass Hatchery has transitioned from composite stocks to indigenous Grande Ronde Basin stocks using captive and conventional broodstocks.

Captive Broodstock–In 1995, the program started the transition to endemic stocks with brood year 1994 smolts. In 2000, the Captive Broodstock Program released their first smolts in Catherine Creek. In 2010 (BY08), the last smolts from captive brood smolts will be released.

Conventional Broodstock—Since 2001, Catherine Creek adults were collected and spawned using conventional hatchery technology. The first release was 2003.

1.14) Expected duration of program.

The Captive Broodstock component–This production portion of this program was terminated with the smolts released in 2010.

The Conventional Broodstock/LSRCP Catherine Creek spring/summer Chinook salmon program is an ongoing project.

1.15) Watersheds targeted by program.
Catherine Creek (ODFW watershed 0800529999)

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

Given the listed and "high risk" status of Snake River spring/summer Chinook, maintaining a hatchery program is currently the only method of supplementing the natural population and providing harvest opportunity on hatchery produced fish in the LSRCP mitigation area.

The first releases of spring/summer Chinook were made with a composite Rapid River/Carson/wild Lookingglass Creek stock made between 1987 and 1990. The captive broodstock program was initiated in 1995 and the first captive smolt release was in 2000. The first release of Conventional Broodstock Catherine Creek smolts was made in 2003. The program production goal was reduced from 250,000 to 150,000 in brood year 2002 and the additional100,000 smolts were reallocated to Lookingglass Creek.

Lookingglass Hatchery is phasing-in the use of moist air incubators as an alternative to Heath style egg incubation. The advantages of using moist air incubators are that the incubators take up less floor space, use only 50 gallons of water in a re-circulating system, and can incubate eggs free of fungus, thereby eliminating the use of formalin. Using moist air incubators would allow most of the Heath style incubation system to be removed and additional fry rearing troughs to be installed, which would increase the available rearing space for fry and reduce rearing densities.

Scientific Reviews

In 2009 two independent scientific review groups, Hatchery Scientific Review Group (HSRG) and Hatchery Review Team (HRT), assessed the Catherine Creek program extensively. Their findings are summarized.

The HSRGreport is available at: *http://www.hatcheryreform.us/hrp/report/appendixe*.

The HSRG recommended two production alternatives.

- The first alternative was to continue the program at 130,000 smolts and designate the population as Contributing and maintain the PNI of 0.52. The program would use 50% natural-origin broodstock (pNOB of 0.50) and would requiring removing a majority (~55%) of the hatchery adults at the weir or through selective fisheries.
- The second alternative was to reduce the program to 75,000 smolts and designate the population as Primary with a PNI of 0.69. The program would use 55% natural-origin broodstock (pNOB of 0.55) and would requiring removing a majority (~70%) of the hatchery adults at the weir or through selective fisheries.

HSRG suggested managers should consider investigating options to improve survival, such as increasing smolt size at release. A plan to increase size at release would need to consider potential changes to the biological factors important to natural reproduction of hatchery-origin spawners. After careful consideration, the mangers do not support the recommendation to increase smolt size. The recommendation to improve survival of hatchery-origin smolts appears contradictive to the selective removal of majority of returning hatchery-origin adults for conservation.

HSRG also suggested managers should continue to implement their successful broodstock BKD management strategy which includes culling.

The Hatchery Review Team (HRT) considered many benefits and risks while reviewing Lookingglass hatchery and Catherine Creek program (USFWS 2009). For their complete assessment, review http://www.fws.gov/Pacific/fisheries/Hatcheryreview/reports.html. In brief, the HRT concluded that programmatic risks outlined were minor and their probability of occurrence was small, thus, did not warrant a proposed change to the current Catherine Creek program (See Lookingglass Creek for facility recommendations). The Review Team is concerned about the continued releases of adults in Indian Creek without clearly defined management goals (SS3 and SS7), as well as, other concerns are outlined below (Table 5).

Table 5. Summarized HRT recommendations for the Catherine Creek program. Note: Acclimation facility needs were not reviewed in detail.

Rec.	Brief Description	Priority	Additional Costs	Comments
SS1	Restate Goals	Low	$0	HGMP
SS2	Adjust sliding scale (Table 13)	Low	$0	US v Oregon issue
SS3	Discontinue adult release in Indian Creek	Moderate	$0	US v Oregon issue
SS4	Report eggs fertilized by jacks	Low	$0	Ongoing (10%)
SS5	Assess acclimation	Low	$0	Ongoing, improved facilities could be expensive ($250,000 to 1M)

SS6	Assess facilities (BPA)	Low	$0	Not reviewed by HRT
SS7	Indian Creek M&E plan	Low	$0	SS3 or develop monitoring plan to assess
SS8a	Continue M&E efforts	High	$0	Ongoing
SS8b	Pedigree study	Moderate	$35,000	Require new objectives to existing efforts
SS10	Continue applied M&E efforts	High	$0	Ongoing

The primary recommendations of the HSRG and HRT reviews were considered as noted. While the HRT recommendations were relatively minor, the HSRG suggested substantial changes in how hatchery fish are used to boost natural production. With respect to the HSRG recommendations, the operators of this program do not propose they be implemented at this time. The rationale for this decision has four key elements. First, a co-manager agreed to protocol for managing hatchery broodstock and escapement needs (sliding scale) has been developed for this program. The co-managers, having long standing differences with respect to the use of hatchery fish, were able to achieve consensus and develop this protocol. Radically changing this agreement, as the HSRG recommendations propose, would necessitate the negation of this achievement and likely create new disagreements that could hamper efforts to recover spring Chinook in northeast Oregon.

Second, there is a need to gather information on what has been learned to date on the effectiveness of this hatchery program and evaluate whether changes might be appropriate to improve the program. However, this evaluation should include the participation of the co-managers. Therefore, this is a long-term process and one that probably best fits within the structure of the 5-year reviews described in Sections 1.10.1 and 1.10,2.

Third, the HSRG recommendations focus on a long-term perspective of what might be one approach for management of the hatchery program. However, the more immediate task for the Catherine Creek is to ensure that the genetic legacy of this population is not lost and to maintain a hatchery broodstock that can be used to facilitate this process as well as serve as a backup should an extreme period of poor ocean conditions, similar to those experienced in the 1990s, occur in the future. We also believe there is considerable uncertainty as to the benefits that will accrue in terms of the production of more natural origin fish as result of the changes suggested by the HSRG. While the genetic model that underpins the analysis done by HSRG may be sound, the translation of this relation to productivity in naturally reproducing salmon populations is tenuous and has not been demonstrated empirically. Therefore, we believe that the short and long-term approach outlined by the draft recovery plan and provided here in Section 1.75 provides a more realistic strategy for the future operation of this hatchery program.

Finally, the HSRG acknowledges that their recommendations are not the only correct path for the future operation of a particular hatchery program as following HSRG policy statement indicates:

> "The Hatchery Scientific Review Group (HSRG) effort was directed to answer the questions of whether and in what manner hatcheries can be used to assist the managers in meeting their conservation and harvest goals for salmon and steelhead in the Columbia River Basin. The HSRG's recommendations are not the only possible alternatives for managing hatchery programs to meet conservation and harvest goals. As such, the managers may develop other solutions which better meet their program principles and

goals. Success over time will be defined by the managers' ability to take actions in the future to adjust hatchery programs based on good science to meet their conservation and harvest goals"

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

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

- ESA Section 10 permit #1011 (expired 2002; HGMP submitted in 2002).
- NPDES 0300J (site number 64492)
- DEQ MOA Water Quality Limited stream list. (carcass disposal)
- Erythromycin INAD 020RLOSCS1 (permit number for 2009)
- Grande Ronde Spring Chinook Hatchery Management Plan (Zimmerman et al. 2002)
- Lower Snake River Compensation Plan (2011 AOP)
- US v. Oregon
- NMFS 4 (d) – Section 7 consultation with USFWS
- Oregon Scientific Taking Permit OR2002-043
- Oregon Scientific Taking Permit OR2002-077

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

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

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

Table 6. Grande Ronde/Imnaha spring/summer Chinook Major Population grouping.

Population	ICTRT size	Status	TRT viability	HSRG
Big Sheep	Basic	extinct	na	stabilizing
Catherine Creek	Large/ Intermediate*	High Risk	Viable	Primary
Imnaha	Intermediate	High Risk	Viable	Primary
Lookingglass Creek	Basic	Extinct	na	stabilizing
Lostine/Wallowa	Large	High Risk	Highly Viable	Primary
Minam	Intermediate	High risk	Viable	Primary
Upper Grande Ronde River	Large	High risk	na	Safety Net /Contributing
Weneha	Intermediate	High risk	Viable	Primary
ICTRT size • Basic 500 • Intermediate 75 • Large 1,000 • Very Large 1,500		TRT Viability • High <1% • Viable <5% Likelihood of extinction in 100 year period	HSRG criteria • Primary PNI 67% • Contributing PNI 52% • Stabilizing PNI no stated goals	
*Catherine Creek weir is managed at the Intermediate level due main stem reach considerations				

The Interior Columbia Technical Recovery Team (ICTRT) established biological viability criteria to monitor recovery efforts in the ESUs for salmon and steelhead listed under the Endangered Species Act. The viability criteria were based on guidelines in NOAA Technical Memorandum *Viable Salmonid Populations and the Recovery of Evolutionary Significant Units* (McElhany et al. 2000). These guidelines were used to describe the Catherine Creek spring/summer Chinook population and other populations within the MPG.

All Grande Ronde/Imnaha MPG populations were assessed at high risk (>5%) of extinction in the next 100 year period. Two populations are extinct (Carmichael et al 2006).

To achieve an ESA viable status to the Grande Ronde/Imnaha MPG, ICTRT recommends that four populations meet the viability criteria and one population meets the highly viable criteria. In addition, two of the three "Large" populations must meet viability. Catherine Creek will be managed as viable. Viable status is more closely aligned with HSRG Primary classification.

The Catherine Creek population is a spring/summer run, and is historically considered

a“Large” sized population by the ICTRT. For abundance and productivity measures this population is considered an “intermediate” based on spawners in Catherine Creek (excludes Indian Creek, Mill Creek, Ladd Creek, and mainstem Grande Ronde near Indian Creek). An “intermediate” population is one that requires a minimum abundance of 750 wild spawners and an intrinsic productivity of 1.8 recruits per spawner (R/S) to be viable at the 5% extinction risk threshold.

The high risk factors for Catherine Creek included productivity and abundance and spawner composition. The elimination of Rapid River stock releases in 1990 and managing the hatchery supplementation as a Primary population should reduce spawner composition risk.

Spring Chinook life history generalizations – Historically, spring Chinook spawned throughout the mainstem and headwater areas of the Grande Ronde/Imnaha MPG (Olsen et al. 1994). Currently, eight populations have been identified. Six of those populations are targeted for hatchery intervention: Big Sheep, Catherine Creek, Imnaha, Lookingglass Creek, Lostine River, and Upper Grande Ronde River. The two of the six populations Big Sheep and Lookingglass Creek are considered extinct. The other two populations, Minam and Wenaha, are managed for natural production.

Adult spring Chinook enter the Columbia River in March through May. Movement into summer holding areas ranges from April through July. Age 4 fish typically dominate returns to the Grande Ronde Basin. Spawning occurs from early August through mid-September and generally peaks in late August. Fry emergence begins in January and extends through June. Fry expand their distribution after emergence in the spring. The extent and direction of fry movement depends on environmental conditions. A fall pre-smolt movement appears to involve a substantial portion of the population in some streams, including Catherine Creek. Juveniles rear for one year and smolt the spring of the year following emergence. Smolt migration from the basin begins in January and extends through early July.

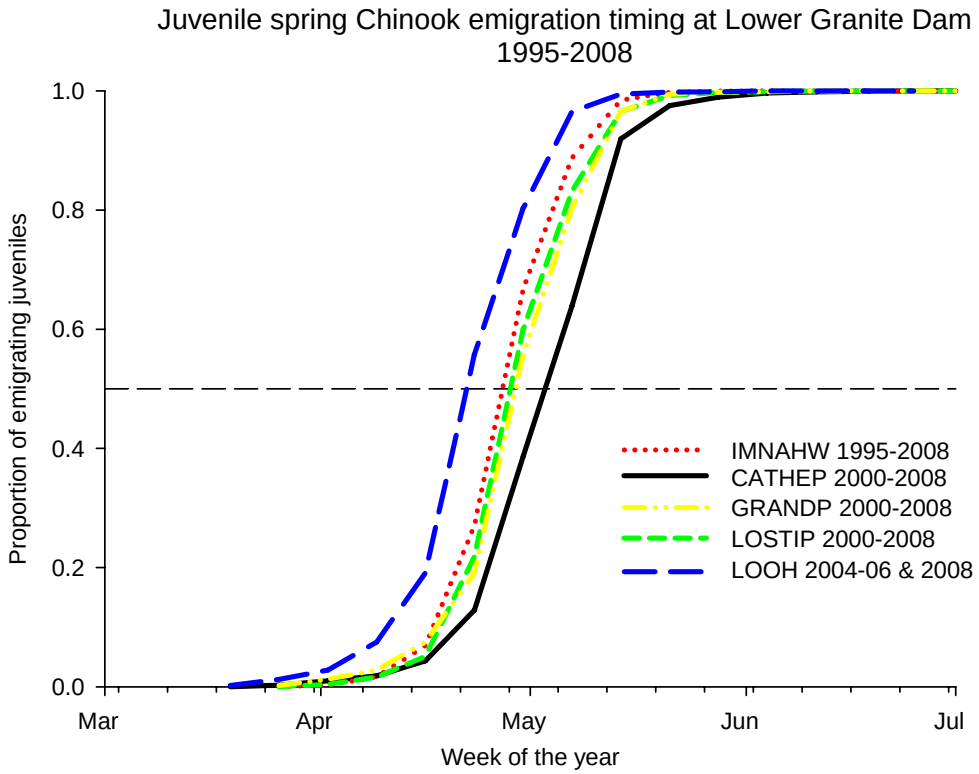

Figure 3. Juvenile spring Chinook emigration timing at Lower Granite Dam, 1995-2008.

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

The hatchery production program may incidentally affect listed Snake River summer steelhead populations. In addition, listed Snake River spring Chinook populations from other basins, Snake River fall Chinook, and Columbia Basin bull trout may be affected to a lesser degree. The magnitude of that affect is unknown, however, it is expected that affects will be reduced from past levels through program modifications outlined in this document.

<u>Summer steelhead</u> - Grande Ronde basin summer steelhead are typical of A-run steelhead from the mid-Columbia and Snake basins. Most adults returning to the Grande Ronde Basin do so after one year of ocean rearing (60%). The remainders are two-salt returns with an occasional three-salt fish. Females generally dominate with a 60/40 sex ratio on average. Returning adults range in size from 45 to 91 cm and 1.4 to 6.8 kg. Adults generally enter the Columbia River from May through August, subsequently entering the Grande Ronde River from September through April. Adults utilize accessible spawning habitat throughout the Grande Ronde Basin. Spawning is initiated in March in lower elevation streams and spring-fed tributaries and continues until early June in higher elevation "snowmelt" systems. Juveniles utilize a wide range of habitats throughout the basin, including areas adjacent to Chinook smolt release locations. Most naturally

produced steelhead smolts migrate after rearing for two years. A much lower percentage migrate after one or three years. Smolt out-migration from the Grande Ronde Basin extends from late winter until late spring. Peak smolt movement is associated with increased flow events between mid-April and mid-May (Setter, ODFW, pers. com.)

ICTRT classified population structure within the Grande Ronde basin (Table 7).

Table 7. Intrinsic size and complexity rating for historical Snake River Steelhead ESU populations. Complexity categories: A = linear; B=dendritic. Size categories in parentheses represent core tributary production areas.

Population	**Weight Area Category**	**Category**	
		Category	**#MaSA (#MiSA)**
Upper Grande Ronde River	Large	B	6 (7)
Wallowa River	Intermediate	B	4 (2)
Lower Grande Ronde River	Intermediate	B	2 (5)
Joseph Creek	Basic	B	3 (3)

Fall Chinook – Fall Chinook in the lower reaches of the Grande Ronde River are considered segments of the Snake River population and exhibit similar life histories. Adult Snake River fall Chinook enter the Columbia River in July and migrate into the Snake River from mid-August through October. Spawning occurs from late October through early December, with fry emergence during March and April. Outmigration occurs within 3-4 months following emergence with peak migration past Lower Granite Dam in late June.

Bull trout – Both fluvial and resident life history forms of bull trout inhabit the Grande Ronde River and a number of tributaries. Habitat conditions and influence of introduced brook trout vary widely across the basin and affect bull trout productivity in some areas. As a result, the basin's bull trout population(s) vary from areas of relative strength in wilderness streams, where brook trout are not currently a problem, to areas where habitat condition and/or interaction with brook trout result in substantially depressed bull trout productivity. Fluvial adults migrate into headwater areas during summer and early fall after over-wintering in mainstem tributaries and the Snake River. Spawning for both resident and fluvial adults occurs in September and October. Fry emerge during the spring. Juvenile summer rearing is restricted to headwater areas by increasing water temperatures downstream.

Snake River Sockeye—No Sockeye are expected to be affected by this program.

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

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

The Grande Ronde Basin once supported large runs of Chinook salmon with estimated

escapements in excess of 10,000 as recently as the late 1950s (USACOE 1975). Natural escapement declines in the Grande Ronde Basin have paralleled those of other Snake River stocks. Reduced spawner numbers combined with human manipulation of previously important spawning habitat have resulted in decreased spawning distribution and population fragmentation.

The Catherine Creek population does not meet viability criteria and is considered high risk. The 10-year geomean (2000-2009) natural origin abundance is 107 adults, which is only 14% of the "intermediate" size population threshold of 750 adults (MAT).

Table 8. Catherine Creek spring Chinook salmon population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity**.**

Brood Year	Total Spawners (w/ jacks)	Adult Spawners	% Natural-Origin	Natural Run (Adults)	Brood Yr. Production (Adults)	Return per Spawner	SAR Adj. Factor	Adj. Brd. Yr. Return	Adj. Return per Spawner
1981	275	263	100%	263	387	1.47	1.59	243	0.93
1982	745	713	100%	713	212	0.30	1.96	108	0.15
1983	733	733	100%	733	206	0.28	1.74	119	0.16
1984	378	378	100%	378	117	0.31	0.61	194	0.51
1985	386	371	100%	371	50	0.14	0.64	79	0.21
1986	399	372	80%	310	4	0.01	0.71	6	0.02
1987	685	669	22%	150	10	0.01	0.55	18	0.03
1988	690	674	24%	160	125	0.19	1.34	94	0.14
1989	**191**	**184**	**38%**	**72**	**16**	**0.09**	**0.56**	**29**	**0.16**
1990	**145**	**144**	**0%**	**0**	**5**	**0.04**	**0.21**	**25**	**0.17**
1991	**64**	**48**	**13%**	**8**	**34**	**0.71**	**0.33**	**103**	**2.13**
1992	**162**	**160**	**25%**	**40**	**46**	**0.29**	**0.60**	**76**	**0.48**
1993	**268**	**257**	**40%**	**99**	**156**	**0.61**	**0.62**	**251**	**0.98**
1994	**28**	**27**	**50%**	**14**	**19**	**0.72**	**0.96**	**20**	**0.75**
1995	**38**	**34**	**100%**	**34**	**50**	**1.48**	**1.67**	**30**	**0.89**
1996	**35**	**34**	**100%**	**34**	**79**	**2.31**	**1.84**	**43**	**1.25**
1997	**103**	**96**	**100%**	**96**	**405**	**4.20**	**3.38**	**120**	**1.24**
1998	**91**	**91**	**100%**	**91**	**347**	**3.82**	**3.37**	**103**	**1.13**
1999	**43**	**43**	**100%**	**43**	**65**	**1.53**	**1.54**	**42**	**0.99**
2000	**58**	**52**	**100%**	**54**	**50**	**0.96**	**1.32**	**38**	**0.73**
2001	512	360	77%	382	**35**	**0.10**	**0.44**	**79**	**0.22**
2002	430	402	50%	241	**128**	**0.32**	**0.73**	**174**	**0.43**
2003	424	400	41%	222	**50**	**0.12**	**0.29**	**170**	**0.43**
2004	215	**204**	17%	52	**102**	**0.50**	-	-	-
2005	143	**132**	26%	42	-	-	-	-	-
2006	251	**239**	37%	103	-	-	-	-	-
2007	171	**161**	29%	72	-	-	-	-	-
2008	216	**199**	35%	87	-	-	-	-	-
2009	275	**191**	46%	122	-	-	-	-	-

The critical population size has been identified as 30% of the viable criteria or 300 spawners for the Catherine Creek population (FMEP submitted February 2009).

- **Provide the most recent 12 year (e.g., 1997-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.**

  The progeny-to-parent ratios as measuredfor the brood years 1997 through 2005 are available for the natural population and from 2001 to 2005 for the hatchery population (Table 9). The average progeny-to-parent (P:P) ratio for hatchery origin fish was 5.31 with a range from 2.57 to 9.24). For the same period (2001 to 2005 brood years) the averageP:P ratio for natural origin fish was 0.39 with a range from (0.09 to 0.88). However, the interpretation of annual variations in progeny to parent ratios of naturally reproducing fish is difficult because the confounding effect of spawner density has not been removed. The progeny to parent ratio observed when the parental numbers are many, will invariably be lower than when the parental numbers are few. Without means for standardizing this density dependent dynamic, the comparison of progeny to parent ratios among different years can easily lead to erroneous conclusions about population status. In addition, this population is exposed to large variations in downstream passage and ocean survival. These variations also can seriously confound the interpretation of progeny to parent ratios, unless standardization is developed for this factor as well. In the case of this population smolt to adult survival estimates are available which could be used to a tool for this standardization.

Table 9. Comparison of progeny-to-parent ratios (P:P) for the hatchery program and the natural spawning populations of spring/summer Chinook salmon in Catherine Creek (age 3 males included) for complete brood year returns (1997-2005). P:P ratios were calculated by dividing the total number of actual parental spawners (both hatchery and natural origin fish; corrected for pre-spawn mortality) by the total number of offspring that returned (in the form of either hatchery fish or naturally produced fish).

Year	Conventional Hatchery Program	Natural
1997	–	5.96
1998	–	4.71
1999	–	1.06
2000	–	0.91
2001	3.85	0.09
2002	5.71	0.33
2003	2.57	0.15
2004	5.19	0.50
2005	9.24	0.88

- Provide the most recent 12 year (e.g. 1997-2009) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Table 10. Adult only (Age 4-5) population estimates (number spawning in nature) for spring/summer Chinook salmon and redd counts (above and below the weir) for the Catherine Creek population, 1997-2008 (ODFW, unpublished data).

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Redds	46	34	40	34	133	158	167	96	74	117	59	101	89	368
Population Est.	82	101	88	53	388	426	460	204	140	268	161	199	199	934

- Provide the most recent 12 year (e.g., 1997-2009) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Prior to 2001 hatchery fish were Rapid River stock. Fromo 2001 onward hatchery fish were from the endemic Catherine Creek stock.The proportion of marked carcasses recovered during 1994 through 2008 spawning ground surveys in the Catherine Creek is reported in Table 10.

Table 11. Origin of spring Chinook salmon carcasses, based on marking of hatchery fish, recovered during spawning ground surveys in Catherine Creek (ODFW, unpublished data) between 1994 and 2007.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Hatchery	0	0	0	2	1	0	1	6	74	124	47	35	60	16	31
Natural	5	7	5	35	20	16	7	52	39	57	10	17	21	6	22
% Hatchery	0	0	0	5.4	4.8	0	0	10.3	65.5	68.5	82.5	67.3	74.1	72.7	58.5

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

- 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.

Adult Chinook broodstock collection - Annual broodstock collection includes

conventional marked and unmarked listed Chinook returning to Catherine Creek. Adults collected are incorporated into a matrix spawning protocol to maintain genetic similarity between hatchery-origin and natural-origin populations. Adults are collected from May (as early as stream conditions allow) to September, based on a systematic approach to pass fish above the weir, outplant, or retain for broodstock based on origin, gender, and age. The approach is based on a pre-season estimate of returning adults and is modified as the run develops.

Spawning, incubation and rearing – Adult fish are killed during the spawning process. Eggs and resulting progeny are subject to mortality during incubation and rearing due to developmental problems, disease, injury and other causes. Every effort is made in the hatchery environment to ensure maximum survival of Chinook at all life stages.

Juveniles trapped – Wild juvenile steelhead, bull trout, and Chinook moving upstream may enter the adult trap during operation which may result in injury and/or mortality. Juveniles entering the Catherine Creek trap can swim through the bars and few are collected.

Wild steelhead and bull trout trapped – Wild adult steelhead and bull trout moving upstream may enter the adult trap during operation which may result in injury and/or mortality. Adults entering the Catherine Creek trap are enumerated and released.

Spawning surveys – Foot surveys are conducted to determine natural spawning density and proportion of hatchery-origin fish in key natural spawning areas from which population abundance estimates are made. Three surveys are conducted (August through September)in all reaches of spawning habitat. Experienced surveyors walk in the stream, avoiding and counting redds and observing fish. Although every effort is made to observe adults and determine their origin without disturbance, spawners are occasionally forced to seek cover. These encounters are brief and spawning fish generally resume their activity within a short period of time. Spawning surveys need to be expanded to include Indian Creek and other tributaries in the population to assess natural spawning and to refine population level abundance estimates and fraction of hatchery fish in the natural spawning population.

Juvenile surveys/collections – Rotary traps are used to monitor early life history of juvenile fish. Collection and handling may result in injury, direct mortality or delayed mortality. Electro-fishing, snorkeling and hook and line sampling may be used to monitor density, size and food habits of residual hatchery steelhead and to collect genetic samples from naturally produced steelhead. These activities, which generally occur from May through October, will result in take of juvenile listed steelhead and occasionally spring Chinook and bull trout. Electro-fishing efforts conform to NOAA guidelines to minimize disturbance and injury to listed fish. Snorkeling is a low impact sampling method that may be used to identify relative proportion of residual hatchery steelhead in key stream reaches. Disturbance of rearing juveniles associated with snorkeling is generally limited to forcing individuals to seek cover and is a short duration effect. Snorkeling surveys

will be conducted when stream temperatures are low, so as to minimize potential for stress and incidental mortality to listed fish. Research PIT tags around 1,000 Chinook parr in the upper reaches of the home streams of each population during the summer.Snorkel or seining may also be conducted in Indian Creek on other tributaries in the population to assess outplanted efforts of adults or eggs and describe progeny life history.

Lookingglass Hatchery intake maintenance – Wild juvenile Chinook, steelhead, and bull trout may be encountered when performing seasonal gravel removal operations in the immediate proximity of the Lookingglass Hatchery water intakes. There have been no redds observed in gravel deposited in the intake structures. Disturbance of rearing juveniles associated with gravel removal is generally limited to forcing individuals to seek cover and is a short duration effect. This may result in injury and/or mortality, but none are expected.

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

Pre-spawning mortality of Catherine Creek adults held at Lookingglass Hatchery and collected from the Catherine Creek facility since 1997 has averaged 8.5%; however, the mortality rates are not evenly distributed. The median mortality rate in the twelve year period is 4.3% (Table 12). Note that no adults were collected in 1997 and 1999.

Table 12. Pre-spawning and handling mortality for Catherine Creek Chinook, 1997-2008.

Year	Catherine Creek		
	Adult	Mort.	%
1997	0	0	na
1998	8	0	0.0
1999	0	0	na
2000	8	1	12.5
2001	25	5	4.2
2002	39	3	7.7
2003	53	5	9.4
2004	24	8	33.3
2005	40	4	10.0
2006	70	3	4.3
2007	77	3	3.9
2008	57	0	0.0

-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).

Table 13. Estimated maximum take levels of listed Catherine Creek spring/summer Chinook by hatchery activities. An additional 300 wild summer steelhead may be captured, handled, and released to enumerate escapement and estimate hatchery steelhead impact.

Listed species affected: Spring/Summer Chinook			**ESU/Population:** Snake River	
Activity: Catherine Creek spring/summer Chinookhatchery program				
Location of hatchery activity: Catherine Creek and Snake Basin			**Dates of activity:** Annual	
Hatchery program operator: ODFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)	Unknown	2,500	1,500	200
Collect for transport b)	190,000	503	500	200
Capture, handle, and release c)	0	2,000	1,500	0
Capture, handle, tag/mark/tissue sample, and release d)	250,000	250,000	700	0
Removal (e.g. broodstock) with numbers of natural origin and hatchery origin fish as per sliding scale schedule of Table 2 of this plan e)	0	0	110	0
Intentional lethal take f)	0	0	110	0
Unintentional lethal take g)	0	40,000	35	0
Other Take (specify) h)	0	1,000	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.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

- 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.

The Catherine Creek weir will not collect adults when water temperature exceeds 18.3^{o}C. Fish will be allowed passage without handling.

Contingency–The number of days that spring Chinook smolts are acclimated at Catherine Creek facility will be reduced if environmental factors prevent the reliable operation of water intakes. Smolts can be released early into target tributaries.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

The proposed program outlined in this HGMP is consistent with the NWPPC Annual Production Review (Report and Recommendations), draft Grande Ronde and Imnaha Basin summary, expired section 10 permits (1011, 1049), draft HGMP submitted in 2002, and addresses issues of concern outlined in the NOAA Hatchery Biological Opinion (1999).

3.2)1. List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

- *Lower Snake River Compensation Plan* – The program is consistent with smolt production levels as outlined in original LSRCP. The proposed program will continue to support a substantial tribal and sport harvest level.
- *U.S. v. Oregon* - The hatchery program outlined within this HGMP is consistent with the 2008-2017 US vs Oregon management agreement (Attachment B).
- *Columbia River Fish Management Plan* – The program would continue to provide substantial harvest in Zone 6 tribal net fisheries as well as in-basin tribal harvest opportunity.
- *Annual Operation Plan (AOP 2011 LSRCP)* – The program is consistent with co-manager agreements outlined in annual operations.

3.3) Relationship to harvest objectives.

The level of hatchery production proposed by this program contributes to meeting the tribal and sport fishery objectives as described a Fisheries Management and Evaluation Plan prepared by the ODFW and Tribal Resource Management Plan prepared by CTUIR. Evidence to the magnitude of this contribution is presented in the next section (3.3.1).

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin and associated natural originfish for the last twelve years (1997-08), if available.

Fisheries that benefit from the hatchery fish produced by this program occur mainly in the mainstem Columbia River and the Grande Ronde basin. Program contributions to ocean fisheries are minimal, as is the case for all Snake River spring/summer Chinook. A description of the various fisheries that benefit from the Catherine Creek hatchery production follow.

Lower Columbia River non-tribal commercial fisheries. – Lower Columbia River non-tribal commercial fisheries occur below Bonneville Dam in the mainstem (statistical zones 1-5) and in Select Areas (off-channel fishing areas). Currently, winter and spring fisheries in the mainstem are mark selective but summer and fall fisheries are not. The lower Columbia River commercial fisheries primarily target white sturgeon during the early portion of the winter season (January through mid-April) and spring Chinook beginning in early March. In some years, target spring Chinook fisheries may not occur until April and can occasionally extend through the spring season (mid-April through June 15).

Lower Columbia River non-tribal recreational fisheries. – The lower Columbia River mainstem below Bonneville Dam is separated into two main areas for recreational harvest; Buoy 10 (ocean/in-river boundary) to the Rocky Point/Tongue Point line, and the Rocky Point/Tongue Point line to Bonneville Dam. These fisheries are mark-selective for spring Chinook. Catch in recreational fisheries above Bonneville is very low compared to the fisheries below Bonneville.

Mainstem Columbia tribal fisheries. – Treaty tribal harvest includes commercial and ceremonial and subsistence (C&S) fisheries. The tribal C&S fisheries are of highest priority and generally occur before tribal commercial fishing. The tribal set net fishery above Bonneville Dam (statistical Zone 6) involves members of the four Columbia River treaty Indian tribes: Yakama Nation, Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation and Confederated Tribes of the Warm Springs Reservation. These fisheries are managed under the jurisdiction of U.S. v. Oregon. The U.S. v. Oregon Management Agreement for 2008-2017 implements abundance-based management on Snake River Chinook and steelhead in the lower mainstem and treaty mainstem fisheries such that fishery impacts increase in proportion to the abundance of natural-origin fish forecast to return once a minimum run-size has been achieved.

Tributary fisheries. – Fishing occurs in the Snake River and the Grande Ronde basins for

spring/summer Chinook. Annual fishery impact rates are set pre-season consistent with fishery management protocol developed within FEMPs and TRMPs and authorized by NOAA Fisheries. This protocol is based on a sliding scale that ties allowed fishery impact rates to forecast return of natural-origin adults. When the return of natural-origin spawners is low, then the fishery will be managed to keep impact rates low. When a large number of natural-origin fish is expected, allowable fishery impact levels will be higher. The allowable impact for each year's fishery is then allocated by the tribal and state managers. Co-managers report catch statistics in season and all fishing stops when the allowable impact for the year is met.

Table 14. Estimated impact rates of all fisheries on natural origin Catherine Creek spring Chinook.

	Fishery			Total Impact
Brood Year	**Ocean**	**Columbia/Snake**	**Tributary**	
1998	0	83	0	83
1999	0	38	0	38
2000	0	178	0	178
2001	12	136	0	148
2002	1	87	0	88
2003	1	115	0	116
2004	7	142	0	149
2005	4	51	0	55
2006	7	128	0	135

3.4) Relationship to habitat protection and recovery strategies.

Human development and land management impacts consistent with those identified across the Columbia Basin affect Chinook production in the Grande Ronde Basin. Loss of channel diversity, sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawal, water temperature and fragmentation of habitat all affect productivity of natural Chinook populations within the watershed. State programs in place through the Department of Environmental Quality, Department of Forestry and Division of State Lands along with federal Clean Water Act and Corps of Engineers 404 regulations provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or those that are federally funded must additionally meet Endangered Species Act listed species protection criteria developed through consultation with US Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Policy Act (NEPA) review.

These protection programs in conjunction with ongoing private and publicly funded restoration efforts have resulted in an improvement in Chinook and steelhead habitat in many Grande Ronde Basin tributaries. Most watershed restoration/improvement projects are funded through the Grande Ronde Model Watershed Program, Oregon Watershed Enhancement Board, Bonneville Power Administration funded Northwest Power

Conservation Council's Fish and Wildlife Program, Mitchell Act Program and Natural Resource Conservation Service's (NRCS) Conservation Reserve Enhancement Program (CREP). Efforts include fencing streamside corridors to promote riparian vegetative recovery, active restoration including channel reconfiguration, improved fish passage at road crossings and diversions, reduced sediment production from roads and cropland and screening of irrigation diversions. Some programs like the Mitchell Act screening program began almost 50 years ago, while others like CREP are very recent. Taken together, habitat protection and improvement measures are (and will continue to be) improving habitat, and productivity, for the basin's wild spring/summer Chinook.

3.5) Ecological interactions.

Predation– Little evidence exists of predation by hatchery released spring Chinook on other salmonids. Hatchery spring Chinook smolts are programmed for release in Catherine Creek at 20 fish per pound and should range in size from 100 to 150 mm fork length. Release timing and methods (volitional release following acclimation) are intended to result in rapid emigration and limit interaction with other species in the river. The small size of hatchery migrants, rapid migration from Catherine Creek, and limited time for conversion from a hatchery diet to a natural diet reduce the likelihood of predation by hatchery Chinook on other salmonids in the Grande Ronde Basin.

There is potential for predation by other salmonids, especially bull trout, on hatchery and natural Chinook. Releases of hatchery Chinook and any potential increase in natural production of Chinook resulting from the LSRCP program could enhance listed bull trout populations by increasing available forage.

Avian predation, especially by mergansers and herons, on hatchery and natural Chinook are a concern post release. Total consumption is unknown, but numerous PIT tags have been recovered in the Ladd Marsh heron rookery (ODFW Fish Research, unpublished data).

Competition– Hatchery Chinook smolts have the potential to compete with natural Chinook, natural steelhead and bull trout juveniles for food, space, and habitat. If significant interaction does occur in Catherine Creek, it is restricted to a short duration as smolts move downstream, or to the immediate vicinity of release sites where hatchery fish are most concentrated. Rapid departure of hatchery Chinook smolts from the tributary is likely to limit competition with rearing wild Chinook, steelhead, and bull trout. Differences in food habits and habitat preferences are likely to limit competition with bull trout.

There is potential for competitive interactions between hatchery Chinook and wild Chinook and steelhead smolts in migration corridors. We do not have information to assess competitive interactions during downstream migration, however, hatchery Chinook smolts are released at a size similar to or slightly larger than natural Chinook smolts (20 fish per pound) and may have a competitive advantage as a result of size.

Behavioral –There are limited data describing adverse behavioral effects of hatchery Chinook salmon releases on natural/wild Chinook salmon populations. Hillman and Mullan (1989) reported that larger hatchery fingerling Chinook salmon, released in June and July in the Wenatchee River in Washington, apparently "pulled" smaller wild/natural Chinook salmon with them as they drifted downstream resulting in predation on the smaller fish by other salmonids. While the effects of migrating hatchery smolts (yearlings) on wild/natural Chinook salmon are unknown at this time the potential for similar effects exists especially with large concentrated releases within natural rearing areas.

Fish Health– Hatchery operations potentially amplify and concentrate fish pathogens and parasites that could affect wild Chinook, steelhead and bull trout growth and survival. Because the hatchery produced spring Chinook for the Catherine Creek program are reared at Lookingglass Hatchery, potential disease impacts on wild salmonids are limited to periods of smolt acclimation and migration, adult returns, trapping, holding, and natural spawning. There are several diseases of concern including bacterial kidney disease (BKD) and infectious hematopoietic necrosis (IHN). Infectious hematopoietic necrosis virus (IHNV) has become more prevalent at Lookingglass Hatchery in recent years. Vertical transmission (parent to progeny) of IHNV is prevented by the ongoing prudent fish culture practice of draining coelomic fluid at spawning and disinfecting eggs in iodophor. Steps have been taken to prevent horizontal transmission (fish to fish) of IHNV and other pathogens present in the surface water supply by the installation of a ultraviolet light water disinfection system. Prudent fish health actions of culling eggs from females with higher levels of *Renibacterium salmoninarum* antigens have helped with controlling BKD. In general, fish have demonstrated good health when reared at Lookingglass Hatchery, whichindicates potential for minimal to low level transmission of any agents they harbor to natural population. Documentation of fish health status of Catherine Creek hatchery Chinook is accomplished through monthly and pre-liberation fish health examinations. Hatchery and natural adults spawned at Lookingglass Fish Hatchery are screened for BKD. There is no evidence of increasing prevalence of diseases (e.g., BKD) (Hoffnagle et al. 2009). Kidney samples are also collected on spawning ground surveys to monitor for potential increase in BKD prevalence due to hatchery adult spawning in nature (O'Connor and Hoffnagle 2007). The prevalence of BKD in hatchery brood adults and wild spawners is similar and low (<1.0%).

Incidental Take at Trapping Facilities – Operation of the Catherine Creek weir and trapping facilities for collection of adult Chinook broodstock has the potential to affect wild steelhead and bull trout. These facilities could delay or otherwise alter migrations and some handling of listed species will occur. When adult steelhead are trapped, they will be checked for marks and passed above the trapping facilities. Steelhead kelts moving downstream are more likely to encounter Chinook trapping facilities. Kelts observed upstream of trapping facilities that can be captured (netted) will be checked for adipose clips and immediately passed downstream.

Bull trout have been captured at the Catherine Creek trapping facility. Bull trout that are

trapped are passed upstream with minimal handling and an "eyeball" estimate of their length is recorded whether greater than or less than 300 mm in length.

Hatchery Effluent– Hatchery effluent discharges directly into Lookingglass Creek, after passing through the settling basin, and may affect survival, growth, and migration of spring Chinook salmon. The pollution abatement system was designed to provide for NPDES (0300-J) permit compliance. The settling basin has a 2 hour retention time, based on a continuous inflow of 1500 gpm, and has an active water volume above the sludge reservoir of 27,000 ft^3. Effluent discharges meet DEQ criteria and there is no indication that the effluent is affecting fish or fish habitat in Lookingglass Creek. There are no plans to study effluent effects in the creek.

Chemicals used at the hatchery include iodophor, erythromycin, and formalin. These chemicals are approved fishery compounds and their use is regulated by label instruction or Investigative New Animals Drug (INADS) permits. Both iodophor and formalin undergo high dilution rates before entering the stream, which renders them innocuous to the fish and the ecosystem. Erythromycin is injected into broodstock adults or fed to juvenile fish for 28 days. A second 28 day erythromycin medicated feed treatment is administered to progeny of Captive broodstock parents with moderate to high ELISA levels. By either route, the drug is assimilated and metabolized within the fish. Any residual antibiotic present in the effluent would come almost exclusively from uneaten food. It is highly unlikely the effluent containing erythromycin would affect the ecosystem in any way.

Water Withdrawal– Water withdrawals to operate facilities, Lookingglass Hatchery in specific, may affect egg survival, juvenile growth and abundance, adult migrations and spawning of Chinook salmon. Lookingglass Hatchery water intake diverts a maximum of 50 cfs that results in reduced flows between the diversion and the out fall of the hatchery, approximately 500 meters. These reduced flows are most prominent during late July, August, and September when hatchery water demands are high and the creek is at its lowest flow. During this period, adult upstream passage may be restricted to some degree; however, there is enough water to allow passage, spawning activity and juvenile rearing.

Redds have been observed in the section of river that has reduced flow because of hatchery water withdrawal. Spawning takes place from mid-August until late September. Spawning in this area would be initiated during the time of the lowest flow, so de-watering of redds is unlikely.

It is highly unlikely that water withdrawals are a problem at the Catherine Creek facility. This facility is operated when water is generally plentiful.

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.

The main water source for Lookingglass Hatchery is Lookingglass Creek (50 cfs water right). Water temperature fluctuates daily and seasonally with mean daily temperature ranging between 1^{o} and 16^{o}C. Additional water sources include one well used for fish culture that is capable of pumping 5 cfs at 14.5^{o} C. Water discharged is monitored under the general NPDES 0300 J permits. High spring run-off has created problems with turbid water and sediment deposition in egg incubation trays, early rearing troughs, large raceways, and associated water delivery pipes. Compliance for screening criteria will be evaluated.

The main water source for Catherine Creek acclimation and adult trapping facilities is Catherine Creek. The acclimation facility has a 5 cfs water right from February through April and the adult collection facility uses approximately 5 cfs from April through September. Water temperature fluctuates daily and seasonally with mean daily temperature ranging between 0.5 ^{o} and 16^{o} C. Compliance for intake screening criteria is being evaluated in NEOH. Currently, the facility produces less than 20,000 pounds of fish per year; therefore, the NPDES general permit (No. 300-J) is not required (per. comm.. Sellars 2001).

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.

Intake screens were replaced at Lookingglass Hatchery in 1999. Current evaluations suggest improvements to the sweeping velocity across the intake screen are necessary.

The potential for entrapment of listed fish exists at the Lookingglass Hatchery and the Catherine Creek facility. Routine maintenance on the traveling intake screens has not prevented fish from entrainment into the main hatchery. Head screens were installed in the Lookingglass hatchery in 2009 to prevent the transfer of Lookingglass Creek fish to the Catherine Creek. A NOAA approved screened intake box at Catherine Creek is used.

Effluent water quality at Lookingglass and Oxbow hatcheries is monitored quarterly under a general 0300-J NPDES permit. Water quality standards and conditions have been good over the past 5 years.

SECTION 5. FACILITIES

5.1) Broodstock collectionfacilities (or methods).

Catherine Creek–The Catherine Creek weir consists of one temporary travel trailer which houses personnel 24 hours a day during the trapping season. Facility security is provided by the occupant of the trailer. The adult trap consists of a hydraulic weir that is attached at the bottom sill of a full channel-width pool and chute type ladder. Adults are collected

by directing fish into an off channel ladder leading to a trapping and holding area of 825 ft^3 (25'x 6' x 5.5'). The trap is covered with aluminum grating and is fully lockable.A maximum of 82 adultscan be held for 48 hours. Adults handled for transport are transferred using a water-filled tube or elevator system. Trapped adults are passed above the weir or transported to Lookingglass Hatchery within 48 hours of collection.

The main water source for the Catherine Creek weir is Catherine Creek. Water temperature fluctuates daily and seasonally with mean temperature ranging between 1^oC and 17^oC.

Collections
Catherine Creek–The Catherine Creek spring Chinook program uses the endemic population for hatchery broodstock. Broodstock collection guidelines (sliding scale) are based on estimated escapement to the mouth of Catherine Creek. The sliding scale was developed cooperatively with co-managers (Table 2). No Captive Broodstock progeny adults (F_1) will be used for broodstock for Catherine Creek but may be used for Lookingglass Creek production.

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

Adults are transported by CTUIR within 96 hours or less after collection to Lookingglass Hatchery in one of three insulated containers: 550-gallon, 400-gallon, and 250-gallon tanks. Tanks are equipped with supplemental oxygen, aeration, and alarms.

5.3) Broodstock holding and spawning facilities.

Conventional Broodstock– Lookingglass Hatchery consists of one hatchery building complex (11,588 ft^2). The complex includes an office, spawning room, incubation and rearing room, cool fish feed storage area, shop, lab, visitor center, and dormitory. The spawning room consists of an anesthetizing tank, brail, spawning table, fish health and fish research stations, and adult return tubes to the adult holding ponds.

Catherine Creek adults can be held in two types of containers: Linear flow raceway 3,200 $ft.^3$ (10x80x4) with holding capacity of 800 fish (1 adult/8 ft^3), or one of three circular tanks each 1,100 ft^3 (20'x4') with a holding capacity of 137 fish (1 adult/8 ft^3). Typically, the Catherine Creek fish are held in the raceway.

Ripe adults are spawned and the eggs are fertilized, water hardened, and transferred to the hatchery building for incubation.

5.4) Incubation facilities.
Lookingglass Hatchery contains 504 incubation trays. Incubation uses up to 150 gpm of chilled well water or UV treated river water. Currently, eggs are eyed on chilled river water and transferred to UV treated water for hatching, button-up, and early rearing.

Lookingglass Hatchery is phasing-in the use of moist air incubators for incubation to the eyed stage and utilizing hatch boxes located inside the early rearing troughs for hatching. The intent is to reduce the demand for chillers and eliminate some of the heath stacks. This will result in more floor space to add additional early rearing troughs to lower early rearing densities.

5.5) Rearing facilities.

Lookingglass Hatcheryoutside rearing containers include 18 raceways with rearing volume of 3,000 ft^3 (10'x100'x3'), four adult holding raceways of 3,200 ft^3 (10'x 80'x 4') divided into fence installed down the center of the adult holding pond, and three adult circular holding tanks 1,100 ft^3 (20'x4'). Inside rearing containers include 28 Canadian troughs.

Currently, 4 early rearing troughs and two outside raceways are allocated to the Catherine Creek program. In 2009/10, Lookingglass staff will utilized one circular tank 1,100 ft^3 (20'x4') for over winter rearing of 20,000 smolts.

5.6) Acclimation/release facilities.

Catherine Creek– CTUIR operates an acclimation facility on Catherine Creek. Acclimation occurs in four raceways approximately 86'x 8'x 3' (2,064 ft^3) in size.

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

1. Icing events at Lookingglass Hatchery intake. Three scenarios can cause ice buildup and blockage of the intake:
   - Icing caused by 1 to 3 week period of sub-zero air temperatures.
   - 1 to 3 week period of sub-zero air temperatures followed by heavy snow resulting in slush ice.
   - Quick warming temperature resulting in blocks of ice breaking loose from Lookingglass Creek and lodging against the intake screens.

2. Freezing of Catherine Creek can result in an icing event stopping inflow of water to the acclimation facility.

3. Spring flows resulting in large amounts of debris and turbid water conditions. Events have led to early releases from acclimation ponds. No fish have been lost due to high spring run-off.

   In 2008, maintenance of the water intake at Lookingglass Hatchery (deepening for more water) caused the mortality of over 60 (out of around 170) Upper Grande Ronde River broodstock being held in a circular in the same building as the Lostine fish. The maintenance stopped flow into the circular and the fish used all of the oxygen before water flow could be returned. No Lostine stock adult mortality occurred during this event.

On June 3 2010, heavy rains that had persisted for several days caused elevated flows in Lookingglass Creek. The creek water was a muddy brown color, contained a high debris load, and was very turbid. Water flows in the creek were high enough that creek water flow was going over the top of screens in place on the outside of the hatchery water intake. The screens are the first line of defense in keeping debris out. The debris coming over the top, penetrated the second set of screens which are traveling water screens and traveled into and through the hatchery water supply line. Water from this supply line was diverted to the hatchery's UV treatment system for UV disinfection before the water is distributed throughout early rearing troughs inside the hatchery building. The UV treatment system has a third 40 micron drum filter with a water spray system to spray debris and small matter off into a waste channel and drain. The spray bar pump for the spray bar system is supplied water from the domestic well located at the hatchery. Coincidental to the environmental condition of Lookingglass Creek, construction of two additional residences by private contractors was ongoing. The private contractors dug through an underground domestic water line and in their efforts to shut off the water which was rapidly leaking out of the system, the private contractors turned off the domestic well and thereby turned off the water supply to the spray bar pump. There was no backup system in place for an event like this. The water line was repaired after a few hours; however the contractors were unable to re-start the domestic well and would have to wait until the next day before a professional could address the water well situation. Lookingglass Hatchery staff monitored the UV system and at quitting time, the lack of water to the spray bar pump did not seem to be having any adverse effect on the UV system or its function. However, during the night, the drum filter clogged with debris and without a spray bar pump to spray the debris to the waste channel, the debris passed through the drum filter and clogged a screen which provides protection to the UV lamps in the UV system. When this screen clogged, water flow was shut off to the rearing containers in the hatchery building resulting in oxygen deprivation and the suffocation of 496,000 fry. The UV system had no alarm system and therefore the loss was not noticed until the next morning. Since the loss occurred, new alarm systems monitoring water depth in the UV treatment have been installed as well as modifying the management approach with regard to operation of the UV system.

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

Lookingglass Hatchery

- Lookingglass Hatchery assigns one person to perform on call duty 24/7 to answer and respond to alarm and emergency situations. The hatchery is equipped with water alarm systems to help prevent catastrophic fish loss resulting from water delivery failure. New alarms have been added at critical water monitoring points in the water delivery system particularly the UV system since the loss in 2010.
- Use UV efficiency test results in combination with staff judgment regarding

environmental conditions of Lookingglass Creek to decide when to by-pass the UV treatment and filtration system.
- Operate intake well (TW2) for icing emergencies
- Maintain back-up diesel motor for TW2
- Low water alarms
- Monitor facilities operation during high flow events
- Maintain screens in working order
- Keep trap and ladder area free of debris
- Annual removal of gravel deposition near the intake

Acclimation Sites

- Acclimation facilities are staffed full time (24/7), and equipped with low water alarms to help prevent catastrophic fish loss resulting from water flow failure.
- Transfer to acclimation sites delayed until early March
- Communications for early releases
- Monitor facilities operation during high flow events
- Maintain screens in working order

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.

Catherine Creek– Conventional broodstock for Catherine Creek spring Chinook salmon program is collected from adult returns trapped at the Catherine Creek weir and transferred to Lookingglass Hatchery for spawning. Broodstock includes conventional hatchery produced adults and natural adults. Captive Broodstock for Catherine Creek was derived from Chinook parr collected from throughout the natural production areas in Catherine Creek. Adults returning from Captive Broodstock production (F_1 generation) are released above the weir to spawn naturally or collected for Lookingglass Creek broodstock.

Smolts from Rapid River stock were released in the mid 1990's. The genetic influence on the local population is unknown, but is believed to be minor because subsequent genetic evaluations have shown that in spite of these out-of-basin transfers the genetic differentiation among natural populations has remained intact (Waples et al 1993; Currens et al. 1996).

6.2) Supporting information.

6.2.1) History.

During the construction phase of Lookingglass Hatchery in the late 1970s, it was thought there were too few natural fish returning to Lookingglass Creek to develop adequate

broodstock in a short time frame. ODFW decided that broodstock development and smolt production goals could be more quickly achieved by importing hatchery stock from outside the basin. In 1978 the first eggs were taken from Rapid River stock (Idaho) and smolts were released into Lookingglass Creek in 1980. Due to egg availability and disease concerns, Carson stock began to replace the Rapid River stock in the mid-1980s. However, Rapid River stock was again imported throughout the late 1980s and early 1990s (Lower Snake River Compensation Plan Status Review Symposium 1998).

In the early 1990s, two major policy rulings influenced the Grande Ronde Basin spring Chinook salmon hatchery program. In 1990, ODFW adopted the Wild Fish Management Policy, which established guidelines for the maximum acceptable level of non-local origin hatchery fish that would spawn in nature with local populations. In 1992, naturally produced Grande Ronde Basin spring Chinook were listed as threatened by the National Marine Fisheries Service (NMFS) under the ESA. The existing hatchery operations were inconsistent with conservation and recovery opinions.

A genetic assessment by an Independent Scientific panel in the US v. Oregon dispute resolution indicated that there remained significant genetic differentiation among natural populations and between hatchery populations and the natural populations, even though significant outplanting and straying of non-local hatchery fish had occurred. There was still significant genetic differentiation between hatchery and natural populations and among the Minam, Wenaha, Grande Ronde, Lostine Rivers and Catherine Creek natural spawners (Waples et. al. 1993; Currens et. al. 1996).

Given the uncertainties of using artificial production to increase natural production, two approaches to hatchery supplementation were implemented using endemic stocks; Captive Broodstock and Conventional Broodstock .

The intent of the Captive Broodstock program was to maintain natural escapement above a minimum threshold (150 adults) to prevent extinction. As natural production and escapement increases, a more traditional or conventional approach to supplementation was implemented to achieve LSRCP objectives.

Table 15. Spawning data for the captive brood Catherine Creek population, 1998-2010

Brood Year	Males Spawned	Females Spawned	Spawning Ratio F/M	Average Fecundity	Egg Take (1,000's)	Eyed Eggs Culled	Eyed Eggs Shipped/ Released	Fry Ponded (1,000's)	Smolt Releases (1,000's)
1998	94	69	0.73	1333	92	1,786	0	43	38
1999	168	162	0.96	1619	262	0	4,799	153	137
2000	177	177	1.00	1901	336	8,141	2,400	200	180
2001	218	124	0.57	1838	228	51,127	0	140	105
2002	132	128	0.97	1819	233	30,993	0	162	145
2003	185	160	0.86	1681	269	15,894	6,250	182	167

2004	127	77	0.61	1439	111	31,227	0	53	46
2005	112	44	0.39	952	42	9,837	200 *fry*	26	22
2006	148	83	0.56	1211	100	38,225	0	48	43
2007	92	79	0.86	1896	150	25,654	0	106	100
2008	118	81	0.69	1568	127	33,377	46,727	36	100
2009	25	69	2.76	2091	144	0	119,489	101	97
2010	0*	14	N/A	1548	22	N/A	0	0	0

* Used males from the Upper Grande Ronde River Captive Broodstock Program. All offspring were used form BKD experiment – none were released.

The Conventional Broodstock program was initiated in 1997 for the Catherine Creek natural populations. However, the populations were below critical escapement preventing the collection of adults in Catherine Creek 1997 through 2000. The first conventional fish were spawned in 2001 (Table 16).

Table 16. Catherine Creek spring/summer Chinook salmon spawning data for 2001-10

Brood Year	Marked Females Spawned	Unmarked Females Spawned	% Un-marked	Spawning Ratio F/M	Average Fecundity	Egg Take	Fry Ponded	Smolt releases
2001	0	12	100%	1.71:1	3,651	43,813	26,426	24,392
2002	0	20	100%	1.18:1	4,096	81,926	71,750	70,959
2003*	0	28	100%	1.47:1	4,639	129,888	123,394	120,753
2004	0	9	100%	1.50:1	2,912	26,204	24,465	23,216
2005	9	8	47.1%	1.42:1	3,149	53,533	49,222	49,696
2006	28	8	22.2%	1.24:1	3,642	131,139	121,868	116,882
2007	30	15	33.3%	1.45:1	3,801	171,065	146,207	138,854
2008	21	11	31.3%	1.6:1	3,885	124,317	115,331	**111,800**
2009	30	13	30.2%	0.93:1	3,843	165,263	154,481	
2010	**32**	**10**	**23.8%**	**0.95:1**	**4,200**	**176,409**		
	150	134	47.1%		3,781	1,103,557	835,418	663,552

*Inventory correction; Since 2004, eggs have been electronically counted
Numbers in bold current inventory
2001-06 brood, estimate survival from green egg to smolt at 87.1%

6.2.2) Annual size.

The LSRCP objective is to produce 900,000 smolts for release in the Grande Ronde Basin. Production has been derived from both Conventional and Captive Broodstock sources at Lookingglass Hatchery. The Catherine Creek portion has been 130,000 smolts although US v. Oregon production tables suggest 150,000.

Captive Broodstock– The last release of captive brood will be in 2011 (2009 brood year).

Conventional Broodstock–The program goal is 150,000 smolts, but current production is 130,000 smolts due to space limitation at Lookingglass hatchery.

6.2.3) Past and proposed level of natural fish in broodstock.
Overall, 55.8% of the females spawned from the conventional program were of natural origin although 100% were natural females during the first four years of the program. From 2005-08, only 33.5% have been of natural origin the past four years (Table 16). The portion of naturally-produced fish to hatchery-produced fish used for broodstock is directed by guidelines outlined in Table 13.

6.2.4) Genetic or ecological differences.
There is currently no information about genetic and ecological differences between the currently used hatchery stocks and wild stocks. Annually, broodstock composition incorporates locally adapted naturally produced fish that is intended to minimize genetic differences.

6.2.5) Reasons for choosing.
Broodstock are indigenous to Catherine Creek and the Grande Ronde Basin.

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.
Conventional adult broodstock is selected systematically from across the run time. Pass/keep ratio varies annually, depending on return projections and is adjusted in-season to ensure representation from across the run as described in Table 2. As described in Section 1.75, the long-term intent for this hatchery program is to take the appropriate measures to ensure the legacy of the natural population is secured and to make substantial increases in natural abundance consistent with protecting the genetic characteristics of the population. Captive Broodstock has been discontinued after 10 years of smolt releases from 2001 through 2011.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).
Adults are collected for the Catherine Creek program.

7.2) Collection or sampling design.
All adults that enter the Catherine Creek trap are sorted by origin (marked Conventional, marked Captive Broodstock or unmarked), gender, and age. Fish are retained for brood stock, out-planted, released above the weir, provided to CTUIR for ceremonial and subsistence, or provide to the local food bank for subsistence. Ratios vary annually depending on escapement estimates and the guidelines outlined in Table 2. Adults are selected randomly from the available fish for use as broodstock. Fish not retained for broodstock are marked with an opercle punch and released above the weir or outplanted. Hatchery jacks may be placed above the weir and comprise up to 10% of the total males passed. Trap efficiency varies by year, but has recently exceeded 95%.

Table 17. Catherine Creek weir operation for spring/summer Chinook salmon collected and spawned from 1997 to 2010.

Run	Operation of Catherine Creek trap		Collection at Catherine Creek trap		Spawning at Lookingglass Hatchery	
Year	Beginning	Ending	Beginning	Ending	Beginning	Ending
1997	10-Jul	3-Sep	22-Jul	26-Jul	Na	Na
1998	9-Jun	30-Sep	13-Jun	4-Sep	Na	Na
1999	7-May	30-Jul	18-Jun	30-Jul	Na	Na
2000	30-Mar	4-Aug	26-May	4-Aug	Na	Na
2001	31-Mar	17-Aug	25-May	13-Jul	23-Aug	9-Sep
2002	12-Mar	13-Aug	20-May	31-Jul	16-Aug	6-Sep
2003	5-Mar	1-Aug	13-May	28-Jul	19-Aug	9-Sep
2004	1-Mar	18-Aug	17-May	12-Aug	2-Sep	30-Sep
2005	11-Feb	3-Aug	6-May	8-Jul	25-Aug	8-Sep
2006	1-Mar	25-Jul	29-May	25-Jul	31-Aug	7-Sep
2007	1-Mar	31-Jul	14-May	1-Jul	22-Aug	11-Sep
2008	3-Mar	9-Sep	27-May	2-Sep	20-Aug	8-Sep
2009	2-Mar	2-Sep	3-Jun	31-Aug	20-Aug	10-Sep
2010	1-Mar	30-July	19-May	24-July	19-Aug	9-Sep

7.3) Identity.

Methods for identifying target populations (if more than one population may be present).

Naturally-produced fish are identified based on lack of marks or tags.

Methods for identifying Captive Broodstock and Conventional Broodstock hatchery origin fish from naturally spawned fish.

Captive Broodstock hatchery fish released have been marked with an adipose fin clip (AD) and implanted with a coded-wire tag (CWT).

In brood year 2001, Conventional Broodstock hatchery fish released into Catherine Creek have been marked with an adipose fin clip (AD), implanted with a coded-wire tag (CWT), and injected with Visual Implant Elastomer (VIE) tag behind the eye. The current marking strategy is to mark hatchery fish with adipose fin clip, represented coded wire tag, and potentially a VIE to distinguish captive from conventional fish, and approximately 20,000 are PIT-tagged. The use of VIE marks will be phased out with the captive program.

7.4) Proposed number to be collected:

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

Current modeling projects brood collections not to exceed 100 adults (50 males and 50 females). However, this number maybe modified as the program develops.

7.4.2) Broodstock collection levels for the last eight years, 2001-2008:
Conventional Broodstock collections for Catherine Creek from 2001 to 2008.

Table 18. Brood stock collection level in Catherine Creek, 2001-2010.

Year	Adults Females	Males	Jacks	Green Eggs	Smolts
2001	12	7	3	43,826	24,392
2002	20	14	3	81,926	70,071
2003	28	21	1	103,916	120,753
2004	9	8	1	26,204	23,216
2005	17	13	6	52,107	49,696
2006	37	28	3	132,501	116,882
2007	45	26	5	171,065	138,843
2008	32	16	4	124,317	111,800
2009	43	31	6	165,263	
2010	42	29	3	176,409	

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

- Adults are passed upstream consistent with the adult sliding scale guidelines outlined in Table 2.
- Surplus hatchery adults can be out-planted in Indian Creek or Lookingglass Creek. In the near term, surplus hatchery adults maybe used to develop the Lookingglass Creek program.
- Tribal ceremonial purposes
- Tribal and recreational fisheries
- Nutrient enhancement (hatchery origin, only)

7.6) Fish transportation and holding methods.
Fish are sorted (released above the weir, kept for broodstock, or outplanted) daily. Fish may be held a maximum of 96 hours.

Adults can be anesthetized with MS 222 or CO_2 prior to handling.

Adults retained for broodstock are transported to Lookingglass Hatchery in 250 gallon

and 550 gallon tanks. Transportation time is about two hours from collection to Lookingglass Hatchery.

7.7) Describe fish health maintenance and sanitation procedures applied.
Collection–Adults retained for broodstock are injected with oxytetracycline (10 mg/kg) and erythromycin (Erythro-100 @ 20 mg/kg) at the collection facility.

Holding–At Lookingglass Hatchery, formalin is dripped into the inflowing water to achieve a concentration of 167 ppm. The treatment is applied for a minimum of three days per week for one hour to control fungus and parasites. Frequency of treatment is adjusted on an as needed basis.

Spawning–All hatchery-spawned females are screened for *R.salmoninarum* using enzyme-linked immunosorbent assay (ELISA). A minimum of 20 adults (if available) are examined for systemic bacteria and BKD. A minimum of 60 spawned fish are sampled for culturable viruses using ovarian fluid and caeca/kidney/spleen sample pools of up to 5 fish.

Progeny– Eggs are water hardened in 100 ppm iodophor solution for a minimum of 15 minutes to control vertical transmission of pathogens including IHNV and *salmoninarum* (BKD). Eggs are culled or segregated in groups based on ELISA titers whenever possible. Groups are identified by the following titer ranges:

- $\leq$ 0.199 =Low
- 0.2 - 0.399 = Moderate
- 0.4 - 0.799 = High
- $\geq$ 0.800 = Clinical

Progeny receive a minimum of one 28 day erythromycin (Aquamycin) feed treatments (INAD 020RLOSCS1) to control BKD.

Disease outbreaks are treated on a case-by-case basis. Therapies and remedial measures are based on conventional and available treatments, new information, and innovation. Warm water therapy can be used if EIBS becomes a problem. It would be used, based on priorities of stocks and raceways affected, after consultation with appropriate entities. Formalin treatments, at the recommendation of Fish Health Services, can be implemented for parasitic infestations.

Disinfections and sanitation guidelines for Lookingglass Hatchery are outlined in Table 19.

Table 19. Recommended Disinfectants (Concentration and time) and application for all chemicals used. Chemicals are used in accordance with label and reporting requirements. Disinfectingand disinfected water must be disposed of in an approved manner.

Disinfectant	Application	Concentration	Time	Comment
Iodophor	Nets, gear and equipment, clipping & tagging van, PIT tag stations, large tub disinfectant containers, spawning colanders and buckets, lib truck, footbaths, floors	100 ppm Note: to make 100 ppm solution mix 6.7 oz of jug strength iodophor to 5 gallons H_2O or 6.7 oz.=189ml	10 min.	-Equipment should be pre-rinsed to remove dirt, mucus or other organic material which reduces the efficacy of disinfectant -Rinse equipment to remove harmful residue if equipment is going into standing water containing fish or fish are being placed into the equipment (tank or bucket) -Argentyne or other buffered iodophors such as Western Chemicals "PVP iodine" would be acceptable
Iodophor	Water hardening eggs	100 ppm	Minimum 15 minutes	This is the statewide general practice
Iodophor	Egg transfers-disinfection at receiving stations	100 ppm	10 minutes	
Isopropyl Alcohol	PIT tag needles and any other apparatus used to insert into fish	70%	10 min. Note: Air dry	-No re-use until air dried -use drying oven to enhance air drying step
Virkon Aquatic	Footbaths, nets, boots, and gear			As per label instructions
Chlorine or Aqueous solution as sodium hypochlorite (Household Bleach)	Lib truck tanks Raceway disinfection	100 ppm 100 ppm	10 min.	Organic matter binds and neutralizes Left to dry and breakdown in sun. Make sure no bleach enters effluent

7.8) Disposition of carcasses.

Spawned carcasses are disposed of in the hatchery landfill. Surplus carcasses may be used for nutrient enhancement consistent with MOA between ODFW and DEQ.

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.

- Brood stock will collected throughout the run
- Only a portion of the adult collections will be used for broodstock and a portion released for natural spawning
- The risk of fish disease amplification will be minimized by consulting with the Fish Health Specialist and following Fish Health Policy sanitation and fish health maintenance recommendations discussed annually with co-managers during the development of the AOP (2009). Prudent fish health measures can be implemented to cull eggs from females with gross signs of BKD or elevated BKD ELISA values.
- Surveys below weirs
- Temperature triggers to stop adult collections (AOP 2009 LSRCP)

SECTION 8. MATING

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

8.1) Selection method.

Conventional Broodstock–Adults are collected daily throughout the operation of the weir. From the collected fish, a predetermined number of adults by age, sex, and origin, are selected systematically. Hatchery broodstock are selected at random for spawning as they mature.

8.2) Males.

Conventional Broodstock– The majority of fertilization occurs with age –four and age-five males. Three-year-old males (jacks) are included in the gene pool. When an abundant number of jacks, typically hatchery origin, are collected, milt is used to fertilize a maximum of 10% of the available eggs. Starting in 2010, a target of 30% of the eggs will be fertilized from larger (>80cm) and presumably older males. Frequently, natural origin males are used multiple times to increase their contribution.

8.3) Fertilization.

Conventional Broodstock– The goal of the program is to produce a minimum mating of 100 family pairs. Matrix or factorial spawning is generally accomplished in 1 X 2, 2x2 or 3x2, 3x3 combinations; therefore, each matrix generates two to nine family pairs.

The sex ratio is expected to be 1:1, however, natural origin males will be prioritized if males numbers are low.

8.4) Cryopreserved gametes.

Conventional Broodstock–Cryopreserved semen has been collected and maintained by

the Nez Perce Tribe at the University of Idaho and Washington State University.The collection of semen for cryopreservation program ended in 2008.

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.

A factorial or matrix-mating scheme is applied to ripe fish on each spawning day. The number of ripe fish, their gender and age determine the matrices. Natural fish are included in each matrix to maximize contribution of natural fish.

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.

There is no current goal; however, the current program indicates 87% survival from green egg to smolt (Table 16). For modeling purposed, we expect 90% survival to fry.

9.1) Incubation:

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

Conventional Broodstock– Adult collections and spawning have occurred from 2001-2008. In 2004, we started using an egg counter to determine fecundity and survival.

Table 20. Egg take and egg loss data for Catherine Creek spring/ summer Chinook at Lookingglass Hatchery, 2001-2008.

Year	Total Egg Take	Egg Loss		Percent Survival to eyed egg stage
		Total	% Loss	
2001	41,826	15,400	36.8	63.2
2002	81,926	11,102	13.6	86.4
2003	103,916	13,388	12.9	87.1
2004	26,204	1,816	6.9	93.1
2005	52,107	2,631	5.1	94.9
2006	132,501	10,766	8.1	91.9
2007	171,065	24,858	14.5	85.5
2008	124,317	7,574	6.1	93.9

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

Captive Broodstock– Surplus eggs to the program goals may be produced in 2009 and 2010 or until the production aspect of the program is phased away.

Conventional Broodstock– There have been no surplus eggs taken to date in the Conventional Program. Surplus eggs from hatchery-origin females may be used in the

Lookingglass Creek program.

9.1.3) Loading densities applied during incubation.
Conventional Broodstock– Eggs are incubated in vertical Heath trays with one female's eggs per tray. After ELISA values are known, eggs are re-counted and 5,000 eggs put into each tray. Flows are regulated at 4.5 to 6 gpm per vertical stack.

Moist air incubators are being considered. Approximately 1,400 eggs will be loaded in 1.2 liter containers.

9.1.4) Incubation conditions.

Conventional Broodstock– Eggs are incubated on UV-treated Lookingglass Creek water supplemented with chilled well water until the ambient water temperature of Lookingglass Creek subsides, historically around the 3rd week of September. After Lookingglass Creek temperatures cool, only UV treated creek water is used to incubate eggs. Eggs from late spawning conventional and captive broodstocks can be incubated in creek water supplemented with pathogen free well water. The well water is 14^{o} C and is used to temper the cold creek water temperatures common in winter, to accelerate growth and development.

Water temperature is monitored using thermometers and recorded daily in the morning and afternoon. Daily thermal units (CTU's) are calculated to determine developmental stages. Eggs are picked at approximately 325-350 CTU's (585 - 630 FTU's). Fry are visually inspected to determine if they are buttoned up prior to ponding and feeding. At approximately 1,000 CTU's (1,800 FTU's) feed is presented to the swim-up fry.

If moist air incubators are deployed, upwelling incubators or hatching boxes will be used, located inside the early rearing trough.

9.1.5) Ponding.
Fry are ponded in double deep troughs at approximately 50,000 fish per container.

Captive Broodstock– Fry are ready to pond at about 1,000 CTU's (1,800 TU). Fry weight is estimated at approximately 0.3 grams (1,500 fish per pound).

Conventional Broodstock– Fry are ready to pond at about 1,000 CTU's (1,800 TU). Fry weight is estimated at approximately 0.4 grams (1,200-1,300 fish per pound).

9.1.6) Fish health maintenance and monitoring.
In both captive and conventional brood programs, fungus is controlled with formalin treatments at a concentration of 1,667 ppm. Treatments are scheduled three times per week for 15 minutes; however, daily treatment will be applied if needed. Little mortality has been attributed to yolk-sac malformation. After eyeing, dead eggs and fry are hand-picked and enumerated. Inventory adjustments are made in the HMIS system.

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.
Green eggs are incubated at Lookingglass and Oxbow hatcheries on pathogen-free UV treated creek water, pumped well, or spring water. Eggs are fertilized at each hatchery and water hardened in 100 ppm iodophor for a minimum of minutes to one hour.

9.2) <u>Rearing</u>:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1997-2008), or for years dependable data are available.

Conventional Broodstock– From brood year 2001 to 2008 the observed green egg to smolt survival at Lookingglass Hatchery has ranged from 0.56 to 0.93, with an average of 0.85. For the purposes of production planning a green egg to smolt survival rate of 0.85 has been assumed in the past with life stage specific survival rates as follows:

- Green egg to eyed-egg: 90%
- Eyed-egg to swim-up fry: 98%
- Swim-up fry to fingerling (marking): 97%
- Fingerling to smolt (marking to release): 99%

9.2.2) Density and loadingcriteria(goals and actual levels).
<u>Lookingglass Hatchery</u>
Early rearing– Catherine Creek fish are loaded in Lookingglass Hatchery early rearing double deep troughs at maximum of 50,000 fish per trough. Fry are reared to approximately 300 fpp before transferred to outside raceways. The expected flow 50 gpm and the rearing volume is 120 ft^3.
Fish culture indices:

- Fish/raceway: 50,000
- Density: 1.39 lb/ft^3
- Density Index: 0.66
- Flow: 3.3 lbs/gpm
- Flow Index: 1.59

Raceway rearing– Catherine Creek fish are loaded in Lookingglass Hatchery raceways for final rearing at maximum of 65,000 fish per raceway. Target fish size is 20 - 25 fpp with an expected inflow of 750 gpm. Pond volume is 3,000 ft^3.
Fish culture indices:

- Fish/raceway: 65,000
- Density: 0.93 lb/ft^3

- Density Index: 0.18
- Flow: 4.3 lbs/gpm
- Flow Index: 0.83

Selected final rearing– Catherine Creek fish can be loaded in circular tanks for over winter final rearing at a maximum of 20,000 fish. Target fish size is 20 – 25 fpp with an expected inflow of 170gpm. Pond volume is 1,100 $ft.^3$.
Fish culture indices:

- Fish/raceway: 20,000
- Density: 0.91 lb/ft^3
- Density Index: 0.17
- Flow: 5.9 lbs/gpm
- Flow Index: 1.12

Catherine Creek acclimation facility:

- Measures (fish size=20 fpp, inflow=300 gpm, volume=2,064 ft^3)
- Maximum number fish/raceway: 31,250
- Density: 0.76 lb/ft^3
- Density Index: 0.14
- Flow: 5.21 lbs/gpm
- Flow Index: 0.95

9.2.3) Fish rearing conditions

Lookingglass Hatchery (early rearing in 2008)– Fish are reared in UV treated creek and pathogen free well water (5° C to 10° C) from late-January to April. Flows are set to maintain acceptable flow indices (Piper 1982); however the UV system limits flow capacity to a maximum of 50 gpm. Troughs are cleaned and mortalities removed regularly.

Lookingglass Hatchery (final rearing)– Fish are transferred to outside raceways in April and early May and reared in raw Lookingglass Creek water. Fish remain in the raceways until March and April of the following year when they are transferred to acclimation sites or released directly into Lookingglass Creek. Water temperature varies seasonally from 0.5° C to 20° C. Raceways are cleaned weekly and mortalities picked daily. During spring runoff, raceway cleaning is suspended.

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 summary by month from initial ponding to release for Grande Ronde Basin spring/summer Chinook at Lookingglass Hatchery, 2007 Brood Year.

Table 21. Monthly weights of Catherine Creek juveniles reared at Lookingglass Hatchery, Brood Year 2007.

Month	Weight (g)	Fish /Pound
January		Sac-fry
February	0.49	920
March	0.93	489
April	2.09	217
May	2.79	163
June	3.52	129
July	5.97	76
Aug	10.81	42
Sept	13.76	33
Oct	14.65	31
Nov	15.13	30
Dec	15.66	29
Jan	16.21	28
Feb	17.46	26
Mar	18.16	25
Apr		Liberated

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

The specific growth rate was calculated from for brood year 2007 averages (Figure 4). The highest growth rates are observed in February and March from first feeding fry and the lowest growth rates in December and January. Growth rates declined August through October with decreasing water temperatures and daylight photoperiod. There is little weight gain from November through January. Winter time cold water and icing conditions greatly reduce feed levels.

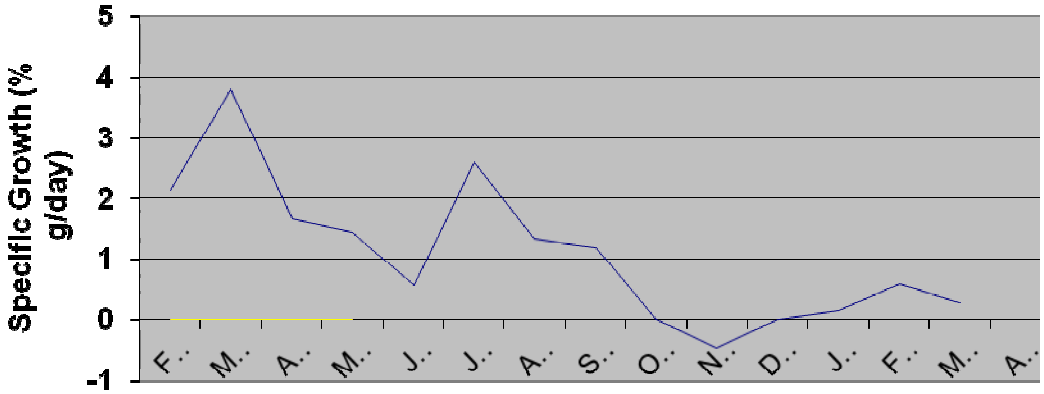

Figure 4. Calculated growth rates for BY07 Chinook stocks at Lookingglass Hatchery.

No hepatosomatic index (liver weight/body weight) and body moisture content were collected to estimate body fat concentration during rearing.

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 (*average program performance*).

At Lookingglass Hatchery, fish are fed BioOregon's Bio-diet starter and Bio Diet fry feeds. The feed is distributed to the raceways with air blower feeders and by hand during periods of cold temperatures. One 28-day erythromycin medicated feed treatment is given in July using Bio-Oregon moist at a target body weight of 1.9%.

Feed rate:

- Start - 5.0% body weight/day
- November through January fish are fed intermittently at "maintenance" ration 0.1-0.2%.
- Final rearing - 0.1-0.2% body weight/day

Overall food conversions are 1.1-1.3.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures. Monthly sample of about 10 (or available) moribund and/or dead fish will be examined for *R. salmoninarum* (BKD) and systemic bacteria. Every other month, examine 5 grab-sampled fish per stock and any moribund fish (monthly) for erythrocytic inclusion body syndrome (EIBS) using blood smears and hematocrits. If EIBS is detected expand monitoring on that raceway to 10 fish per month. Examine gill and skin wet mounts by microscopy from a minimum of five fish. These may be from a combination of moribund and healthy fish. If bacterial gill or cold water disease is suspected, make smears from the gills on agar medium.

BKD – One 28-day therapeutic erythromycin (Aquamycin) medicated feed treatment is scheduled except for progeny of captive brood with moderate to high ELISA values which receive two medicated feed treatments. The first treatment for captive brood progeny, if needed, is administered in April or May. All fish receive a medicated feed treatment in July.

EIBS–There is no prophylaxis for EIBS except avoidance of the infectious agent. Bacterial cold-water disease is the most common secondary infection. Oxytetracycline or Aquaflor prophylaxis will likely be implemented based on the sensitive nature of this stock if conditions warrant its use.

Fungus– Formalin treatments are given for one-hour treatment for two consecutive days after fin clipping operations, PIT-tagging and VIE marking. Following Fish Health Services recommendations, formalin treatments can be implemented for parasitic infestations.

Disease Outbreak Plan– Disease outbreaks are treated on a case-by-case basis. Therapies and remedial measures are based on conventional and available treatments, new information, and innovation. Warm water therapy may be used if EIBS becomes a problem. It would be used, based on priorities of stocks and raceways affected, after consultation with co-managers.

Table 22. Disease history (2003 to present)of Catherine Creek Conventional and Captive Broodstock adults and all progeny[a].

Disease or Organism	Conventional Adults	Captive Brood	All Progeny
IHN Virus	Yes	No	Yes
EIBS Virus	No	No	No
Aeromonas salmonicida	No	No	No
Aeromonas/Pseudomonas	Yes	Yes	Yes
Flavobacterium psychrophilum	Yes	Yes	Yes
Fl. columnare	No	No	No
Renibacterium salmoninarum	Yes	Yes[b]	Yes
Yersinia ruckeri	Yes	No	Yes
Carnobacterium sp.	No	No	No
Ichthyobodo	No	No	Yes
Gyrodactylus	No	No	No
Ichthyophthirius multifilis	No	No	No
Epistylis	No	No	Yes
Ambiphrya (Scyphidia)	No	No	Yes
Trichodinids	No	No	No
Gill Copepods	Yes	No	No
Coagulated Yolk Disease	No	No	Yes
External Fungi	Yes	Yes	Yes
Internal Fungi	No	No	Yes
Myxobolus cerebralis	No	Yes	No
Ceratomyxa shasta	Yes	No	No

[a] "Yes" indicates detection of the pathogen but in many cases no disease or fish loss was associated with presence of the pathogen. "No" indicates the pathogen has not been detected in that stock.
[b] BKD is the leading cause of death in the captive program.

Note: the Catherine Creek Chinook Fish Health Monitoring Plan for Captive Broodstock progeny and the Conventional Program is explained in the Lower Snake Program Operation Plan document developed annually by the co-managers in this program. The Grande Ronde Basin Captive Broodstock Annual Operation Plan covers fish health monitoring plans for the Captive Broodstock.
Refer to section 7 for fish health and sanitation procedures.

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

na

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.
Traditional hatchery rearing methods are applied at Lookingglass Hatchery. After eggs are eyed; fish are produced on natural water temperatures and photoperiods. Daily feed rations are primarily distributed with automatic feeders to limit human interaction.

Fish are acclimated in Catherine Creek water for 2 to 3 weeks prior to 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.
The incorporation of natural fish into production is intended to reduce the long-term impacts of domestication. Progeny are reared and released as smolts. Fish are released to coincide with natural fish emigration timing and reduce natural and hatchery fish interactions in freshwater. The intent is to maintain hatchery production in proportion to natural production of juveniles.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels. Smolt production surplus to program goals and rearing space at Lookingglass Hatchery can be released in Lookingglass Creek. Production releases target smolt age class.

Table 23. Planned release numbers for Catherine Creek.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	-	-	-	-
Unfed Fry	-	-	-	-
Fry	-	-	-	-
Fingerling	-	-	-	-
Yearling	150,000	20-25	March/April	Catherine Creek

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

- **Stream, river, or watercourse:**Catherine Creek (HUC-17060104)
- **Release point:** River Mile 21.5
- **Major watershed:** Grande Ronde
- **Basin or Region:** Snake River

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

Table 24. Summary of spring/summer Chinook released in Catherine Creek, 1987-2009. Note: Fish have been 100% marked since BY1998 released in 2000.

Release year	Stock	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Smolts	Avg weight (g)
1987	-	-	-	-	-	-	-	88,667	10.9
1988	RR/Carson							151,888	20.6
1989	RR/Carson							83,100	13.2
1990	RR							70,002	19.9
1991-99	-	-	-	-	-	-	-	0	–
2000	CC-Captive Brood							37,980	22.5
2001	CC-Captive Brood							136,902	19.7
2002	CC-Captive Brood							180,343	18.6
2003	CC-Captive Brood							105,313	12.8
	CC-Conv Brood							24,392	12.6
2004	CC-Captive Brood							92,413	23.1
	CC-Conv Brood							70,521	23.4
2005	CC-Captive Brood							68,827	24.0
	CC-Conv Brood							120,753	21.8
2006	CC-Captive Brood							45,604	28.6
	CC-Conv Brood							23,216	28.6
2007	CC-Captive Brood							21,572	26.7
	CC-Conv Brood							49,696	26.7
2008	CC-Conv Brood							116,882	19.9
2009	CC-Conv Brood							138,843	20.0

Note: A total of 46,727 surplus eyed eggs from the captive brood program were released in Indian Creek in 2008.

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

Surplus eyed eggs are typically released in late October or early November. Eggs are placed on the stream bed and carefully covered with gravel.

Smolts are released from acclimation sites in late March to mid-April to mimic natural

fish emigration timing and reduce the natural and hatchery fish interactions in freshwater. During the last four years, fish have been acclimated for 4 to 6 weeks, allowed to volitionally emigrate for up to 21 days before forced into the river in mid-April. The forced release occurs in late afternoon or early evening. No culling is applied to non-migrants. It is anticipated that acclimation time will be reduced to a minimum of 14 days due to the numbers of fish produced and the size of the acclimation containers.

Table 25. Summary of Catherine Creek acclimation and release dates 2000-2010.

Rel.Year	Arrival	Volitional Release	Forced release
2000	February 28	April 2	Aril 18
2001	March 8	April 2	April 16
2002	February 26	April 2	April 15
2003	March 7, 24	March 13, 31	March 23, April 14
2004	March 8, 24	March 15, 30	March 22, April 12
2005	March 7, 28	March 14, April 4	March 7, April 7
2006	March 13	March 27	April 12
2007	March 12	March 26	April 11
2008	March 10	March 24	April 14
2009	March 9, 24	March 16, April 1	March 23, April 13
2010	March 15, 16	March 29	April 12

10.5) Fish transportation procedures, if applicable.

Chinook smolts are loaded with water using a fish pump. Fish are separated from the water and transferred into liberation tankers ranging in capacity from 2,400 to 5,000-gallons. Fish are loaded at a rate of 1.0 lb/gallon. Transport time from Lookingglass Hatchery to acclimation sites is less than two hours. Supplemental oxygen and aeration is provided and temperature is monitored during transport.

10.6) Acclimation procedures

In general, Chinook smolts arrive at the acclimation facilities in early March and are held on river water for a minimum of one week. After at least a week, screens are removed and fish are allowed to volitionally leave the pond until force out. All fish are forced out in late March or mid-April.

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

Currently, 100% fish are marked with an adipose fin clip. A represented group of at least 60,000 is imbedded with coded wire tag.

VIE tags maybe applied to differentiate captive brood production from the conventional production.

Approximately 21,000 smolts are PIT tagged for comparative survival studies, emigration performance to Lower Granite Dam, and in-season adult abundance estimates.

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

Surplus smolts of hatchery origin females maybe released in Lookingglass Creek; however, fish surplus to programmed needs would be released at an earlier life stage or culled as eggs.

10.9) Fish health certification procedures applied pre-release.

Sixty normal appearing grab-sampled smolts are sampled at Lookingglass Hatchery prior to transfer to the acclimation sites. Pretransfer grab-sampled numbers may vary depending on the disease history and number of fish for a given brood year. Individual fish are examined for *R. salmoninarum* by ELISA. Five grab-sampled fish per raceway are tested for EIBS. In addition a target of 10 moribund and/or dead fish is tested for *R. salmoninarum* by ELISA and systemic bacteria. A subsample of mortalities is tested for virus. Gill/kidney/spleen samples from grab-sampled fish are examined in 3-fish sample pools and assayed for viruses. Wet mounts of skin and gill tissue from a minimum of five live fish are examined by microscopy. If smolt groups are held at acclimation sites longer than three weeks they will be evaluated with a lesser number of grab-sampled fish as in protocol above. At a minimum, a target of 10 (or available) moribund and/or dead fish will be sampled from acclimation sites for *R. salmoninarum* and systemic bacteria. A subsample of these fish will be tested for viruses.

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

Environmental conditions are a concern at all acclimation sites and may lead to early releases. The Lookingglass Hatchery manager and facility operators have the authority to release fish in an emergency. Section (5.7.2) describes winter icing conditions that can result in the intake becoming blocked to inflowing water.

In the event of an emergency release, the Hatchery Manager and Facility Operators will notify their immediate supervisor, ODFW Regional Manager, co-mangers, and federal cooperators.

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.

Chinook smolts are acclimated and released in late March or mid-April after a volitional release opportunity. Releases coincide with warming water temperature and increasing river flow. The intent is to reduce theinteractions with naturally produced Chinook and steelhead by reducing the time fish reside in freshwater.

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.

- Mark all smolts and determine mark rate
  - (*Indicators: 1a, 1b, 2b, 3a, 4a, 4b, 7a, 26a)*
- Analyze marked fish recovery data collected by others from Columbia River, Snake River and other fisheries to determine harvest numbers and rate
  - *(Indicators: 1a, 1b, 2b, 3a, 25a, 25b, 26a)*
- Conduct statistically valid creel studies in the system to determine effort and harvest of hatchery fish and incidental handling rate for other fish
  - *(Indicators: 2a, 3a, 3b, 4a, 5a, 25a, 25b)*
- Monitor smolt release size, numbers, timing, location and smolt movement
  - *(Indicators: 7a, 14b, 17a, 22a, 22b, 22c, 24a, 25a, 25b)*
- Monitor adult collection, numbers, status and disposition
  - *(Indicators: 2b, 3a, 11a, 11b, 11c, 14a, 15a, 15b, 16a, 16b, 17b, 19a, 20a, 20b, 20c, 20d, 25a, 25b)*
- Monitor survival, growth and performance of hatchery fish in the hatchery and in nature
  - *(Indicators: 6a, 25a, 25b)*
- Determine proportion of hatchery adults in key natural spawning areas and population as a whole via adult mortality recoveries or other methods.
  - *(Indicators: 19a, 25a, 25b)*
- Develop genetic profiles for hatchery and natural Chinook populations in the basin and conduct regular monitoring
  - *(Indicators: 18a, 20c, 25a, 25b)*
- Monitor wild fish escapement trend in key natural spawning areas and population as a whole via redd count surveys and adult origin reconstruction via adult mortality recoveries or other methods.
  - *(Indicators: 15a, 17b, 19a, 20b, 21a, 21b, 25a, 25b)*
- Develop and implement evaluation plans and report findings consistent with needs of the program for adaptive management
  - *(Indicators: 25a, 25b)*
- Monitor discharge water quality and water withdrawals and report annually on compliance with related permits.
  - *(Indicators: 12a, 23a, 23b, 23c, 23d)*
- Monitor health of adult and juvenile Chinook associated with hatchery production.
  - *(Indicators: 8a, 8b, 9a, 9b, 9c, 11b)*

It is expected that these monitoring activities will provide the basic information needed to evaluate this program and its impact on the natural population (both positive and negative). However, additional data or analyses may be necessary to ensure the following key pieces of information are available to evaluate this program. The key information pieces are:

1 - A time series of wild and hatchery spawner escapement estimates for the entire

Catherine Creek population
2 - Distribution of spawners within the watershed that the population occupies,
3 - Proportion of hatchery fish, by year, for the entire population,
4 - Age composition of spawners, preferably by year, but if not a summary from multiple years that is useable;
5 - Estimated annual impact of tributary and downstream fisheries (including mainstem Columbia and ocean as appropriate);
6 - Number of wild fish removed for hatchery broodstock and proportion of the hatchery broodstock that are wild fish (i.e. pNOB);
7 - Green egg to smolt survival for hatchery program
8 - Smolt to adult survival for hatchery releases;
9 - Hatchery strays recovered from other basins based on CWT or PIT recoveries;
10 - The size of hatchery smolts relative to wild fish;
11 - The timing of the hatchery smolt release versus out-migration timing of the wild smolts;
12 - An index on how quickly the hatchery smolts migrate after release and how many of them do not migrate at all (residualize).

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.
Current monitoring and evaluation funding covers most activities listed above. However, further studies and monitoring may be needed to improve the Catherine Creek Chinook Salmon Hatchery Program, which will require increased funding. Given the concern regarding the influence that hatchery supplementation may exert on natural populations, it is imperative that we examine potential methodologies for eliminating or minimizing those effects. Our desire is to find ways to improve the hatchery program and our ability to manage it.

Database Development and Maintenance – **High Importance**
We see the need for a "data steward" within the ODFW LSRCP Program to develop and maintain the databases needed for organizing the data collected while monitoring the LSRCP hatchery programs and supplemented natural populations. These databases will allow us to conduct analyses within specific populations, as well as among LSRCP Chinook salmon populations, and will facilitate the effective compilation and transfer of information to the LSRCP databases. They will also have to be coordinated with those from LSRCP, BPA and NOAA Fisheries, the agencies to which we will submit these data, and be available to all co-management agencies

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.

- NMFS guidelines are followed in all electro-fishing activities.
- Experienced surveyors are utilized to conduct spawning surveys. Surveyors will walk in the stream, crossing when necessary, avoiding and counting redds and observing fish.

- Experienced fish culturists and pathologists perform activities associated with fish production within the hatcheries.
- Experienced fish culturists respond to alarms 24 hours per day 7 days per week.

SECTION 12. RESEARCH

12.1) Objective or purpose.

Research and monitoring have been an integral part of the Captive Broodstock and Conventional Hatchery programs since their inception. The purpose of all past, present or planned research project in these programs is to find ways to improve these and other hatchery programs.

Catherine Creek spring Chinook salmon reared at Lookingglass Fish Hatchery have come from either the Captive Broodstock Program or the Conventional Hatchery Program. Each program has specific protocols and emphases.

Captive Broodstock Program— The Catherine Creek Captive Broodstock Program has come to an end. The 2010 spawn was the last for this program. Only 14 females were spawned. No Catherine Creek males were left, so the eggs were fertilized by males from the Upper Grande Ronde River Captive Broodstock Program and the offspring were used in a BKD vertical transmission study (none will be released). However, there will be several more years of returning adults of the $F_1$and F_2generations to be monitored. This will be accomplished, as it has been, along with monitoring the adult returns of the Conventional Hatchery Program.

Conventional Hatchery Program—The Conventional Hatchery Program is integrated with the Captive Broodstock Program described above and we compare specific parameters of the two programs(e.g., growth, health and survival in both the hatchery and in nature). Additionally, we have conducted experiments to improve the effectiveness of hatchery rearing, including examining the effect of exercise on smolt physiology and subsequent survival to maturation. We have also examined the effectiveness of different rearing densities and sizes at release. Currently, we are examining genetic changes in hatchery Chinook salmon in the Imnaha River. Future research may examine methods for reducing the rate of jacking and straying in hatchery salmon and increasing survival to adulthood and program efficiency (e.g., do we need to acclimate smolts prior to release?).

Conventional Broodstock adults are collected from the weir on the Catherine Creek in the spring through summer and held at Lookingglass Hatchery until they are spawned in August/September. Eggs are incubated at Lookingglass Hatchery for rearing to smolt, targeted for a mean weight of 23 g and a mean fork length of 125 mm, at their release as yearling smolts. All fish are marked differentially by raceway and a portion of fish from each raceway is PIT-tagged to monitor outmigration survival and characteristics. In March or April, fish are transported to an acclimation facility located within the area of Catherine Creek where natural fish spawn. The acclimation site is supplied with

unfiltered ambient stream water and fish are given supplemental feed. In March and April, after a 14-30 day period of acclimation, fish are released into the stream, first volitionally and then forced out about two weeks later.

The F_1 generation matures one, two, three, or four summers after they are released. Some of these fish are captured in fisheries while others return to the Grande Ronde Basin. A weir placed on Catherine Creek, upstream of the town of Union, monitors returning adults. Of those adults returning, some will be allowed to spawn naturally and some may be collected at weirs for use in hatchery broodstock. Some of the returning Captive Broodstock F_1s may be released as spawners in unseeded habitat, such as Lookingglass Creek.

F_1 generation fish that spawn naturally may reproduce with natural fish or other F_1 generation fish. Progeny produced from these matings (the F_2 generation) migrate to the ocean as yearlings and return when they are 3, 4 and 5 years old. We have been and will continue to monitor the production and life history characteristics of the F_2 generation fish.

Collaboration with the Captive Broodstock and Early Life History programs and spawning ground surveys are necessary to evaluate the Conventional Hatchery and Captive Broodstock programs. Both Conventional Hatchery and Captive Broodstock fish are compared with natural fish. Size, age, fecundity and time of maturation of adults, as well as fertility, egg size, and health, growth and survival of the F_1 generation are some of the variables compared.We can also use genetic parental analyses to compare spawning success (production of an F_2 generation) in nature between fish reared in nature vs. those reared to smolt stage in a hatchery.

12.2) Cooperating and funding agencies.

- Lower Snake River Compensation Program
- Nez Perce Tribe
- Confederated Tribes of the Umatilla Indian Reservation
- Bonneville Power Administration
- National Marine Fishery Service

12.3) Principle investigator or project supervisor and staff.

Richard W. Carmichael
Timothy Hoffnagle
Joseph Feldhaus
Debra Eddy
Sally Gee
Shelby Warren
Steve Boe (CTUIR)

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.
Conventional Hatchery Program
1. Monitoring hatchery/wild ratios in natural spawning streams–Adult spring/summer Chinook are captured and enumerated at the existing facilities: Catherine Creek, Lostine River, Upper Grande Ronde River, and Lookingglass Creek. See section 2.2.3.
Spawning surveys – In addition to adult trapping, density and hatchery/wild ratio of spawners in natural spawning areas is monitored via direct observation, redd counts and carcass recoveries on the spawning grounds. See section 2.2.3.

12.6) Dates or time period in which research activity occurs.
Research is an ongoing activity.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.
Conventional Broodstock–Handling of fish will include enumeration, measurement, gender identification, marks and release at the site of capture. Fish are held in containers with well-aerated water of suitable temperature (< 18° C). If handling involves more than determining species and enumeration eg., measurement, marking or tissue sampling, fish are anesthetized with MS-222 before the procedure and allowed to fully recover before release. Adults are transported to Lookingglass Hatchery or released upstream within 48 hours of capture.

12.8) Expected type and effects of take and potential for injury or mortality.
Monitoring and evaluation will involve take of all types (Table 12). Injury due to capture, marking and tissue sampling is inevitable. Hooking wounds, electro-fishing injury and other physical damage is generally temporary in nature. Some fish, however, succumb to the effects of such injury. This mortality, in addition to occasional direct loss due to capture and handling, accounts for the lethal take estimates that may occur during monitoring and evaluation activities.

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 table" (Table 12).
See Table 12

12.10) Alternative methods to achieve project objectives.
Unknown.

12.10) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.
We expect to encounter summer steelhead juveniles and bull trout during sampling. However, the number of encounters is expected to be less than ten juvenile fish of each species per tributary, as a result, the level of mortality is expected to be negligible.

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.

- Listed steelhead, Chinook and bull trout sampled during the residual steelhead study and genetic monitoring will be conducted in compliance with NOAA Electro-fishing Guidelines to minimize the risk of injury or immediate mortality.

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:  , ODFW NE Region Hatchery Coordinator
Date: April 29, 2011

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

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

15.2) Description of non-anadromous salmonid species and habitat that may be affected

by hatchery program.

Bull trout – Both fluvial and resident life history forms of bull trout inhabit the Grande Ronde Basin including the Minam River, Wenaha River, Catherine Creek, Lostine River, and Upper Grande Ronde River. Bull trout utilize suitable habitat within the basin. Fluvial adults migrate into headwater areas during summer and early fall after over-wintering in mainstem tributaries and the Snake River. Spawning for both resident and fluvial adults occurs in September and October. Fry emerge during the spring. Juvenile rearing is restricted to headwater areas where water remains cooler.

15.3) Analysis of effects.

The only identified direct effect of the hatchery operation on bull trout is trapping migrant fluvial fish in the adult Chinook traps on Catherine Creek, Lostine River, Upper Grande Ronde River, and Lookingglass Creek facilities. The traps are operated March through September. Number of fish trapped annually ranges from 0 to 50. Fish are held a maximum of two days, handled and passed upstream.

Hatchery operations– Water withdrawal for Chinook smolt acclimation occurs in the late winter and spring at a time when stream flow is high. Adequate flow is maintained for adult steelhead as well as migrant fluvial bull trout. Facility maintenance including intake excavation, occurs in the summer months when water temperatures preclude the presence of bull trout.

Fish health – See section 3.5 and 7.7.

Ecological/biological– Releases of smolts and juveniles occur downstream of most bull trout rearing areas minimizing potential competition and predation. Releases of listed hatchery steelhead may however provide substantial forage for larger fluvial bull trout over-wintering in the lower reaches of the system (see section 3.5).

Predation/competition – Fingerling releases can interact with bull trout in the rearing distribution. Some limited predation of and competition with smaller bull trout may occur in these areas.

Monitoring and evaluations– see section 12.11.

Habitat – The effects on bull trout rearing habitat of Lookingglass Creek, Catherine Creek, Lostine River, and Upper Grande Ronde River is unknown. Migratory behavior of fluvial bull trout is, however, disrupted briefly as they encounter the adult Chinook traps during operation.

15.4) Actions taken to mitigate for potential effects.

- Smolts are released at a time and size designed to optimize migration out of the system and minimize interaction with bull trout.
- Bull trout handled at the adult trap are sorted, measured and released upstream.