HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	**Lower Snake River Compensation Plan (LSRCP) Little Sheep Creek Summer Steelhead Hatchery Program**
Species or Hatchery Stock:	**Summer Steelhead (Stock # 029)**
Agency/Operator:	**Oregon Department of Fish and Wildlife**
Watershed and Region:	**Imnaha / Snake River / Columbia Basin**
Date Submitted:	Phase-1, December 2002
Date Last Updated:	May, 2002

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lower Snake River Compensation Plan (LSRCP), Little Sheep Creek Summer Steelhead Hatchery Program.

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

Oncorhynchus mykiss, summer steelhead, Oregon hatchery stock # 029, ESA-listed as threatened. Imnaha Basin wild summer steelhead (O. *mykiss*) are part of the Snake River Steelhead ESU, which were listed as a threatened species under the federal Endangered Species Act (ESA) in August, 1997. As a result of incorporating listed wild fish from Little Sheep Creek into the Little Sheep Hatchery broodstock, hatchery progeny are listed as well. Additionally, Imnaha Basin summer steelhead are within the range of the Columbia Basin bull trout ESU, which was listed as threatened under the ESA in June, 1998 and Snake River spring chinook ESU, which were listed as a threatened species under the ESA in April, 1992. These fish are also a sensitive species under Oregon's Sensitive Species Rule (OAR 635-100-0040).

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 - Program funding/oversight
2. Confederated Tribes of the Umatilla Indian Reservation – Comanagers
3. Nez Perce Tribe – Comanagers

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

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 steelhead program in Oregon includes an

integrated Grande Ronde basin program as well. Staff are shared between the two programs at an approximately 70% Grande Ronde basin and 30% Imnaha basin level. Combined program staff includes: (2) Hatchery Managers, one at Wallowa Hatchery and one at Irrigon Hatchery, (7 ½) technician positions, (1) trades maintenance worker position and (1) office manager position. Annual operation and maintenance costs for the Imnaha portion of the FY 2001 program include: an estimated $103,959 for Wallowa Hatchery and $234,000 for Irrigon Hatchery

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

Adult Collection and Holding: Adult summer steelhead are collected in the Imnaha basin (HUC-17060105) at the Little Sheep Creek facility located on Little Sheep Creek (RK 8.4), 11 km southwest of the town of Imnaha, Oregon (Fig. 1).

Spawning: Fish are spawned at the Little Sheep Creek facility.

Early Incubation: Incubation of eggs from green egg to eyed egg stage occurs at Wallowa Hatchery. Wallowa Hatchery is located along Spring Creek (RK 1), a tributary to the Wallowa River at RK 66.8, and one km west of Enterprise, Oregon (Fig. 1).

Final incubation and Rearing: Final incubation (eyed egg to hatching) and rearing to smolt size occurs at Irrigon Hatchery. Irrigon Hatchery is located along the south bank of the Columbia River, above John Day Dam, near Irrigon, Oregon.

Acclimation to release: Smolts are transferred from Irrigon Hatchery in March and April to an acclimation pond at the Little Sheep Creek facility and held for varying lengths of time, before being released into the Little Sheep Creek.

Direct Stream Release: In addition, smolts are transported from Irrigon Hatchery in April and released directly into Big Sheep Creek (RK 14.5).

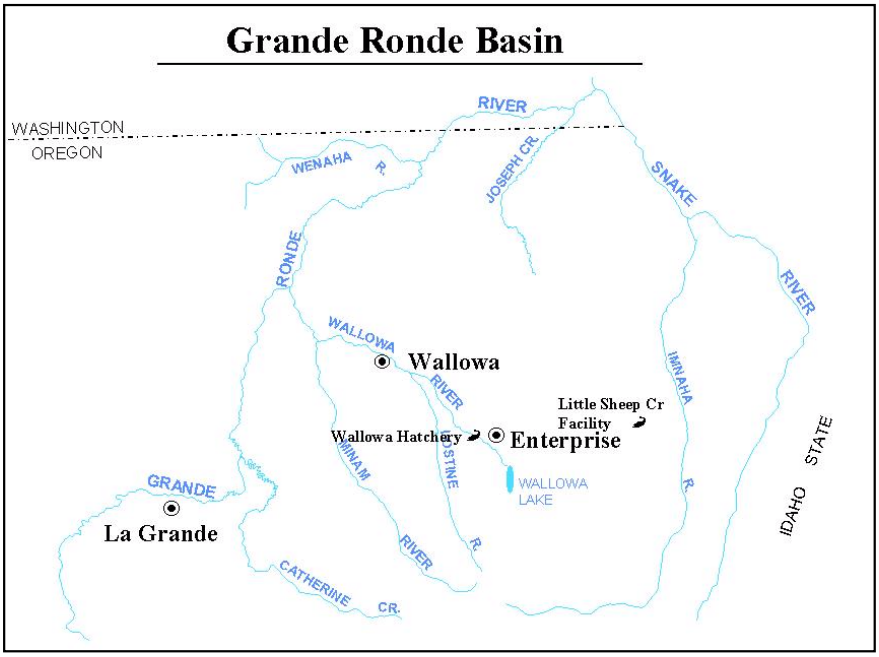

Figure 1. Map of the Grande Ronde and Imnaha basins indicating the location of Wallowa Hatchery and Little Sheep Creek Facility.

1.6) Type of program.

Integrated Harvest: A combination of harvest augmentation - "to increase sport and/or commercial harvest opportunities by releasing artificially propagated salmon smolts" (IMST 2001-1) and supplementation - "to increase the abundance of an existing, but depleted population". IMST has defined supplementation as "the use of artificial propagation in the attempt to maintain or increase natural production while maintaining long-term fitness of the target population, and keeping the ecological and genetic impacts on non-target populations within specified biological limits" (RASP 1992).

1.7) Purpose (Goal) of program.

The goal of this program is to mitigate for fish losses occurring as a result of the construction and operation of the four Lower Snake River Dams. The program goal is to return 2,000 hatchery adults to the area above Ice Harbor Dam. Based upon this adult goal and an estimated 0.61% smolt-to-adult survival rate the target for smolt production was set at 330,000 fish.

Program specific goals include:

- Establishing an annual supply of brood fish that can provide an egg source capable of meeting compensation goals.
- Restore and maintain the natural spawning population.
- Reestablish sport and tribal fisheries.
- Establish a total return of adult fish resulting from LSRCP activities in Oregon that meets the compensation goal.
- Minimize the impacts of the program on resident stocks of game fish.

1.8) Justification for the program.

The Little Sheep Hatchery Program provides adult steelhead for recreational and tribal harvest within the Lower Snake River Compensation Plan mitigation area (Snake River and tributaries above Ice Harbor Dam). The program utilizes an endemic steelhead hatchery stock that was founded on summer steelhead indigenous to Little Sheep Creek. Wild adults from Little Sheep Creek are incorporated within the broodstock annually and hatchery origin adults are allowed to spawn naturally in Little Sheep Creek each year. A portion of returning adults and smolts are also released into Big Sheep Creek to "supplement" natural spawner numbers.

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

Legal Mandates - Provide adult hatchery summer steelhead within the LSRCP mitigation area while minimizing adverse impacts to listed fish.

Performance Standard (1): Imnaha basin steelhead production contributes to fulfilling tribal trust legal mandates and treaty rights

Indicator 1(a): Estimated number of program steelhead harvested in tribal fisheries by run year.

Indicator 1(b): Estimated number of Imnaha basin wild steelhead harvested in tribal fisheries by run year.

Performance Standard (2): Program contributes to annual mitigation requirements

Indicator 2(a): Estimated number of recreational angler days in the Imnaha basin steelhead fishery by run year

Indicator 2(b): Estimated annual harvest in LSRCP mitigation areas and annual escapement to the hatchery facility.

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 wild fish, by fishery

Indicator 3(b): Estimated number of recreational angler days in the Imnaha basin steelhead fishery by run year.

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, at release, 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 steelhead, 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 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

Performance Standard (11): Any distribution of carcasses or other products for nutrient enhancement meets appropriate disease control regulations and interagency agreements.

Indicator 11(a): Number and location of carcasses distributed for nutrient enrichment

Indicator 11(b): Disease examination of all carcasses to be used for nutrient enrichment

Indicator 11(c): Statement of compliance with applicable regulations and guidelines

Performance Standard (12): Effluent from artificial production facilities will not detrimentally affect populations.

Indicator 12(a): Verify that hatchery effluent is in compliance with existing NPDES permit conditions and water quality standards.

Performance Standard (13): 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 (14): Hatchery program is sustainable.

Indicator 14(a): Number of broodstock collected is sufficient to maintain the hatchery brood.

Indicator 14(b): Number of smolts released achieves smolt production goals.

Conservation Objectives - Conserve genetic and life history diversity of steelhead within the Imnaha River.

Performance Standard (15): Broodstock collection does not reduce potential juvenile production in natural rearing areas

Indicator 15(a): Number of wild summer steelhead retained for broodstock collection does not exceed 25% of the annual natural spawner population.

Indicator 15(b): Percentage of wild fish returning to the facility taken for broodstock comprises at least 5% of the brood population.

Performance Standard (16): Weir/trap operations do not result in significant stress, injury or mortality in natural populations

Indicator 16(a): Adult trapping mortality rate for wild fish does not exceed 5%

Indicator 16(b): Adult trap is checked daily when in operation.

Performance Standard (17): Juveniles are released after sufficient acclimation at the Little Sheep Creek facility to maximize homing to target sub-basins.

Indicator 17(a): Smolts are acclimated for 3-4 weeks prior to release.

Indicator 17(b): The proportion of hatchery summer steelhead returning to the hatchery facility is equal to or greater than 95% of reported escapement.

Performance Standard (18): Patterns of genetic variation within and among natural summer steelhead populations do not diverge as a result of artificial production programs.

Indicator 18(a): Compare genetic profiles and divergence of naturally produced juveniles from indicator areas within the Big Sheep Creek subbasin over time

Performance Standard (19): Hatchery produced adults do not exceed an average of 50% of natural spawners in the Big Sheep Creek subbasin.

Comment [TL1]:

Indicator 19(a): Proportion of hatchery and wild fish in key natural steelhead spawning areas

Performance Standard (20): Broodstock selection strategies effectively maintain genetic and life history characteristics in the hatchery population.

Indicator 20(a): Percentage of wild fish in the broodstock comprises at least 5% of the hatchery brood.

Indicator 20(b): Timing of hatchery adult returns to the Little Sheep Creek facility mimics wild steelhead returns.

Indicator 20(c): Genetic profile of wild and hatchery fish in Little Sheep Creek does not significantly diverge.

Indicator 20(d): Size and age composition of returning adults is consistent with wild run over time.

Performance Standard (21): Broodstock collection does not significantly alter spatial and temporal distribution of naturally spawning summer steelhead populations

Indicator 21(a): Number of wild adult fish aggregating or spawning immediately below the adult weir does not exceed historical distributions and spawning activity.

Indicator 21(b): Wild summer steelhead are captured and sorted, and either retained, transported, or released according to annual run timing and run size.

Ecological Impacts

Performance Standard (22): Release numbers do not exceed habitat capacity for spawning, rearing, migration corridor, and estuarine and near-shore rearing.

Indicator 22(a): Smolts are released in April through May and are released into targeted locations to promote smolt emigration.

Indicator 22(b): Proportion of residual hatchery smolts in key natural rearing areas does not exceed 10%.

Indicator 22(c): Outmigration behavior of hatchery smolts matches that of their wild counterparts.

Performance Standard (23): 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 23(a): Water withdrawals compared to applicable passage criteria
Indicator 23(b): Water withdrawal compared to NMFS juvenile screening criteria
Indicator 23(c): Proportion of diversion of total stream flow between hatchery facility intake and out-fall
Indicator 23(d): Length of stream impacted by water withdrawal
Performance Standard (24): Predation by artificially produced fish on natural produced fish does not significantly reduce numbers of natural fish
Indicator 24(a): Size at, and time of juvenile release compared to size and timing of natural fish present

Monitoring and Evaluation:
Performance Standard (25): Monitoring and evaluation occurs on an appropriate schedule and scale to assess progress toward achieving experimental objectives and evaluating the beneficial and adverse affects on natural populations
Indicator 25(a): Monitoring and evaluation framework including detailed timeline
Indicator 25(b): Annual and final reports
Performance Standard (26): Release groups are marked to allow evaluation of effects on local natural populations
Indicator 26(a): Visible mark (Ad-clip) ratio in hatchery release groups

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).
Collection is not expected to exceed 120 males and 120 females. Age composition and fecundity of adults varies from year to year. However, given normal program adult survival, female fecundity and egg to smolt survival 220 adults (50/50 sex ratio) will produce approximately 330,000 smolts. For the year 2001 we targeted collection of 108 males and 106 females and produced 330,000 smolts.

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

Life Stage	Release Location	Annual Release Level
Yearling	Big Sheep Creek	100,000[1]
Yearling	Little Sheep Creek Facility	230,000[1]
Fingerling	Big Sheep Creek	50,000[2]

[1] Program goals, actual smolt numbers may exceed those listed by up to 10%
[2] Represents a place holder for occasional egg-take overrun.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.
The 1989 to 1993 summer steelhead (stock 029) brood reared at Irrigon Hatchery and released into Little Sheep Creek survived at an average rate of 0.49% and were caught primarily in tribal gillnet (Columbia Basin) and other freshwater fisheries (Lewis, 1999). The harvest rate of summer steelhead stock 029 within the Imnaha basin averaged 110 per year for run years 1991 through 1996 (ODFW RFMEP, 1997). Harvest and escapement has met the mitigation goal of

2000 fish above Ice Harbor Dam only occasionally (Table 1) due to lower than expected program smolt to adult survival most years (Table 2).

Table 1. Adult harvest and escapement (run reconstruction) for Little Sheep Creek summer steelhead, 1988-1996.

Run Year	Ocean	Columbia R. Net[1]	Columbia R. Sport	Deschutes[2]	Snake R. Sport[3]	Escapement[4]	Run Year Total
1987-88	0	168	14	7	2	802	993
1988-89	0	306	73	0	147	306	832
1989-90	15	494	181	159	302	1,051	2,202
1990-91	0	269	12	237	218	411	1,147
1991-92	0	908	255	92	481	947	2,683
1992-93	0	1,120	478	102	410	2,017	4,127
1993-94	4	183	101	20	32	144	484
1994-95	2	62	61	19	35	294	473
1995-96	0	89	257	6	172	465	989

[1] Includes Treaty net, ceremonial and subsistence, and test fisheries.
[2] Includes sport and tribal ceremonial and subsistence fisheries.
[3] Includes Snake River and tributaries (Program Compensation Area).
[4] Includes recoveries at hatchery weirs and within and outside the Snake River Basin (includes some strays; most recoveries are within the Program Compensation Area).

1.13) Date program started (years in operation), or is expected to start.
Initial adult collection for the program occurred in 1982. Resulting smolt releases began in 1983.

1.14) Expected duration of program.
The program is ongoing, with no expected end in the foreseeable future.

1.15) Watersheds targeted by program.
Little Sheep (0207212) and Big Sheep (020721) creeks

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.
Given the listed status of Snake River summer steelhead, maintaining a hatchery program is currently the only method of maintaining harvest opportunity in the LSRCP mitigation area.

Table2. Smolt-to-adult survival for Little Sheep Creek hatchery steelhead based on coded-wire tag recoveries, 1986-1994 brood years.

Brood Year	Tag Code	Date Released	Number Released	Experimental Group	Total Adult Recoveries	Estimated Survival
1986	74122	5/5/87	47,836	Production	85	0.18%
1987	74033	4/14/88	27,329	Production	123	0.45%
1987	74034	4/14/88	27,545	Production	167	0.61%
BY87 Totals			54,874		290	0.53%
1988	74656	4/24/89	27,461	Production	80	0.29%
1988	74657	4/24/89	27,235	Production	91	0.33%
BY88 Totals			54,696		171	0.31%
1989	75124	4/17/90	26,363	Production	265	1.01%
1989	75125	4/17/90	26,164	Production	318	1.22%
BY89 Totals			52,527		583	1.11%
1990	75355	4/23/91	23,948	Direct Stream	137	0.57%
1990	75356	4/23/91	19,516	Direct Stream	101	0.52%
1990	75357	4/23/91	24,282	Acclimated	331	1.36%
1990	75358	4/23/91	26,644	Acclimated	338	1.27%
BY90 Totals			94,390		907	0.96%
1991	75859	4/27/92	26,895	Acclimated	5	0.02%
1991	75860	4/27/92	24,828	Direct Stream	0	0.00%
1991	75861	4/27/92	27,195	Direct Stream	3	0.01%
1991	75862	4/27/92	26,752	Acclimated	1	0.00%
BY91 Totals			105,670		9	0.01%
1992	76061	4/28/93	24,357	Acclimated	61	0.25%
1992	76062	4/28/93	24,806	Acclimated	58	0.23%
1992	76063	4/28/93	22,560	Direct Stream	51	0.23%
1992	76101	4/28/93	23,382	Direct Stream	57	0.24%
BY92 Totals			95,105		227	0.24%
1993	70321	4/25/94	24,658	Acclimated	85	0.34%
1993	70322	4/25/94	23,876	Acclimated	34	0.14%
1993	70323	4/25/94	22,900	Direct Stream	35	0.15%
1993	70324	4/25/94	24,187	Direct Stream	23	0.10%
BY93 Totals			95,621		177	0.19%
1994[1]	70919	5/1/95	54,985	Direct Stream	143	0.26%
1994[1]	75820	5/1/95	26,980	Acclimated	119	0.44%
1994[1]	75821	5/1/95	26,630	Acclimated	135	0.51%
BY94 Totals			108,595		397	0.37%

[1] CWT recoveries from brood year 1994 are complete through 3-year old adult returns

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

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

- An abbreviated HGMP was forwarded to NMFS in 2000 without response.
- The program has operated under NMFS program specific Biological Opinions since 1993. The most recent Biological Opinion was released in 1999 and a new one is expected in early 2002.
- Research activities associated with the existing steelhead hatchery program are covered within ODFW 4 - d take allowance.
- Oregon recreational fisheries associated with this program are described in a Regional Fish Management Plan (RFMP) submitted to NMFS in1998.

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

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

- Identify the ESA-listed population(s) that will be directly affected by the program. ESA listed naturally produced summer steelhead returning to Little Sheep Creek are collected and utilized in the hatchery broodstock (see below). Notably, progeny from hatchery and wild fish spawned are listed as well.

- Identify the ESA-listed population(s) that may be incidentally 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, Snake River fall chinook and Columbia Basin bull trout may be affected to a lesser degree (Section 15).

Summer steelhead - Imnaha basin summer steelhead are typical of A-run steelhead from the mid-Columbia and Snake basins. Most adults (60-70 %) return to the basin after one year of ocean rearing. Most of the remainder return as two-salt adults. Occasional three-salt fish are observed among returning spawners. Females generally predominate 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 Imnaha from September through May. Adults utilize accessible spawning habitat throughout the Imnaha basin including Little Sheep Creek above the facility weir.

Spawning begins in March (in lower elevation and spring-fed tributaries) and continues through early June in higher elevation snowmelt systems. Juveniles utilize a wide range of habitats throughout the basin including areas adjacent to smolt release locations. Most (~ 75-80 %) naturally produced smolts migrate after rearing for two years in freshwater tributaries. A much lower percentage (~ 20-25 %) migrates after one or three years. Smolt out-migration from the Imnaha basin extends from late winter until late spring; however, peak smolt movement is associated with increased flow events, generally between mid-April and mid-May.

Due to a lack of biological data and the intent to minimize risks to natural populations resulting from fish propagation activities, a conservative approach to delineating steelhead population structure in the Imnaha Basin was considered. This approach yielded four distinct population structures: 1) Zumwalt – Camp Creek and Imnaha tributaries downstream of Big Sheep Creek from the west; 2) Lower Imnaha – Imnaha River downstream of Big Sheep Creek and tributaries from the east; 3) Big Sheep Creek – Big Sheep Creek and tributaries exclusive of Camp Creek; and 4) Upper Imnaha – Imnaha River and tributaries above Big Sheep Creek. Additionally, the identified population structures are based upon basin size and differences in hydrology, elevation, geology, temperature regime, aspect and spawn timing. For the purposes of this plan populations are grouped into management units as indicated to accommodate inference from existing information regarding potential population unit boundaries. Individuals from all the above listed populations may be intercepted and handled in Columbia River and Snake River basin recreational fisheries. Only individuals from the Big Sheep Creek population have a high likelihood of being intercepted during broodstock collection (at Little Sheep Creek trap).

Comment [TL2]:

Spring chinook – Spring chinook spawn in headwaters of the Imnaha River and Big Sheep Creek sub-basins. Many areas of the basin including mainstem reaches below spawning areas and tributaries that maintain suitable habitat conditions are utilized by rearing juveniles. The Imnaha basin also contains a conservation hatchery program for spring chinook. The combined natural

and hatchery returns to the basin have ranged from several hundred to an expected 6,000 in 2001, with most recent years falling between 400 and 800 adults.

Adult spring chinook enter the Columbia River in March through May. Spring chinook move into summer holding areas from May through July. Age - 4 fish typically dominate returns to the Imnaha basin. Spawning occurs from early August through September and generally peaks in late August. Fry emergence begins in February and extends into May. Fry expand their spatial distribution after emergence in the spring; the extent depending on annual environmental conditions. A substantial portion of the basin population will move into lower river reaches in the fall, and over-winter until smoltification. Generally, juveniles will rear for one year in freshwater, then smolt and begin migration the following spring; smolt migration begin in late January and extends through early July.

Comment [TL3]:

Fall chinook – Fall chinook in the lower reaches of the Imnaha are considered segments of the Snake River population and exhibit similar life histories. Spawning is generally limited to a few redds located in the lower five miles of the river. 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. Smolt emigration occurs within several months following emergence with peak migration past Lower Granite Dam in late June.

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

Summer steelhead - Population viability analysis is not available for all steelhead Management Units within the Imnaha basin. However, analysis of spawning survey data from Camp Creek suggests steelhead populations within the basin are viable and resilient (Chilcote, 2001). Furthermore, the analysis determined that productivity of this population was such that it would remain viable and productive under modestly increased mortality or harvest. We utilized results of analyses completed to infer population status in adjacent management units (Table 3).

General trends of observed steelhead spawner abundance within the basin can be represented as reaching a low in the late 1970s, gradually increasing to a peak in the mid-1980s, and declining to another low in the late 1990s before recovering slightly. Average abundance (spawner density) over the last 6 years in Camp Creek, a tributary of Big Sheep Creek, exceeded the viable threshold level: 1.2 spawners per mile identified by Chilcote (2001)(Table 4).

Table 3. List of the natural steelhead populations, "Viable Salmonid Population" thresholds within the Imnaha basin (Chilcote, 2001).

Management Units	Critical Thresholds (Abundance in spawners/mile)	Viable Thresholds (Abundance in spawners/mile)	Associated hatchery stock(s)
Zumwalt	Abundance: 0.36	Abundance: 1.2 Productivity: replacement rate =1	Little Sheep
Big Sheep[1]	Abundance: 0.36	Abundance: 1.2 Productivity: replacement rate =1	Little Sheep
Lower Imnaha[1]	Abundance: 0.36	Abundance: 1.2 Productivity: replacement rate =1	Little Sheep
Upper Imnaha[1]	Abundance: 0.36	Abundance: 1.2 Productivity: replacement rate =1	Little Sheep

[1] By inference from adjacent Zumwalt management unit

Table 4. Previous 6-year average steelhead spawner density (spawners per mile) for population units in the Imnaha basin examined (Chilcote, 2001)

Population	Sub-population	Observed Abundance	Viable Threshold	Critical Threshold
Zumwalt[1]		4.7	1.2	0.36

[1] Zumwalt population includes Camp Creek and Camp Creek is the only stream in that population unit area surveyed for spawner abundance.

Spring chinook, fall chinook and bull trout

Adequate population viability analysis has not been completed for Imnaha basin spring chinook and bull trout or Snake River fall chinook.

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

Table 5. Recruits per spawner for naturally spawning wild steelhead in Camp Creek. (Chilcote, pers. comm.)

Year	Recruits per spawner	Year	Recruits per spawner	Year	Recruits per spawner
1974	1.77	1981	6.07	1988	0.37
1975	6.68	1982	9.53	1989	0.60
1976	8.24	1983	4.70	1990	0.17
1977	1.76	1984	4.04	1991	0.68
1978	1.53	1985	1.46	1992	1.91
1979	1.44	1986	0.45	1993	0.56
1980	1.33	1987	0.29	1994	0.48

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

Time series adult steelhead abundance data for the Imnaha sub-basin is limited to two sources; an index redds count in Camp Creek (Fig. 2) and the adult counts at the Little Sheep facility (Fig 3). Although accurate counts of adults are obtained at the weir, adult escapement is not representative of the basin due to the impacts of broodstock collection and the level of hatchery fish interaction, unique to the Little Sheep system.

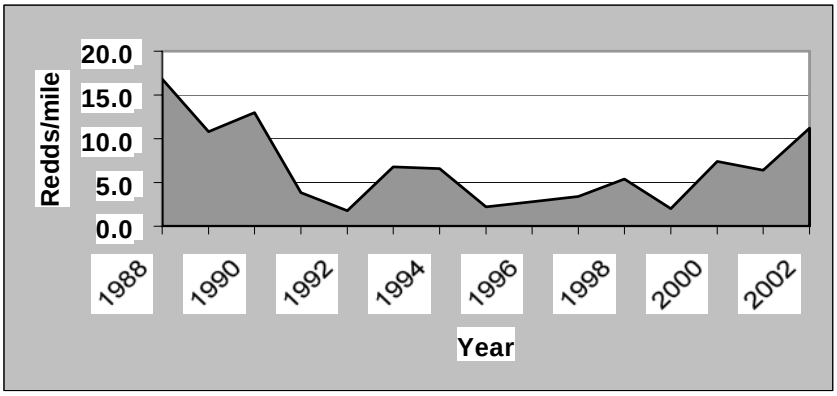

Figure 2. Spawning survey count data for Camp Creek a tributary of Big Sheep Creek, 1988-2002 (Fish District files).

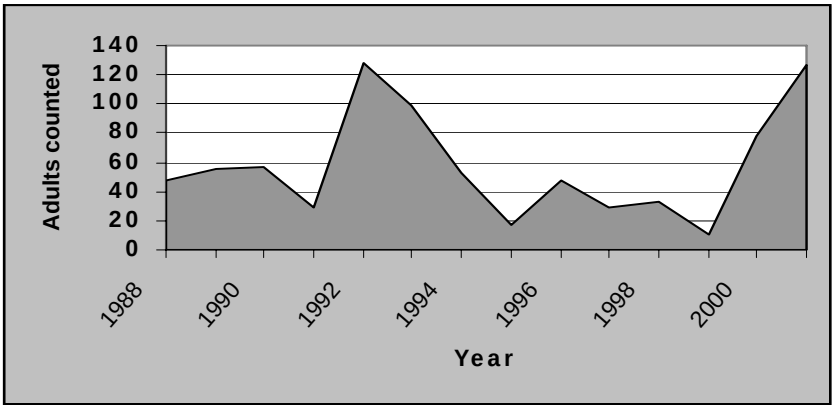

Figure 3. Wild steelhead trapped at the Little Sheep Creek Facility, 1988-2002 (District and Hatchery files).

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.
Few adults are observed during annual spawning surveys. However, during spawning surveys on Camp Creek, all six adults identified as to origin were of wild origin. Additionally, in 2000 and 2001 less than 5% of the fish captured at Lightening Creek (NPT trap)in the Lower Imnaha tributaries were identified as being hatchery reared.. However, a relatively large numbers of hatchery adults have been released into the Big
Sheep drainage in recent years; and it is assumed that a high proportion of natural spawners there is of hatchery origin. .

Refer to Table 9 for details regarding the number and proportion of hatchery and wild fish passed above the weir at Little Sheep Creek.

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 broodstock collection - Annual broodstock collection includes unmarked listed steelhead returning to the Little Sheep Creek weir. Adults collected are incorporated into a matrix spawning protocol to enhance genetic diversity within the hatchery population. . Adults are collected from March through June. Less than 25% of the wild fish returning to the weir are collected and retained for broodstock; all others are passed upstream to spawn naturally. Recent program operation has attempted to incorporate at least 5% wild fish in the broodstock annually and has averaged 8.1% with a range of 1.1% to 16.4% wild fish since 1988 (Table 9).

Spawning, incubation and rearing – Most adult fish are killed during the spawning process. Wild males are live spawned and passed above the weir when their condition suggests they will survive and potentially spawn again. . Eggs and resulting progeny are subject to mortality during incubation and rearing due to disease, injury and other causes. Every effort is made in the hatchery and at acclimation and adult collection facilities to ensure maximum survival of steelhead at all life stages.

Juveniles trapped – Wild juvenile steelhead moving upstream may enter the adult trap during operation. This may result in injury and/or mortality.

Spawning surveys – Foot surveys conducted to determine natural spawning density and proportion of hatchery fish in key natural spawning areas are likely to result in observation of natural listed summer steelhead adults and juveniles. These surveys are conducted annually in various reaches of spawning habitat from March through May. Experienced surveyors walk along the stream, crossing when necessary, 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.

Juvenile surveys/collections – Electrofishing, 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. Electrofishing efforts conform to NMFS electrofishing 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.

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

Table 6. Adult pre-spawning and handling mortality occurring at the Little Sheep Creek facility, 1988-2001.

Adult Mortality				
Year	Hatchery		Wild	
	Males	Females	Males	Females
1988	17	19	0	0
1989	11	2	9	0
1990	14	5	0	0
1991	10	1	0	0
1992	44	6	0	7
1993	7	3	0	0
1994	1	0	1	0
1995	7	0	0	0
1996	2	0	0	0
1997	2	12	0	0
1998	15	1	0	0
1999	2	0	0	0
2000	6	2	0	1
2001	1	0	0	0

Refer to Table 8 and 9 (Section 6.2) for a description of adult collection and egg take since 1990.

- 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 7 includes projected take for the program, including take of hatchery reared fish which as a group include progeny of listed wild fish and are therefore part of the ESU.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.
Take levels may vary depending on the number of returning adults, and survival rates (for all life stages) in the hatchery. We will notify NMFS regarding the situation, if it occurs. Hatchery disease outbreaks or high egg loss may also result in take levels above those indicated in Table 7 (Refer to Appendix A for specific disease prevention protocols).

Table 7. Estimated take levels of listed salmonids by hatchery activities.

Listed species affected: Summer Steelhead		**ESU/Population:** Snake River	
Activity: Little Sheep Creek steelhead hatchery program			
Location of hatchery activity: Imnaha 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)	500,000	500	0	280
Collect for transport b)	500,000	0	500	280
Capture, handle, and release c)	0	500	500	0
Capture, handle, tag/mark/tissue sample, and release d)	50,000	340,000	2,500	0
Removal (e.g. broodstock) e)	0	0	40W/220H	0
Intentional lethal take f)	50,000	200	40W/220H	0
Unintentional lethal take g)	50,000	50,000	20	0
Other Take (specify) h)	0	0	0	0

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
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.

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 NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

The proposed programs outlined in this HGMP is consistent with the NPPC Annual Production Review (Report and Recommendations) and address issues of concern outlined in the NMFS Hatchery Biological Opinion (1999).

3.2) 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.

- *US vs Oregon* - The hatchery program outlined within this HGMP is consistent with the now out-dated Appendix B hatchery smolt production agreements of the *US vs Oregon* negotiations and the intent to provide fish for harvest in tribal and sport fisheries into the future.
- *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.

3.3) Relationship to harvest objectives.

Direct mortality to wild/natural fish shall remain below 15% for group A steelhead runs of 75,000 or less (All Species Review, 1997). All steelhead released into Imnaha subbasin for harvest purposes are adipose clipped, such that they are externally distinguishable from naturally produced fish and those designated for supplementation in the Imnaha Basin. Further, only adipose fin clipped steelhead may be retained in the sport fishery.

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

Little Sheep Creek stock hatchery fish are intercepted in fisheries from the ocean to the Imnaha River (Table 2).

3.4) Relationship to habitat protection and recovery strategies.

Human development and land management impacts consistent with those identified across the Columbia Basin affect steelhead production in the Imnaha basin. Loss of channel diversity, sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawn, water temperature and fragmentation of habitat all affect productivity of natural steelhead 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 Engineer 404 regulations provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or 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 Protection Act (NEPA) review.

These protection programs in conjunction with ongoing private and publicly funded restoration efforts have resulted in an upward trend in steelhead habitat in many Imnaha basin streams. Most watershed restoration/improvement projects are funded through the Grande Ronde Model Watershed Program, Oregon Watershed Enhancement Board, Bonneville Power Administration funded Northwest Power Planning Council's (NPPC) 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, 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 improve habitat for (and productivity of) the basin's wild summer steelhead populations.

3.5) Ecological interactions.

The narrative below is adapted from Biological Assessments completed by ODFW for the Grande Ronde summer steelhead hatchery program and submitted to NMFS in 1993 and 1994. NMFS developed Biological Opinions for guidance in operating the Grande Ronde steelhead hatchery

program based on these documents.

Predation - Predation requires opportunity, physical ability and predilection on the part of the predator. Opportunity only occurs when distribution of predator and prey species overlaps. This overlap must occur not only in broad sense but at a microhabitat level as well. Physical ability and predilection imply, in general, a steelhead at least 250mm in length with an individual prey item less than one third its length (Horner 1978; Hillman and Mullan 1989; Beauchamp 1990; Canamela 1992). Although, Jonasson et. al. (1995) found no significant relationship between residual hatchery steelhead size and salmonid prey size in pen experiments.

The following discussion reviews these factors as they relate to the interaction between actively migrating and residualized hatchery steelhead smolts and emergent fry, fingerling and smolts of listed species. Relative size of proposed hatchery steelhead smolts (225 mm @ 4 fpp) compared to spring chinook smolts (90 mm) and wild steelhead migrants, both yearlings (80-120 mm) and two year old smolts (150 mm +) should preclude any substantial predator/prey interaction among migrating fish based on some studies cited above.

Timing of hatchery steelhead smolt releases and distribution of fry of listed species limit potential interaction. Hatchery steelhead smolts are released in April and early May, approximately mid-way through the spring chinook emergence period. However, hatchery release sites are downstream of documented spring chinook spawning areas and opportunity for these fry to move into steelhead migration corridors is limited. Fry , both spring and fall chinook, distributed downstream and potentially available to steelhead smolts would likely be seeking preferred habitat areas near stream margins. Bjorn and Reiser (1991) reviewed literature on habitat preferences of juvenile salmonids and concluded that newly emerged fry prefer shallow areas of low velocity (<10 cm/s) and larger fish occupy deeper and faster areas. Partitioning of habitat by chinook fry and steelhead smolts minimizes direct interaction between the two species.

Naturally produced steelhead fry generally emerge during June, after a high proportion of released hatchery steelhead smolts has migrated from the system. Yearling natural steelhead in areas accessible by migrating smolts achieve lengths of 80 to120 mm by the time of smolt releases making them less vulnerable to predation due to their size and ability to avoid predators. Bull trout fry tend to maintain themselves in headwater spawning areas and thus avoid interaction with smolts.

A varying percentage of hatchery steelhead releases do not migrate. ODFW considers hatchery steelhead remaining after June 15 to be residuals. These fish, by remaining in the Grande Ronde system have an increased opportunity to interact with juvenile listed fish. Although most residual rates vary from a few percent (Viola and Schuck 1991) to 10% (Partridge 1985, 1986), some estimates have been higher than 25% (Viola and Schuck 1991; Crisp and Bjorn 1978).

Studies of the effect of size at release and acclimation on rates of hatchery steelhead residualism have been conducted in Idaho, Washington, and Oregon. In some cases results are contradictory. Larger smolts may residualize at a higher rate than smaller smolts (Partridge 1985, 1986) although some minimum size is necessary for outmigration (Crisp and Bjorn 1978). In northeast Oregon, ODFW found that residual steelhead remaining two to five months after release were significantly smaller at release than the mean length of the release group as a whole (Jonasson et. al. 1993, 1994 and 1995). Results of residualism studies suggest that direct stream releases residualize at a higher rate than acclimated fish (Schuck 1993; Jonnason et. al. 1995).

Steelhead residuals normally remain near their release point (Whitesel et. al. 1993; Jonasson et. al. 1994 and 1995; Canamela 1992). Partridge (1986) noted that most residual steelhead were within about 8km of the upper Salmon River release site. Schuck (1993) reported steelhead residuals were found about 20km below and 10km above release sites in the Tucannon River, Washington. Steelhead residual densities were highest within 8km of release sites and decreased quickly above and below these sites in the Grande Ronde and Imnaha rivers in Oregon (Whitesel et al. 1993).

The number of residual steelhead appears to decline steadily throughout the summer in most Snake River basin release areas. This may be due to harvest, other mortality, and outmigration. Partridge (1986) noted that where harvest was heavy virtually no steelhead were present for harvest after ten weeks in the upper Salmon River. In the East Fork Salmon River, where harvest pressure was light, he found residuals in the harvest sixteen weeks after the late May release date. Viola and Schuck (1991) noted that residual populations in the Tucannon River of Washington declined at a rate of about 50% per month from June to October (declining from 4.3 to 0.8% of the total released). Whitesel et al. (1993) found residual steelhead up to twelve months after release, however, densities declined precipitously over time. For example, residuals from the 1992 Big Canyon release were present near the release site at densities (#/100 square meters) of approximately 55 in summer, 18 in fall, 7 in winter, and less than one in spring of 1993. Angling regulations for 24 miles of the Imnaha River below Big Sheep Creek focus harvest on hatchery residuals by allowing harvest of only adipose fin clipped trout.

The LSRCP program funded studies in Oregon, Washington, and Idaho to evaluate food habits of steelhead smolts and residuals. Whitesel et al. (1993) sampled 676 steelhead stomachs (65 smolts and 611 residuals) during spring of 1992 through spring of 1993. Stomachs were taken from smolts collected at the screw trap operated by Nez Perce tribe at mile 4 of the Imnaha River. None of the smolt stomachs sampled contained fish. Residual steelhead were sampled by angling and electrofishing in the Imnaha and Grande Ronde basins. No chinook were observed in any of the residual hatchery steelhead stomachs, although 54 (8.0%) contained fish (mainly sculpins) and 8 (1.2%) contained salmonids (rainbow or whitefish). Subsequent sampling in 1993 resulted in examination of 358 residual hatchery steelhead stomachs. Fish or fish parts were found in only three stomachs including one 63mm *O. mykiss* and sculpins (Jonasson et. al. 1994). Residual steelhead do not appear to prey on juvenile chinook in northeast Oregon and have low rates of predation on other salmonid.

Competition - Hatchery steelhead smolts have the potential to compete with chinook, natural steelhead and bull trout juveniles for food, space, and habitat. Canamela (1992) concluded that effects of behavioral and competitive interactions would be difficult to evaluate or quantify. If significant interaction does occur, it is restricted to a short duration as smolts move downstream or to the immediate vicinity of release sites due to the limited dispersal of residual steelhead. The size difference between residual steelhead and chinook fry will probably result in selection of different habitat areas (Bjorn and Reiser 1991) and further reduce the likelihood of interactions between species. Direct competition between hatchery smolts or residuals and natural smolts and rearing juveniles is likely due to the substantial overlap in macro and microhabitat. A study of interaction between resident rainbow and hatchery steelhead residuals concluded that in a situation where the two were held together in pens, the smaller resident rainbow showed decreased growth when compared to controls (McMichael, et. al. 1997). This suggests similar influence on smaller juvenile steelhead. In a natural situation juvenile fish can move to alternate habitats to avoid the negative interaction. Although the ultimate result of this type of interaction in the natural environment is unknown, shifts to what may be less suitable habitat may also result in impacts to growth.

Bull trout associated with areas influenced by residual hatchery steelhead are generally fluvial adults and are more likely to out compete and prey on hatchery steelhead due to a significant size advantage.

Disease - Hatchery operations potentially amplify and concentrate fish pathogens that could affect wild chinook, listed adult and juvenile steelhead and bull trout growth and survival. Because the hatchery produced summer steelhead for the mitigation program are reared at Irrigon Hatchery, outside these watersheds of concern, disease impacts by these stocks on basin wild salmonids are extremely unlikely. Irrigon is supplied with constant temperature well water; as a result disease occurrence and the presence of pathogens and parasites are infrequent. When infestations or infections have occurred, they have been effectively treated due to the almost ideal conditions at Irrigon. Further evidence for the relative disease-free status of these stocks at Irrigon is the very low mortality that occurs during rearing following typical early lifestage losses. Documentation of disease status in these stocks is accomplished through monthly and preliberation fish health examinations. No transfers of steelhead juveniles with known clinical infections or infestations have been made to the Imnaha basin from Irrigon.

When steelhead from Irrigon Hatchery are acclimated at the Little Sheep Creek facility for over 30 days, a preliberation fish health examination is also conducted.

Returning adult summer steelhead held for artificial spawning at the Little Sheep Creek facility potentially create a concentrated source for the pathogens and parasites they carry. The increase in risk posed to natural chinook, steelhead and bull trout by these fish is considered minimal for several reasons. First, it is unlikely that the hatchery steelhead adults that return to the production facilities harbor any agents that naturally spawning steelhead do not also carry. Second, cold water temperatures during the winter and the combination of cool water temperatures and high flows during spring holding season for steelhead adults are, again, not conducive to infectious processes. This reduces the potential for transmission between adults in holding ponds and from those fish to fish in the natural habitat. Documentation of the disease status of the adult steelhead stocks is accomplished through annual fish health examinations of both spawning adults and pre-spawning mortality. Results of these examinations over the past five years indicate a low prevalence and incidence of serious fish pathogens and parasites in these stocks.

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.

Early incubation and rearing for Grande Ronde and Little Sheep Creek steelhead programs occur at Wallowa and Irrigon Hatchery. The facilities were designed for a combined program production of 1.68 million smolts at 5 fish/lb. (1.35 million smolts for the Grande Ronde program). Initial incubation (green to eyed egg) occurs at Wallowa Hatchery on spring water and well water (250 gpm). Some adjustment of water temperature can be achieved through mixing the two water sources. Incubation after eye-up occurs at Irrigon Hatchery and uses 120 gpm of temperature controlled well water. Rearing at Irrigon is accomplished in 68 circular starter tanks and 32 raceways with an approximate well water supply of 46.6 cfs. Combined program smolt production is limited by ground water available for rearing at Irrigon Hatchery. Water for the Little Sheep Creek facility is taken from Little Sheep Creek (Christianson 1994). Water use for those facilities includes 4,000 gpm for acclimation and 2,300 gpm for adult holding, well within the existing water rights. Water quality at acclimation is generally good. Occasionally, freshets result in increased sediment loads and reduced water quality of inflow water at the acclimation facility.

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.

Potential for entrapment of wild juvenile steelhead exists at the acclimation site. Intake screening at this location meets NMFS screening criteria and minimizes risk to wild steelhead encountering the intake. Water withdrawals for acclimation utilize portions of natural flow from Little Sheep Creek. However, adequate instream flow is maintained to provide rearing habitat and juvenile passage within the bypass reach. Stocking densities in the acclimation ponds are adjusted to maintain quality of outflow water. Effluent water quality at Irrigon and Wallowa Hatchery is monitored quarterly under NPDES water quality standards and conditions. Compliance at these two facilities has been good over the past 5 years.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

The Little Sheep Creek adult trap consists of a fish ladder leading from the base of a concrete and steel grate weir to a finger weir and "V" trap at the upper end. Flow from Little Sheep Creek is diverted through the trap and ladder. The weir excludes all migration upstream past the facility except through the ladder and trap.

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

Brood fish are spawned at the Little Sheep Creek facility.

5.3) Broodstock holding and spawning facilities.

Adults are held in a 40'x20'x4'concrete pond (3200 cu. ft.) at target maximum densities of 2.5 ft^3/fish and 2 gpm/fish.

5.4) Incubation facilities.

Incubation facilities for the combined Imnaha and Grande Ronde steelhead program include:

– Wallowa Hatchery (incubation to eyed stage) 228 Vertical stack incubation trays, 4/stack

Eggs are transferred from Wallowa Hatchery to Irrigon Hatchery at the eyed-egg stage via truck.

– Irrigon Hatchery (incubation eyed-egg to ponding) 288 vertical stack trays, 12/stack.

5.5) Rearing facilities.

Rearing facilities for the combined Imnaha and Grande Ronde steelhead program at Irrigon Hatchery include:

– (68) 6’ circular fiberglass tanks for initial rearing
– (32) 20'x100'x4' concrete raceways after initial rearing to smolt size

5.6) Acclimation/release facilities.

– Little Sheep Acclimation pond is a concrete pond 195' long, 50' wide and 3.5' deep (34,125 cu.ft.)

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

In 1998, 1,112,000 surplus eggs were reared at a temporary facility at river km 26 on the Imnaha River with the intent of releasing them as fry into the Imnaha River and Big sheep Creek. Unfortunately, a flood event occurred during spring thaws and resulted in early release of the fry, 287,511 were released into Big Sheep Creek and 39,074 were released into the Imnaha River. This occurrence was not a part of the planned program, and is not expected to happen again.

Comment [TL4]:

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

- Monitor facilities operation during high flow events.
- Maintain screens in working order.
- Keep trap and ladder area free of debris.
- Adjust diversions to maintain flow in passage facilities and bypass reaches.
- Adjust acclimation densities to maintain quality of facility outflow.
- Staff facility 24 hours a day, seven days a week during period of trap operation.

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.
Source

6.1) Source.

Broodstock is indigenous to Little Sheep Creek and has been collected at Little Sheep Creek facility annually since the start of the program (1982) (ODFW Steelhead Plan, 1995). Little Sheep Creek stock is the only acceptable stock for release into the Imnaha River drainage (IHOT, 1995).

6.2) Supporting information.

6.2.1) History.

Adult collection and subsequent egg-take and fry ponded since 1990 are reported in Table 8. There have been no out-of-basin transfers used to supplement egg-take and program needs. All adults needed for broodstock were collected, held and spawned at Little Sheep Creek acclimation facility. Following egg-take and fertilization, viable eggs were transferred to Wallowa Hatchery and incubated through eye-up. Eyed eggs are then transferred to Irrigon Hatchery to rear until pre-smolt, at which time many were returned to Little Sheep Creek Acclimation Pond to rear for another three-to-four weeks before release. An anomaly to the standard program occurred in 1998: 1,122,000 eggs were transferred to a temporary satellite incubation and early rearing facility. This allotment was incubated and reared for 4-6 weeks and was released as fry (139,074 into and 288,311 into Big Sheep Creek).

Table 8. Number of adult summer steelhead collected at the Little Sheep Creek trap, number of fish spawned, number of egg transferred and number of fry ponded at Little Sheep Creek, 1990-1999

Brood Year	Adults Counted	Adults Collected			Egg Take (in 1,000's) *Little Sheep Cr Facility*	Egg Transfers (in1,000's) [In/Out] *Wallowa Hatchery*	Fry Ponded (in 1,000's) [1] *Irrigon Hatchery*	Other Stock Transfers Ponded
		Males Spawned	Females Spawned	Spawning Ratio (M:F)				
1990	981	157	179	0.88	849	849 / 536	425	0
1991	395	133	130	1.02	455	0 / 339	326	0
1992	789	201	189	1.06	749	0 / 506	456	0
1993	1,872	158	134	1.18	647	0 / 483	437	0
1994	194	35	102	0.34	454	454 / 352	347	0
1995	295	102	99	1.03	342	342 / 310	306	0
1996	489	114	159	0.72	728	728 / 559	471	0
1997	968	188	188	1.0	877	877 / 438	123	0
1998	719	203	352	0.58	1,691	1,066 / 890 1,122 / 0 [2]	384 0	0 0
1999	343	91	126	0.72	607	607 / 516	506	0
2000	520	118	120	0.98	569	569/465	459	0
2001	713	131	109	1.20	480	480/390	310	0

[1] Fry are ponded and reared to pre-smolt age at Irrigon Hatchery.

[2] In 1998, 110,000 eyed eggs were transferred from Wallowa Hatchery and 1,122,000 viable eggs were transferred from Little Sheep Creek facility to a satellite incubation and early rearing facility operated by the NPT. Estimated egg number differs between our facility estimate and NPT.

6.2.2) Annual size.

Past hatchery escapement goals were based upon annual smolt production needs. In the recent past, a return of approximately 220 adults was needed to meet the annual green egg-take goal (538,000) which supplied 330,000 smolts to the Imnaha River subbasin (AOP, 2001). Annual number of adults collected, spawned and used for broodstock purposes are reported in Table 9.

Table 9. Number of wild and hatchery adults returning to and spawned at the Little Sheep Creek facility, 1990 to 2001.

			Adults Passed Above the Weir to Spawn Naturally			Adults Spawned		
Return Year	Origin	Adults Counted	Male	Female	Percent Wild	Male	Female	Percent Wild
1988	Wild	47	14	18		6	6	
	Hatchery	808	189	223	7.2%	109	165	4.2%
1989	Wild	56	10	16		4	20	
	Hatchery	306	31	121	14.6%	24	109	15.3%
1990	Wild	57	7	14		13	23	
	Hatchery	924	293	302	3.4%	144	156	10.7%
1991	Wild	29	6	8		4	9	
	Hatchery	366	23	18	25.5%	129	121	4.9%
1992	Wild	128	37[1]	38		25[1]	33	
	Hatchery	661	52	57	40.8%	188	144	14.9%
1993	Wild	99	17	60		4	18	
	Hatchery	1773	60	17	50.0%	154	116	7.5%
1994	Wild	53	21[1]	20		15[1]	8	
	Hatchery	141	19[2]	17	53.2%	20[2]	94	16.8%
1995	Wild	17	3[3]	10		1[3]	4	
	Hatchery	278	28	6	27.7%	101	95	2.5%
1996	Wild	47	22[4]	19		6[4]	6	
	Hatchery	443[5]	36	32	37.6%	108	153	4.4%
1997	Wild	29	9	15		2	2	
	Hatchery	937	32	21	31.2%	186	186	1.1%
1998	Wild	33	7	18		2	6	
	Hatchery	686	44	72	17.7%	198[6]	346	1.3%
1999	Wild	11	2	3		3	3	
	Hatchery	332[7]	42	33	6.3%	88	124	2.8%
2000	Wild	77	36[8]	23		17[8]	14	
	Hatchery	443[9]	114	106	21.1%	114	106	12.4%
2001	Wild	127	37[10]	74		19[10]	16	
	Hatchery	1227	330	344	14.1%	112	93	14.6%

[1] Includes 12 wild males spawned and released
[2] Includes 10 hatchery males live spawned and released above weir
[3] Includes 1 wild male spawned and released
[4] Includes 6 wild males spawned and released
[5] Includes 22 males and 46 females outplanted to local ponds.
[6] Produced 1,598,340 green eggs.
[7] Includes 25 males and 17 females released into Big Sheep Creek
[8] Includes 13 wild males spawned and released.
[9] Includes 55 males and 83 females released to Big Sheep Creek
[10] Includes 8 wild males spawned and released.

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

Refer to Table 9 regarding the past number and proportion of adult wild steelhead incorporated into the hatchery broodstock. In addition to adults released upstream of the weir in Little Sheep Creek adults have been released into Big Sheep Creek since 1999. Those releases include 17 females and 25 males in 1999, 83 females and 55 males in 2000 and 184 females and 170 males in 2001.

6.2.4) Genetic or ecological differences.
There are no identified genetic or ecological differences between the natural spawner population and the hatchery population. Specifically, information regarding this program is not currently available. However, the broodstock was originally founded from the Little Sheep Creek population and wild steelhead comprise a component of the hatchery brood annually (refer to Table 9), to minimize differences between the broodstock and wild fish.

6.2.5) Reasons for choosing.
Little Sheep Creek summer steelhead were chosen as the brood source for the Imnaha River subbasin program because they are indigenous to the Imnaha Basin, and because they were available and accessible.

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.
Broodstock are selected systematically from across the run. Pass/keep ratio varies annually, depending on return projections and is adjusted in-season to insure representation from across the run. Only hatchery fish are released in the Big Sheep Creek watershed to enhance natural spawner numbers.

Comment [TL5]:

SECTION 7. BROODSTOCK COLLECTION

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

7.2) Collection or sampling design.
Little Sheep Creek fish trap opens in early March and runs until no adults have entered the trap for 10 days; typically in late-May. Fish are generally processed every Monday and Thursday and spawned every Tuesday. The existing facility provides a complete barrier to upstream passage at all flows. All fish moving upstream must enter the trap. Proportions of fish released and kept for broodstock vary annually, depending on run projections. Approximately 10% of returning natural fish, by sex, are taken for broodstock. In recent years, an attempt has been made to recover the maximum number of adipose left-ventral (AdLV) finclipped fish in order to evaluate harvest and return rates. It is assumed that AdLV clipped fish return to the trap in numbers representative of hatchery returns as a whole. Pass/keep ratios are based on broodstock needs and projected hatchery and wild returns and are used to determine fish collected for spawning and released on a weekly basis across the run. Female broodstock needs are determined based on; 1) green egg needs as determined by the smolt goal and recent egg to smolt survival, 2) expected fecundity as predicted by past average fecundity by ocean age, 3) the expected proportion of 1-salt and 2-salt females and 4) recent average adult survival. Males are collected at a 1-to1 ratio with females. Broodstock needs and subsequent collection has declined over time as egg to smolt survival has improved. Wild fish are retained for spawning by sex at a rate that provides a minimum of 5% of the broodstock, up to a maximum of 25% of the expected wild return (Table 9). The remainder of the broodstock is made up of hatchery fish. Actual returns are monitored and compared to expected run development over the spawning season. In-season adjustments to collection rates are made as needed to maintain adequate broodstock collection or to release adults surplus to broodstock needs.

Wild adults not selected for broodstock are all released upstream in Little Sheep Creek. Pass ratios are developed based on projections based on the following guidelines. Prior to1999

hatchery adults surplus to egg-take needs were either passed above the weir or killed. Since1999, hatchery adults not needed for broodstock are released upstream in Little Sheep Creek and into Big Sheep Creek in equal numbers up to 500 fish in each stream. Escapement surplus to egg-take needs above the 1000 fish level are transported to Big Sheep Creek.

7.3) Identity.

(a) Methods for identifying target populations (if more than one population may be present).
A portion (50,000 steelhead and 15% of total production)) of the Imnaha stock are tagged with a coded wire tag, and marked with an adipose fin clip (Ad+CWT). CWT tag data allow differing hatchery stocks to be differentiated based upon their tag code; hence, the number of out-of-basin stray adults returning to the Imnaha River drainage and alternate sub-basins can be monitored.

(b) Methods for identifying hatchery origin fish from naturally spawned fish.
All smolts designated for harvest are adipose clipped for identification in the fishery. Supplementation fish (50,000 each in Little Sheep and Big Sheep creeks) receive no mark. Attempts will be made to identify these returning fish as to origin via dorsal fin characteristics.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):
Adult collection rate is adjusted annually based upon recent average adult and green egg to smolt survival rates. Recent broodstock collection includes approximately 220 adults with approximately a 50/50 sex ratio.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:
Refer to Table 8 for the number of summer steelhead collected, number spawned, green egg take, and number of fry ponded since 1990. Additionally review Table 9 regarding the number of adult returns and the number of adults retained for broodstock (by hatchery and wild fish); and the number of steelhead passed above the weir at Little Sheep Creek facility.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
Adult hatchery fish are not culled. Hatchery adults in excess to broodstock needs are passed above the weir or out-planted to Big Sheep Creek.

7.6) Fish transportation and holding methods.
Adults selected for brood stock are held in a concrete pond and sorted for ripeness each week prior to spawning.

7.7) Describe fish health maintenance and sanitation procedures applied.
There are no disease treatments given to adult steelhead. However, steelhead are inspected for fish health throughout their development at Little Sheep Creek facility (adult and smolt life stage) and Irrigon Hatchery (egg to pre-smolt life stage). Refer to Table 10 for a five-year disease history of this program and to Attachment A for a detailed description of the Fish Health Management Plan. Note, fish health inspections are conducted by trained hatchery staff and ODFW fish pathologists.

Table 10. Five year disease history (1996 to present) of Imnaha steelhead spawners at Wallowa Hatchery, progeny reared at Irrigon Hatchery and smolts at acclimation sites [a].

	Life stage and Location of Examination		
Disease or Organism	Adults @ Little Sheep	Progeny @ Irrigon	Smolts @ Little Sheep
IHN Virus	Yes	No	No
EIBS Virus	No	No	No
Aeromonas salmonicida	Yes	No	No
Aeromonas/Pseudomonas	Yes	Yes	Yes
Flavobacterium psychrophilum	Yes	Yes	Yes
Fl. columnare	No	No	No
Renibacterium. salmoninarum	Yes	No	No
Yersinia ruckeri	Yes	No	No
Carnobacterium sp.	Yes	No	No
Ichthyobodo	No	No	No
Gyrodactylus	No	No	No
Ichthyophthirius multifilis	No	No	No
Trichodinids	No	No	No
Salmincola species (gill copepods)	Yes	No	No
Coagulated Yolk Disease	No	No	No
External Fungi.	Yes	No	No
Internal Fungi	No	Yes	No
Myxobolus cerebralis	Yes	No	No[b]
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] Smolts from Irrigon are negative for *M. cerebralis* but may get exposure to the infective stage during acclimation at the Little Sheep Creek facility.

Note, that the Little Sheep Creek steelhead Fish Health Monitoring Plan outlined in Attachment A is further explained in the Lower Snake Program Operation Plan document developed annually by the co-managers in this program. These monitoring plans are consistent with monitoring plans developed by the Integrated Hatchery Operations Team for the Columbia Basin anadromous salmonid hatcheries (see Policies and Procedures for the Columbia Basin anadromous Salmonid Hatcheries, Annual Report 1994. Bonneville Power Administration).

7.8) Disposition of carcasses.

Spawned carcasses are transported to a landfill for disposal. At this time ODFW does not have permission to conduct a nutrient enrichment study in Little Sheep or Big Sheep creeks but may pursue use of carcasses in this manner in the future.

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.

The risk of fish disease amplification will be minimized by following sanitation and fish health maintenance and monitoring guidelines outlined in Attachment A.

SECTION 8. MATING

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

8.1) Selection method.

Spawners are selected systematically, according to previously established pass/keep guidelines, from fish returning to the weir each week across the run. Recovery of adipose left-ventral clipped fish is encouraged when selecting hatchery-origin spawners. Hatchery broodstock are selected at random for spawning as they mature. Wild fish contribution is maximized by attempting to incorporate them into the maximum number of matrices.

8.2) Males.

Target sex ratio for this program has been a 1:1 male-to-female spawning ratio. See Tables 8 for actual spawning ratios from 1990 to present. Males are retained at a higher rate from the early portion of the run to compensate for the lack of males at the end of the run.

8.3) Fertilization.

Matrix spawning is accomplished in 3x3 combinations. Number of groups containing at least one wild fish is maximized. Wild males are live spawned and passed upstream.

8.4) Cryopreserved gametes.

Cryopreserved sperm collected and maintained by the Nez Perce Tribe is available from past brood years. However, there are currently no plans to use the cryopreserved sperm.

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.

Spawners are collected at systematically, by sex from across the run. Wild fish are included in each brood and matrix-spawning strategies maximize contribution of wild fish to spawner groups. Matrix spawning attempts to utilize wild fish in as many groups as possible. Spawning groups are tracked. Those containing only hatchery by hatchery crosses may be culled subsequent to pathology determination. Wild x wild and hatchery x wild crosses are retained unless severe pathology conditions exist.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

While program smolt goal has remained constant since initiation, egg take has varied over time due to low spawners numbers some years (1991,1994 and 1995), elimination of across the run egg culling after 1997 and disagreement between co-managers regarding use of surplus adults (1998) (Table 11). The current program attempts to meet the 330,000 fish smolt goal by using average fecundity and survival to calculate the number of spawners needed. Adults surplus to egg-take needs and any surplus progeny are released into Little Sheep and Big sheep creeks.

Table 11. Egg take and egg loss data for Little Sheep Creek summer steelhead hatchery

operations at Wallowa Hatchery, 1988-2001 brood years (Greg Davis, Wallowa Hatchery, personal communication).

Year	Egg Take	Egg Loss		Percent Survival
	Total	Total	% Loss	to eyed egg Stage
1988	827,255	288,244	34.8%	65.2%
1989	757,752	219,532	29.0%	71.0%
1990	849,432	313,187	36.9%	63.1%
1991	455,292	116,548	25.6%	74.4%
1992	749,330	121,430	16.2%	83.8%
1993	647,272	124,522	19.2%	80.8%
1994	454,140	101,720	22.4%	77.6%
1995	341,925	31,595	9.2%	90.8%
1996	728,244	169,489	23.3%	76.7%
1997	877,049	97,400	11.1%	88.9%
1998	1,066,307	176,100	16.5%	83.5%
1999	606,740	90,550	14.9%	85.1%
2000	568,500	103,770	18.3%	81.7%
2001	479,970	90,340	18.8%	81.2%

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

Fecundity and survival vary from year to year. The program utilizes estimates of fecundity and survival based upon recent mean values, and hatchery spawner numbers are based upon these estimates. Surplus progeny can result when fecundity or survival exceeds what is expected. However, all eggs collected are utilized for program smolt production or for fry releases to Big Sheep Creek. Disagreement between co-managers regarding appropriate management of adults returning to Little Sheep Creek in 1998 resulted in collection of over 1,000,000 surplus eggs. Those eggs were targeted for release as fry in various locations in the Imnaha basin. Since 1998 co-managers have agreed to outplant all surplus adults to Big Sheep and Little Sheep creeks.

Comment [CS6]:

9.1.3) Loading densities applied during incubation.

Table 12. Incubator flow, eggs/tray, egg size and effluent dissolved oxygen for steelhead eggs incubated at Wallowa Hatchery, 1988-2000 (Davis, pers. comm.).

Year	GPM per tray	Eggs per tray	Egg Size (eggs/gram)	Effluent D.O. (PPM)
1988	3.0	11,500-16,000		7.2 - 8.6
1989	3.0	11,500-16,000		7.2 - 8.6
1990	3.0	11,500-16,000	7.94 - 7.20	7.2 - 8.6
1991	3.5	11,500-16,000	8.40 - 6.81	7.2 - 8.6
1992	4.0	11,500-16,000	10.23 - 7 .20	7.2 - 8.6
1993	4.0	11,500-16,000	10.23 - 7.62	7.2 - 8.6
1994	4.0	11,500-16,000	8.32 - 6.46	7.2 - 8.6
1995	4.0	11,500-16,000	10.44 - 7.55	7.2 - 8.6
1996	3.5	11,500-16,000	10.08 - 8.82	7.2 - 8.6
1997	4.0	11,500-16,000	11.63 - 9.4	7.2 - 8.6
1998	4.0	11,500-16,000	11.63 - 9.35	7.2 - 8.6
1999	4.0	11,500-16,000	12.93 - 9.68	7.2 - 8.6
2000	4.0	11,500-16,000	12.99 - 9.26	7.2 - 8.6

9.1.4) Incubation conditions.

Incubation to the eyed-egg stage occurs on spring and well water at Wallowa Hatchery and from eyed-egg stage to hatching on temperature controlled well water at Irrigon Hatchery. Sediment is not a problem at either site (Table 13) (Greg Davis, personal communication).

Table 13. Incubation water parameters at Wallowa and Irrigon hatcheries

Hatchery	Source	D.O. (mg.L)	Temp. (F)	Conditions
Wallowa	Well	8.4	56º Avg.	Clear and silt free
Wallowa	Spring	9.8	42º-53º	Clear and silt free
Irrigon[1]	Well	10.0	42º-55º	Clear and silt free

[1] Well water temperature is mechanically controlled

Wallowa and Irrigon Hatcheries – Water temperature is continuously monitored via recording thermograph or via chillers for water entering incubation trays. Dissolved oxygen has never presented a problem for egg survival (Table 14).

Table 14. Incubation water parameters at Wallowa and Irrigon hatcheries

Hatchery	Source	D.O. (mg/l)	Temp. (F)	Conditions
Wallowa	Well	8.4	56º Avg.	Clear and silt free
Wallowa	Spring	9.8	42º-53º	Clear and silt free
Irrigon[1]	Well	10.0	42º-55º	Clear and silt free

[1] Well water temperature is mechanically controlled

9.1.5) Ponding.

Fry are ready to pond at about 950 TU and 2800 fish per pound at Irrigon Hatchery. Forced ponding occurs in mid to late June.

9.1.6) Fish health maintenance and monitoring.

Disease treatments for Little Sheep Creek steelhead eggs are given at Wallowa and Irrigon Hatcheries. During spawning ovarian fluid is drained, eggs are fertilized and then water hardened in 75 ppm iodophor for 15 minutes. Green eggs are transferred from the Little Sheep Creek facility to Wallowa Hatchery. Formalin treatments are given @ 1:600 for 15 minutes three times per week for the prevention of fungus. Eyed eggs are transferred to Irrigon Hatchery and upon arrival are disinfected in 75-ppm iodophor for 10 minutes. Formalin treatments @ 1:600 are continued three times per week until hatching which is usually no more than two weeks after arrival to Irrigon Hatchery. Refer to Section 7.7 for additional details regarding the Fish Health Management Plan and a 5-year disease history.

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.

Eggs are incubated in pathogen free, silt free water to insure maximum survival.

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 (1988-99), or for years dependable data are available.

Estimates of fingerling produced are unavailable. Fry estimates are based upon egg take estimates less estimated mortality and are relatively inaccurate. Some years the estimate of smolts produced exceeds the estimate of fry. In recent years, fry and fingerling releases have further confused estimates of survival (Table 15).

Table 15. Estimated number of fry produced, survival from fry to smolt and smolts released for the Little Sheep Creek steelhead hatchery program, 1990-1994.

Year	Estimated eggs collected	Estimated survival to fry	Estimated fry produced	Estimated survival fry to smolt	Estimated smolts produced
1990	849,432	50.03%	425,000	77.46%	329,217
1991	455,292	71.60%	326,000	85.54%	278,849
1992	749,330	60.85%	456,000	74.65%	340,386
1993	647,272	67.51%	437,000	80.22%	350,551
1994	454,140	76.41%	347,000	97.57%	338,570

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

– Program goals:

5.67 lbs/gpm
1.20 lbs/ft³

– Actual at end of rearing cycle:

35,000 @ 4.1/lb = 8500 lbs/pond
1500gpm/pond = 5.66 lbs/gpm
7000cuft/pond = 1.21 lbs/ft³

During peak loading liquid oxygen is used to maintain the dissolved oxygen in all ponds at a minimum DO concentration of 6 mg/l.

9.2.3) Fish rearing conditions

Fish are reared in well water (seasonal variations 50° F-62° F). Dissolved oxygen levels are monitored during peak production and maintained at a minimum of 6 mg/l. Raceways are cleaned weekly and mortalities are picked daily.

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.

Table 16. End of month weight for samples of Little Sheep steelhead juveniles, 2001

Month	Fish /Pound
June	3100
July	430
Aug	154
Sept	77
Oct	40
Nov	21
Dec	12.5
Jan	8.3
Feb[1]	5.8
Mar[1]	5.2
Apr	5.0

[1] Larger fish are transferred to acclimation ponds beginning in February

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program*

***performance*), if available**.
Growth rates are fairly constant. In October fish are programmed for size at release and fed no less than 70% AGR.

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*).

- Fish are started on Bio Diet Starter then switched to Silver Cup Salmon from 800 fish/lb. to smolt.
- Feed rate:
  Start - 5.0% body weight/day
  End - 0.9% body weight/day
- The feed is distributed to the raceways with Garon feeders.
- Food conversions are 1.1

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.
Juvenile fish are treated for bacterial infections if necessary with oxytetracycline under an Investigational New Animal Drug Permit (INAD). Refer to Section 7.7 regarding the Fish Health Monitoring Plan and 5 year disease history for this program.

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

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.
Acclimation of both early- and late-release groups allows reduced densities during final rearing but also results in releases of groups late in the wild smolt migration period.

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.

- No groups of fish are culled from the program except for disease considerations or mistaken inclusion of stray fish in the broodstock. Smolts are reared to a size and released at a time similar to size and migration timing of wild fish.
- Smolts are acclimated at Little Sheep Creek and Big Sheep Creek beginning in February and extending through April and volitionally leave from April to May. This not only provides for extended acclimation before release, but also reduces rearing densities at Irrigon Hatchery.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fry or fingerling	50,000[1]	100/30	July/October	Big Sheep Creek
Yearling	330,000	5	April/May	Little Sheep and Big Sheep creeks

[1] Fry/ fingerling numbers represent a placeholder for occasional unplanned surplus egg takes.

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

Stream, river, or watercourse: Little Sheep Creek
Release point: River km 5 (smolts)
Major watershed: Imnaha River
Basin or Region: Snake River

Stream, river, or watercourse: Big Sheep Creek
Release point: River km15 (smolts and fry)
Major watershed: Imnaha River
Basin or Region: Snake River

Stream, river, or watercourse: Big Sheep Creek
Release point: River km 30-52 (fry/fingerling)
Major watershed: Imnaha River
Basin or Region: Snake River

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

Summer steelhead have been released into Little Sheep Creek, a tributary to Big Sheep Creek, and the Imnaha River since 1983. Smolt releases into Little Sheep Creek have comprised a significant portion of each broodyear's production: between 61-91%. From 1990 to 1998, all steelhead released into Little Sheep Creek were of smolt age, and were released in the spring, approximately one year after parent fertilization (Table 17). Beginning in 1998 some juvenile steelhead (of fingerling size) were released in the fall, after being reared in the hatchery environment for 5-6 months.

From 1991 to 1995, summer steelhead were released directly into the mainstem Imnaha River. These releases comprised approximately 15-22% of broodyear production and averaged 6.51 fish/lb. (Table 17).

Beginning in 1998, summer steelhead juveniles were released into Big Sheep Creek during the fall. In 1998, they comprised only 1% (5,015 fish) of total broodyear production. In 1999 this release group increased to 90,000 fish and in 2000, to 100,216 fish. In 2001 no fall releases were made, and none are planned for 2002.

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

Smolts are force released on target date in mid-April for the first acclimation group and in early to mid May for the second acclimation group. Smolts, fry and fingerlings are direct stream released into Big Sheep Creek from tankers at various accessible locations (Table 17). Release locations vary with season and weather.

10.5) Fish transportation procedures, if applicable.

Smolts are transported from Irrigon Hatchery to acclimation facilities via tanker trucks ranging in size from 2,000 to 5,000 gallon capacity. Loading density criteria are described in the Oregon State Liberation Manual.

10.6) Acclimation procedures.

Smolts are transported to acclimation facilities from 3 to 6 weeks prior to intended release date. Smolts are forced from the pond on target release date.

Table 17. Juvenile and smolt releases of Little Sheep Creek hatchery steelhead in the Imnaha

drainage, 1990-2001 (All data extrapolated from ODFW HMIS database).

Brood Year	Facility	Release Date	Location	Number Released	Pounds Released	Number Per Pound
1990	Irrigon H	11/21/90	Snake River - 1	71,698	1,256	57.08
	Irrigon H	04/23/91	Little Sheep Cr.	50,581	7,903	6.40
	Little Sheep Cr.	04/23/91	Little Sheep Cr.	192,401	37,505	5.13
	Irrigon H	05/01-05/03/91	Little Sheep Cr.	86,235	14,373	6.00
1991	Irrigon H	04/27/92	Little Sheep Cr.	52,227	8,586	6.10
	Little Sheep Cr.	04/27/92	Little Sheep Cr.	196,560	35,100	5.60
	Irrigon H	05/01/92	Imnaha R.	86,235	3,484	8.30
1992	Irrigon H	04/28/93	Little Sheep Cr.	48,725	8,479	5.75
	Little Sheep Cr.	04/28/93	Little Sheep Cr.	237,969	43,267	5.50
	Irrigon H	04/29/93	Imnaha R.	53,692	8,849	6.07
1993	Irrigon H	04/25/94	Little Sheep Cr.	47,965	9,405	5.10
	Little Sheep Cr.	04/25/94	Little Sheep Cr.	252,809	54,019	4.68
	Irrigon H	04/26/94	Imnaha R.	49,767	9,390	5.30
1994	Irrigon H	04/28/95	Imnaha R.	50,676	7,369	6.88
	Irrigon H	05/01/95	Little Sheep Cr.	56,954	10,653	5.35
	Little Sheep Cr.	05/01/95	Little Sheep Cr.	230,882	45,271	5.10
1995	Irrigon H	04/29/96	Little Sheep Cr.	53,566	10,608	5.05
	Little Sheep Cr.	04/29/99	Little Sheep Cr.	268,537	49,729	5.40
1996	Little Sheep Cr.	04/15/97	Little Sheep Cr.	208,936	39,422	5.30
	Little Sheep Cr.	05/13/97	Little Sheep Cr.	118,524	23,705	5.00
1997	Little Sheep Cr	04/26/98	Little Sheep Cr.	86,422	18,004	4.8
	Little Sheep Cr	04/26/98	Little Sheep Cr.	30,674	6,260	4.9
1998	Irrigon H	11/04/98	Big Sheep Cr.	5,015	85	59.00
	Little Sheep Cr.	04/13/99	Little Sheep Cr.	215,294	45,135	4.77
	Little Sheep Cr.	05/18/99	Little Sheep Cr.	119,378	22,107	5.40
	Wallowa H	7/98	Big Sheep Cr.	288,311	240	1200
	Wallowa H	7/98	Imnaha River	139,074	116	1200
1999	Irrigon H	09/09/99	Big Sheep Cr.	90,000	720	125.00
	Irrigon H	09/10/99	Little Sheep Cr.	59,976	480	125.00
	Irrigon H	04/18-20/00	Big Sheep Cr.	100,007	19,240	5.2
	Little Sheep Cr.	04/12/00	Little Sheep Cr.	161,582	35,827	4.51
	Little Sheep Cr.	05/10/00	Little Sheep Cr.	66,624	17,260	3.86
2000	Irrigon H	09/06/00	Big Sheep Cr.	93,680	910	103.00
	Little Sheep Cr.	04/11/01	Little Sheep Cr.	159,159	38,259	4.16
	Little Sheep Cr.	05/09/01	Little Sheep Cr.	83,297	18,510	4.50
	Irrigon H	04/17-20/01	Big Sheep Cr.	100,166	19,203	5.22

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

Releases include both harvest and supplementation fish. All harvest group fish receive adipose clips (180,000 Little Sheep Creek and 50,000 Big Sheep Creek releases). Two groups of 25,000 each from the Little Sheep Creek allocation additionally receive coded wire tags for harvest and return rate evaluations. One coded-wire tag group is included in the early-acclimated release and one coded-wire tag group is included in the late acclimated release at Little Sheep Creek Facility. At the request of the NPT, supplementation groups (50,000 Little Sheep Creek and 50,000 Big Sheep Creek releases) do not receive adipose clips. Little Sheep Creek supplementation groups are marked with blank-wire tags. Big Sheep Creek supplementation smolt group are not marked

in any way. All fry and fingerling released receive adipose clip marks.

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

Fish are identified as surplus when projected numbers exceed capacity of the hatchery facilities for rearing to smolt (~340,000). Identified surplus steelhead are released as fry or fingerling and are released into Big Sheep Creek (Section 10.3, 1998-2000 brood years).

10.9) Fish health certification procedures applied pre-release.

See section 7.7 and Attachment A.

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

Steelhead would not be directly released from Irrigon Hatchery; rather, they would be transferred to Little Sheep Creek and/or Big Sheep Creek for release. Additionally, fish held in the acclimation pond at Little Sheep Creek could be forced out if circumstances warrant.

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.

Planned program fish releases occur only in the Big Sheep Creek drainage (includes Little Sheep Creek). Program direction is to avoid collecting eggs surplus to smolt production needs. The majority of fish are released as smolts to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook and steelhead juveniles. Occasionally, shifts in fecundity result in excess egg collection. On these occasions progeny surplus to smolt production needs are released as fry or fingerling. Close tracking of actual fecundity and estimated egg take are employed and number of adults spawned is adjusted during the spawning season in an effort to minimize taking of surplus eggs. Since 1999 brood, (years somewhat consistent with planned operation) smolts made up 98.5%, 60% and 78% of releases in 1998, 1999, and 2000 respectively (Table 17). All 2001 brood fish are to be released as smolts.

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 harvest smolts and determine mark rate
  (*Indicators: 1a, 1b, 2b, 3a, 4a, 4b, 7a, 26a)*
- Analyze marked fish recovery data collected by others from Columbia, Deschutes, Snake river fisheries to determine harvest numbers and rate
  (Indicators: 1a, 1b, 2b, 3a, 25a, 25b, 26a)
- Conduct statistically valid creel studies in the Imnaha 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

(Indicators: 6a, 25a, 25b)

- Determine density of residual smolts and fingerling in key natural production areas
  (Indicators: 22c, 25a, 25b)
- Determine proportion of hatchery adults in key natural spawning areas via observation and/or trapping
  (Indicator: 19a, 25a, 25b)
- Develop genetic profiles for hatchery and natural steelhead populations in the basin and conduct regular monitoring
  (Indicator: 18a, 20c, 25a, 25b)
- Monitor wild fish escapement trend in key natural spawning areas via observation and /or trapping
  (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 and criteria, i.e., screening and fish passage criteria.
  (Indicators: 12a, 23a, 23b, 23c, 23d)
- Monitor health of adult and juvenile steelhead associated with hatchery production.
  (Indicators: 8a, 8b, 9a, 9b, 9c, 11b)

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, funding to monitor potential hatchery/wild interaction, including ratios of hatchery and wild fish in natural spawning areas and genetic monitoring will require commitment of additional resources.

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 will be followed in all electrofishing activities.
- Experienced surveyors will be utilized to conduct spawning surveys. Surveyors will walk along the stream, crossing when necessary, avoiding and counting redds and observing fish.
- Experienced fish culturists and fish pathologists will perform activities associated with fish production within the hatcheries.

SECTION 12. RESEARCH

12.1) Objective or purpose.
The ongoing LSRCP program research is designed to:

- Document hatchery rearing and release activities and subsequent adult returns.
- Determine success of the program in meeting mitigation goals and index annual smolt survival and adult returns to Lower Granite Dam.
- Provide management recommendations aimed at improving program effectiveness and efficiency.
- Provide management recommendations aimed at reducing program impacts on listed fish.

12.2) Cooperating and funding agencies.

Lower Snake River Compensation Program
Nez Perce Tribe
Confederated Tribes of the Umatilla Indian Reservation

12.3) Principle investigator or project supervisor and staff.
Richard W. Carmichael
Jim Ruzycki
Michael W. Flesher
Debra Eddy

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

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.
1. Monitoring hatchery/wild ratios in natural spawning streams - Adult steelhead will be captured and enumerated at the existing Little Sheep Creek facility. See section 2.2.3.
2. Sampling to determine impacts of residual hatchery steelhead – Electrofishing, will be used to determine relative abundance of wild *O. mykiss* and hatchery steelhead residuals and fingerling in Big Sheep and Little Sheep creeks. Wild juveniles will be anesthetized measured for length and released after recovery. All sampling will occur when water temperatures do not pose additional risk to fish sampled.
3. Genetic monitoring – Wild juvenile *O. mykiss* will be sampled from various natural production areas in the course of genetic monitoring. Samples will be collected using electrofishing gear. Juvenile *O. mykiss* sampled will be captured and anesthetized with MS222 and measured for length. Non-lethal tissue samples will be removed for genetic analysis and the fish will be allowed to recover before they are released back into the stream segment from which they were collected.
4. Spawning surveys – In addition to adult trapping, density and hatchery/wild ratio of spawners in selected natural spawning areas will be monitored via observation. See section 2.2.3.

12.6) Dates or time period in which research activity occurs.
1. March 15 – June 15
2. April 1– September 30
3. July 1 – September 30
4. March 15 – June 15

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.
Handling of listed fish will generally be restricted to enumeration, measurement and release at the site of capture. Fish will be held in containers with well-aerated water of suitable at temperatures less than 64° F. If handling involves more than determining species and enumeration i.e., measurement, marking or tissue sampling, fish will be anesthetized with MS-222 before the procedure and allowed to recover before release. Transport will be by hand in water-filled containers with a holding period of up to two hours.

Comment [CS7]:

12.8) Expected type and effects of take and potential for injury or mortality.
Monitoring and evaluation will involve take of all types (Table 7). Injury due to capture, marking and tissue sampling is inevitable. Hooking wounds, electrofishing 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 account for the lethal take estimates that may occur during monitoring and evaluation activities (Table 7).

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 7).
See Table 7

12.10) Alternative methods to achieve project objectives.

- The use of cast nets or other devices to monitor hatchery/wild ratios in spawning areas has been considered. However, this type of sampling represents greater risk to sampled fish, produces increased sample bias and smaller expected sample size than trapping.

- The nature of our genetic sampling strategy, to develop a profile and monitor genetic characteristics of *O. mykiss* in a variety of streams across the basin, precludes use of steelhead smolts collected at traps used to monitor smolt movement. Alternate techniques such as smolt trapping are too labor intensive to consider feasible.

- Observation via snorkeling will be used in place of electrofishing for enumerating residual steelhead in streams suitable for effective use of that technique and where collection of residual hatchery smolts is not required.

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

Due to our inability to differentiate between listed anadromous and non-listed resident forms of *O. mykiss*, take estimates include both (Table 7). Occasionally, we expect to encounter spring chinook juveniles and bull trout during sampling. However, the number of encounters and as a result the level of mortality, is expected to be less than ten juvenile fish per species.

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 collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.
- Every effort will be made to insure that adult trapping facilities do not delay movement of or cause injury to listed fish, including daily trap checks.

SECTION 13. ATTACHMENTS AND CITATIONS

Attachment A

Little Sheep steelhead fish health monitoring plan

- A qualified fish health specialist will conduct all fish health monitoring.
- Annually examine a minimum of 60 brood stock for the presence of reportable viral pathogens. This sample size is great enough to assure a 95% chance of detection of a pathogen present in the population at the 5% level. American Fisheries Society "Fish Health Blue Book" procedures will be followed.
- Conduct examinations of juvenile fish at least monthly and more often as necessary. A representative sample of healthy and moribund fish from each lot of fish will be examined. The number of fish examined will be at the discretion of the fish health specialist.
- Annually examine up to 20 adult mortalities (if available) for systemic bacteria.
- Investigate abnormal levels of fish loss when they occur.
- Determine fish health status prior to release or transfer to another facility. The exam may occur during the regular monthly monitoring visit, i.e. within 1 month of release.
- Appropriate actions including drug or chemical treatments will be recommended as necessary. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile will be generated when possible.
- Findings and results of fish health monitoring will be recorded on a standard fish health reporting form and maintained in a fish health database.
- Fish culture practices will be modified if deemed necessary after review with facility personnel. Pertinent discussion items are as follows: nutrition, water flow and chemistry, loading and density indices, handling, disinfection procedures, and disease treatments.
- If carcasses from this stock were used for nutrient enrichment there would be enhanced fish health monitoring requirements. Carcasses would need to be labeled and frozen for identification until laboratory results are complete and only carcasses cleared for out-planting could be used. All fish should be sampled for *Myxobolus cerebralis* (whirling disease). No fish determined to be positive for *M. cerebralis* spores would be used for this purpose. Other monitoring plans would be consistent with guidelines for the use of adult salmon and steelhead carcasses for nutrient enrichment (ODFW memorandum November 7, 2000). For example, if IHNV is found during a given spawning season and the prevalence exceeds 30% then carcasses could no longer be used for this purpose for that spawning season.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

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.

Activities associated with the operation of this steelhead hatchery program as they affect bull trout are authorized under the Operation of the Lower Snake River Compensation Plan Program Biological Opinion (file # 1024.0000, 1-4-99-F-2) issued by the U. S. Fish and Wildlife Service's Snake River Basin Office, Boise, Idaho, April 8, 1999.

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 Imnaha River and a number of tributaries. Bull trout utilize suitable habitat within the Imnaha River basin including; mainstem Imnaha River, it's North and South forks and the lower reaches of several smaller tributaries to the upper Imnaha system, Big Sheep Creek and tributary Lick Creek and Little Sheep Creek and several of it's small tributaries. 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 above approximately river kilometer 67 on the Imnaha and river kilometer 40 on Big Sheep and Little Sheep creeks.

The bull trout population in the Imnaha River appears reasonably robust based on recent spawning inventory. Spawning counts on the Imnaha River accounted for nearly 400 redds in 2001. Habitat conditions vary widely across the basin and affect bull trout productivity in some areas. As a result, the basins bull trout population(s) vary from areas of relative strength in wilderness streams (mainstem Imnaha River and upper Big Sheep Creek) to areas where bull trout are less productive (Little Sheep Creek and middle reaches of Big Sheep Creek). Two-pass electrofishing density estimates in Big Sheep, Lick, Salt and Little Sheep creeks were conducted in 1992. That work suggested moderate to high densities of rearing bull trout in streams except Little Sheep Creek. No bull trout were collected from sample reaches of Little Sheep Creek. Densities ranged from 5.6 to 15.8 (1+ and older) fish per $100m^2$ within sample sections containing bull trout in the other Imnaha tributaries, in addition to varying densities of 0-age bull trout (Smith and Knox, 1992).

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 steelhead trap at the Little Sheep Creek facility. The trap is operated in the late winter and spring. Number of fish trapped annually ranges from 0 to 10. Fish are held a maximum of four days, handled and passed upstream.

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

Fish health – The Little Sheep Creek facility is located downstream of all juvenile/resident rearing areas. However hatchery program juveniles are likely to encounter holding fluvial bull trout on their seaward migration in the Imnaha system. Adult hatchery steelhead are released into both Big Sheep Creek and Little Sheep Creek and are likely to move upstream into the lower reaches of bull trout juvenile/resident rearing areas. Also see section 3.5 and 7.7 and Attachment A.

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 – A small percentage of residual steelhead smolts have been found to migrate upstream in Big Sheep and Little Sheep creeks over 35 km in to reside at low densities in the lower reaches of bull trout rearing distribution (Whitesel, et. al., 1993). Some limited predation of and competition with smaller bull trout may occur in this overlap zone.

Monitoring and evaluations - see section 12.11.

Habitat - The Little Sheep Creek facility does not affect juvenile/resident bull trout rearing habitat. Migratory behavior of fluvial bull trout is, however, disrupted briefly as they encounter the adult steelhead trap during its operation.

15.4 Actions taken to mitigate for potential effects.

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

15.5 References

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