HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Entiat National Fish Hatchery (ENFH) Leavenworth Hatchery Complex
Species or Hatchery Stock:	Summer Chinook Salmon (*Oncorhynchus tshawytscha*)
Agency/Operator:	U. S. Fish and Wildlife Service (USFWS)
Watershed and Region:	Entiat River, tributary to the Columbia River Washington State
Date Submitted:	7/31/2009
Date Last Updated:	

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.
Entiat National Fish Hatchery (ENFH)

1.2) Species and population (or stock) under propagation, and ESA status.
Summer Chinook salmon *(Oncorhynchus tshawytscha)*, unlisted.

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:
The US Bureau of Reclamation (BOR) acts as the primary funding entity. Other involved parties include those associated with the Columbia River Fish Management Plan and the *US v. Oregon* court decision as well as other co-managers not party to *US v Oregon* such as the Confederated Tribes of the Colville Reservation (CCT).

1.4) Funding source, staffing level, and annual hatchery program operational costs.
Entiat NFH summer Chinook salmon (SUS) program is funded by the BOR at about $200,000 annually, and is staffed by 3 FTE's. Fish marking, evaluation, and fish health programs are not included in the above operational costs. Other USFWS offices funded by the BOR conduct these programs.

1.5) Location(s) of hatchery and associated facilities.
Entiat NFH is part of the Leavenworth Complex, which also includes the Leavenworth and Winthrop NFH's. Entiat NFH is located west of Entiat, WA on the Entiat River, WRIA 46, 6.7 river miles (rm) above its confluence with the Columbia River. Fish returning to Entiat NFH must travel about 491 rm and negotiate passage through eight Columbia River hydroelectric dams.

1.6) Type of program.
Isolated Harvest.

1.7) Purpose (Goal) of program.
Mitigation: The goal of the program is to compensate for lost fish production due to the construction of Grand Coulee Dam by producing summer Chinook salmon for commercial, sport and tribal harvest in a manner which minimizes adverse impacts to the environment.

1.8) Justification for the program.
Due to the construction of Grand Coulee Dam, approximately 1,140 miles of former spawning and rearing habitat was blocked. This loss of habitat equates to an estimated loss of thousands of returning adults annually. The Leavenworth NFH Complex (which includes Entiat NFH) was constructed to mitigate for these losses.

The program is intended to function as a segregated program for harvest benefits. Fish from this program are not intended to spawn naturally and are not intended to establish, supplement, or support any summer Chinook salmon populations occurring in the natural environment.

Harvest benefits derived from this new program could be substantial. Using survival and harvest data from the Wells Dam and Okanogan/Similkameen summer Chinook programs, the FWS estimates that 1,619 adults could be harvested annually originating from this new program. This estimate does not include a potential Entiat River fishery, which is a high priority for the Service. Also see Section 3.3.

Recently, NOAA in their 2008 BiOp (NOAA 2008) proposed a list of appropriate management practices that isolate or avoid interactions between hatchery origin fish (HOF) and natural origin fish (NOF) that should be implemented for programs that produce fish exclusively for harvest purposes. Such practices include: 1) "release fish at a size and condition factor that reduces residualism", 2) "releasing fish away from populations that are important to salmon and steelhead recovery", 3) "acclimate hatchery smolts to improve homing fidelity so that adult returns can be harvested and collected at hatchery facilities and so hatchery fish do not spawn naturally and produce offspring that compete with natural salmon and steelhead", 4) "release fish at a size and condition factor that leads to their prompt emigration to the ocean", and 5) "mark fish externally so they can be distinguished for harvest purposes and collected for hatchery broodstock." In addition, the Hatchery Scientific Review Group (HSRG) recently published a management guideline for segregated hatchery programs stating "maintain proportion of Hatchery Origin Spawners (pHOS) <5%. When pHOS>5%, either (a) reduce the size of the hatchery program and/or (b) implement new measures to recapture hatchery-origin fish to reduce pHOS to <5%." The FWS proposes to implement these recommendations whenever possible, and make programmatic adjustments if data indicates the need.

The FWS currently conducts Chinook salmon redd surveys in the Entiat River Basin. The collection of post-spawn adults (carcasses) and determining their identity/origin is a key component of the surveys. Although 36% of the spawning population of SUS is made up of out-

of-basin strays (2004 to 2008), the FWS will make every attempt to minimize the pHOS of ENFH origin. This data, obtained through carcass recoveries, will determine potential future actions to control or reduce the number of ENFH adults passing the facility to areas where natural spawning occurs (i.e., construction of a weir, etc). The adult collection ladder will operate throughout the SUS run, and all hatchery-origin adults will be retained. Those in excess of brood needs will be provided to local Native American Tribes for subsistence and ceremonial purposes or other pre-approved sources.

1.9, 1.10) List of program "Performance Standards"
Performance Indicators are designated as "Risk assessment" (**R**) or "Benefits" (**B**).

Legal Mandates:

1. Mitigation for Grand Coulee Dam.
2. Provides fish for terminal, lower river and ocean fisheries.
3. Protects trust resources and reserved rights of tribes.
4. Addresses ESA responsibilities.

Performance Standard (1): Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in applicable agreements such as under *U.S. v. Oregon.*

Indicator (a): **(B)** Total number of fish harvested in tribal fisheries targeting this program.

Indicator (b): **(B)** Total fisher days or proportion of harvestable return taken in tribal resident fisheries, by fishery.

Performance Standard (2): Program contributes to mitigation requirements as stated in the Columbia River Fish Management Plan and the *U.S. v. Oregon* decision.

Indicator (a): **(B)** Number of fish released by program, returning, or harvested, as applicable to given mitigation requirements.

Performance Standard (3): Program addresses Endangered Species Act (ESA) responsibilities.

Indicator (a): **(R)** Consultations under Section 7 of the ESA are completed in a timely fashion. The resultant Biological Opinions and associated Incidental Take Statements are strictly adhered to.

Harvest:
Performance Standard (4): Fish produced for harvest are produced and released in a manner enabling effective harvest, while avoiding over-harvest of non-target species.

Indicator (a): **(R)** Annual number of fish produced by this program caught in all fisheries, including estimates of fish released and associated mortalities, by fishery.

Indicator (b): **(R)** Annual numbers of each listed, non-target species caught (including fish released) in fisheries targeting this population.

Indicator (c): **(B)** Recreational angler days, by fishery.

Indicator (d): **(B)** Catch per unit effort, by fishery.

Performance Standard (5): Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.

Indicator (a): **(R)** Marking rate by mark type for each release group.

Indicator (b): **(R)** Sampling rate by mark type for each fishery.

Indicator (c): **(B)** Estimated total contribution of this program to fisheries, by fishery as estimated by the recapture of marked individuals.

Conservation of Wild/Naturally Spawning Populations:
Performance Standard (6): Releases are sufficiently marked to allow statistically significant evaluation of program effects on the local natural population.

Indicator (a): **(R)** Marking rates and type of mark.

Indicator (b): **(R)** Number of marks and estimated total proportion of this population in juvenile dispersal and in adults on natural spawning grounds.

Life History Characteristics:
Performance Standard (7): Annual release group does not compete with or interfere with naturally produced population

Indicator (a): **(R)** Location of releases relative to natural rearing areas.

Indicator (b): **(R)** Timing of hatchery releases, compared to natural populations.

Indicator (c): **(R)** Migration behavior of releases from this program.

Genetic Characteristics:
Performance Standard (8): Juveniles are released on-station to maximize homing ability to intended return location.

Indicator (a): **(R)** Location of juvenile releases.

Indicator (b): **(R)** Release type, whether forced, volitional, or direct stream releases.

Indicator (c): **(R)** Proportion of adult returns to program's intended return location, compared to returns to unintended upstream dams, fisheries, and artificial or natural production areas.

Performance Standard (9): Juveniles are released at fully smolted stage.

Indicator (a): **(R)** Level of smoltification at release, compared to a regional smoltification index (when developed). Release type, whether forced, volitional, or direct stream release.

Research Activities:

Performance Standard (10): The artificial propagation program uses standard scientific procedures to evaluate various aspects of artificial propagation.

Indicator (a): **(R)** Scientifically based experimental design, with measurable objectives and hypotheses.

Performance Standard (11): The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objective and evaluate beneficial and adverse effects on natural populations.

Indicator (a): **(R)** Monitoring and evaluation framework including detailed time line.

Indicator (b): **(R)** Annual and final reports.

Operation of Artificial Production Facilities:

Performance Standard (12): The artificial production facility is operated in compliance with all applicable fish health guidelines and facility operation standards and protocols.

Indicator (a): **(R)** Annual reports indicating level of compliance with applicable standards and criteria.

Indicator (b): **(R)** Periodic audits indicating level of compliance with applicable standards and criteria.

Performance Standard (13): Effluent from the artificial production facility will not detrimentally affect natural populations.

Indicator (a): **(R)** Discharge water quality compared to applicable water quality standards and guidelines, including those relating to temperature, nutrient loading, chemicals, etc.

Performance Standard (14): Water withdrawals and in-stream water diversion structures for facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.

Indicator (a): **(R)** Water withdrawals compared to applicable passage criteria.

Indicator (b): **(R)** Water withdrawal facilities comply with National Marine Fisheries Service (NMFS), USFWS, and Washington Department of Fish and Wildlife (WDFW)

juvenile screening criteria.

Indicator (c): **(R)** Proportion of diversion of total stream flow between intake and outfall.

Performance Standard (15): Releases do not introduce pathogens not already existing in the natural populations, and do not significantly increase the levels of existing pathogens.

Indicator (a): **(R)** Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence.

Indicator (b): **(R)** Juvenile densities during artificial rearing/meet standard.

Performance Standard (16): Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

Indicator (a): **(R)** Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present.

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish). Approximately 150 pairs of adult SUS are needed for an annual release of 400,000 smolts.

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

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Entiat River	350 - 400K

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

Since this is an entirely new program with a different species, this data is not yet available.

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

The program is expected to begin in fall 2009 with the first shipment of eggs from Wells Fish Hatchery.

1.14) Expected duration of program.
Ongoing

1.15) Watersheds targeted by program.
Entiat River, WRIA 46

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.
The ENFH mitigation program was recently reviewed by the Columbia River Basin Hatchery Review Team (HRT). With co-manager input, program alternatives were proposed and discussed and the preferred alternative was implemented (stop production of the unlisted spring Chinook stock, begin production of different species (SUS). Please refer to the full report (USFWS 2007) at http://www.fws.gov/pacific/fisheries/hatcheryreview/reports.html for complete details. This program was also recently reviewed by the HSRG. The recommendations from the HSRG were very similar to those of the HRT. The HSRG had one main recommendation; cease production of the out-of-basin, unlisted stock of spring Chinook salmon (completed).

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

2.1) List all ESA permits or authorizations in hand for the hatchery program.
ESA consultation with USFWS (Sec 10): MCFRO-11, August, 2008. Expires on 12/31/2010
Since this an entirely new program utilizing a different species, this HGMP serves as the ESA permit application.

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

2.2.1) Description of NMFS ESA-listed salmonid population(s) affected by the program.
The NMFS ESA-listed salmonid species most likely affected by the Entiat NFH program are Upper Columbia River spring Chinook and steelhead (*O. mykiss*). An extensive volume of literature exists to describe these species and specific ESA-listed stocks of concern. This literature has been extensively summarized by Mullan et al. (1992), Chapman et al. (1995), Myers et al. (1998), Good et al (2005) and Peven (2007). Electronic versions of these summaries are available upon request.

Spring Chinook

Adult spring Chinook destined for the upper-Columbia Basin enter the Columbia River beginning in March and reach peak abundance (in lower river) in April and early May (Chapman et al. 1995). Spring Chinook enter the main stem portions of tributaries from late-April to July. Spawning occurs from late-July through September, usually peaking in mid to late August (Chapman et al.

1995). From 1991 to 2000, the average date for peak spawning in the upper Wenatchee River and tributaries ranged from August 25th to September 4th (Mosey and Murphy 2002).

Data from post-spawn adults collected and sampled in mid-Columbia tributaries, 1986 to 1993, shows that on average, 5% of males return at age 3, 58% at age 4, and 37% at age 5. Female averages are 58% at age 4, and 42% return at age 5 (Chapman et al. 1995). On the spawning grounds, Chapman et al. (1995) indicated that females may dominate the males in numbers, but state that the ratio may be closer to 1:1. This is because there is a greater likelihood of recovering females on the spawning grounds than males (Chapman et al. 1994).

From 1994 to 2001, the average length (hypural length) of wild males (including jacks) collected from Wenatchee Basin natural spawning areas is 64 cm (range of averages = 52 to 71 cm). For females, the average is 66.5 cm (range of averages = 63 to 71 cm) (Mosey and Murphy 2002).

Wild juvenile spring Chinook salmon originating in the upper-Columbia Basin emigrate towards the ocean during their second year. Average size at emigration (April and May) ranges from about 91.8 mm to 100.5 mm (averages from three emigration studies) (Chapman et al. 1995). Trapping results on the Wenatchee River showed that wild yearling spring Chinook averaged 97.3 mm in length with peak catch occurring on April 10th reaching 50% of their passage date by April 12th and 90% passage by May 17th of 2004 (Volkhardt et al. 2005).

From 1985 to 1993, the average 10th, 50th, and 90th percentile passage at Rock Island Dam was April 21st, May 10th, and June 3rd respectively (Chapman et al, 1995). Although these percentages are strongly influenced by releases from Leavenworth NFH, Chapman et al. (1995) believe that the naturally produced migrants have a run timing similar to the hatchery component.

Data obtained from carcass recoveries, years 2000 to 2008 in the Entiat River Basin, shows an average sex ratio of returning spring Chinook adults of 64% female and 36% male. Age structure of NOR during this same period was: female, 0% age 3, 74% age 4, and 26% age 5. For returning males, 12% returned at age 3, 57% at age 4, and 31% age 5 (Hamstreet and Carie, 2001 to 2004 and Hamstreet C. O. 2005 to 2009). The peak of spawning generally occurs around the first week of September.

Steelhead

Steelhead destined for the upper-Columbia region enter the Columbia River between May and September (WDF et al. 1990). They pass Rock Island Dam from July through the following May. All steelhead spawn in the spring regardless of when they enter the Columbia River. Spawning ground surveys have been on-going since 2001 (Hillman et al. 2008). Fish generally spawn from late March through early June.

Females make up about 65% of adults sampled at Wells Dam; of smolts sampled at Rock Island Dam in 1988, 63% were female (Chapman et al. 1994).

Howell et al. (1985) reported age estimates from creel surveys in the Wenatchee River from the late 1970s to the early 1980s. Scale samples from these surveys were used for age determination. In the Wenatchee River, they report naturally produced steelhead of five different age classes (2.1,

2.2, 2.3, 3.1, and 3.2), with the largest percentage in the 2.1 class. The "European Method" was used for age determination where the first digit represents the number of winters spent in freshwater and the second digit indicates the number of winters in saltwater.

Migrating steelhead smolts captured at Rock Island Dam average 163 to 188 mm. Similarly, smolts trapped on the lower Wenatchee River averaged 169.5 mm in length for the age-2 migrants which dominated 66.3% of the catch. These smolts emigrated primarily in late-April through May with peak catch occurring on April 27th and 50% passage by May 7th of 2004 (Volkhardt et al. 2005). Adults returning after one year average 59 to 64 cm, whereas those spending two years at sea average 67 to 76 cm when returning to freshwater. Between 1986 and 1993, wild adults of both sexes combined, averaged 66.5 cm (Chapman et al. 1994).

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program. None

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program. Entiat River spring Chinook and summer steelhead.

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

Spring Chinook

The Entiat spring Chinook population is part of the Upper Columbia ESU. This ESU contains only one extant MPG (Major Population Group) including 3 current populations; Wenatchee, Entiat, and Methow Rivers (ICTRT 2004). The ICTRT classified the Entiat River spring Chinook population as "basic" in size based on historical habitat potential (ICTRT 2005). This classification requires a minimum abundance threshold of 500 wild spawners with different intrinsic productivity (greater than 1.0 r/s) to exceed a 5% extinction risk on the viability curve (ICTRT 2005). Additionally, the Entiat spring Chinook population was classified as a "type A" population (based on historic intrinsic potential) because of its simple, linear tributary structure (ICTRT 2005).

Summer Steelhead

The Entiat summer steelhead population is part of the Upper Columbia ESU that only has one extant MPG that includes 4 current populations: Wenatchee, Entiat, Methow Rivers, and Okanogan, plus Crab Creek (ICTRT 2004). The ICTRT classified the Entiat River summer steelhead population as "basic" in size on historic habitat potential (ICTRT 2005). This classification requires a minimum abundance threshold of 500 wild spawners with sufficient intrinsic productivity (>1.0 r/s) to exceed a 5% extinction risk on the viability curve (ICTRT 2005). Additionally, the Entiat steelhead population was classified as a "type A" population (based on historic intrinsic potential) because of its simple spatial structure (i.e., only 2 branches) (ICTRT 2005).

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

Spring Chinook

Population viability is considered as *low*. The number of natural-origin adults in the Entiat River ranged from 18 to 1,197 between 1960 and 2003 with a 12-year geometric mean ranging from 90 to 490 adults. The 12-year geometric mean at the time of listing (1999) was 92 spawners. During the period 1960 to 1999, R/S for spring Chinook in the Entiat watershed ranged from 0.16 to 4.72 with a 12-year geometric mean ranging from 0.41 to 1.12. The 12-year geometric mean at the time of listing (1999) was R/S=0.76. The ICTRT concluded that spring Chinook in the Entiat River have a high risk of extinction over the next 100 years (USFWS 2007).

Summer Steelhead

Population viability is considered as *low*. Between 1967 and 2003, escapement of naturally produced steelhead in the Entiat River watershed ranged from 9 to 366 adults with a 12-year geometric mean ranging from 24 to 118 adults. Estimated R/S values are the same as those described for Wenatchee River steelhead (assuming hatchery fish do not reproduce successfully, R/S values ranged from 0.13 to 4.73 adults for spawn years 1978 to 1997 with a 12-year geometric mean ranging from 0.71 to 1.96 based on adult counts at Priest Rapids Dam). The ICTRT has concluded that Entiat River steelhead have a moderate to high risk of extinction over the next 100 years (USFWS 2007).

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

Spring Chinook

During the period 1960 to 1999, returns per spawner for spring Chinook in the Entiat subbasin ranged from 0.16 to 4.72. The 12-year geometric mean of returns per spawner during this period ranged from 0.41 to 1.12. The geometric mean at the time of listing (1999) was 0.76 (UCSRB 2007).

For broodyears 2001 to 2004, using data obtained from rotary-screw trapping and redd surveys in the Entiat River, Cooper estimated that the average egg-to-emigrant survival for these years was 4.0%. For the same years, emigrants per redd averaged 185 per year (M. Cooper pers. comm.). These estimates comport well with those reported in Mullan et al 1992.

Summer Steelhead

See previous section.

- Provide the most recent 12 year annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Spring Chinook

The ICTRT has identified one historical Major Spawning Area (MaSA)- the Entiat- and no Minor Spawning Areas (MiSAs) within the Entiat population. Currently, the primary spawning areas used by spring Chinook in the Entiat population are the mainstem Entiat (above the Mad River), and below Entiat Falls (UCSRB 2007). Also see Table 2 below.

Summer Steelhead

The ICTRT identified two major and three minor spawning areas for the Entiat summer steelhead population. The major spawning areas include the Upper Entiat (including Mud,

Potato, and Stormy Creeks) and the Mad River (including Tillicum Creek) whereas the minor spawning areas include the Lower Entiat (including Roaring Creek), Swakane Creek, and Pine Canyon. Based on agency defined distribution, only the Upper Entiat MaSA and Lower Entiat MiSA would meet the ICTRT definition of occupied habitat (mouth to rm 7.2) (UCSRB 2007). Starting in 2003, USFWS staff began conducting steelhead redd surveys in the Entiat River Basin. In 2005, these surveys were expanded in area and methodology. Therefore, only data from 2005 to 2008 are used for the following estimate. The average number of steelhead redds per year was 154 (range= 60 to 223). No fish per redd estimate is currently available. Due to the nature of steelhead being repeat spawners, coupled with high water flows during the survey period, no carcasses were recovered and hence, no estimate of percent of hatchery or natural origin is available.

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

Table 2. Entiat River Spring Chinook Redd and Adult Return Counts, 2000 to 2008.

Return year	Redd Counts	Return Total*	Hat %	Count	Wild %	Count
2008	116	278	51	142	49	136
2007	102	245	56	137	44	108
2006	107	257	58	149	42	108
2005	148	355	51	181	49	174
2004	126	302	53	160	47	142
2003	108	259	32	83	68	176
2002	112	370	34	126	66	244
2001	202	485	30	146	70	339
2000	73	175	69	121	31	54
Mean	122	303	48	138	52	165
Range	73-202	175-485	30-69	83-181	31-70	54-339

* Total return counts were calculated by expanding the redd counts using the expansion value of 2.4 fish/redd except in 2002 where 3.3 fish/ redd was used. Data source Entiat River spawning ground reports 2000 to 2008.

See previous section for steelhead data.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS 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.

The collection of broodstock at ENFH is slated to begin in 2012 (estimated first jack return). Broodstock collection is directed at an unlisted species (SUS) and has a very low potential to "take" listed spring Chinook or steelhead. By the time the collection ladder would open, the vast majority of listed spring Chinook would be upriver of the hatchery

and therefore would not enter the adult holding ponds. Spring Chinook production at ENFH ceased, with the last releases occurring in 2007. From 1994 to the present, fewer than 6 natural-origin spring Chinook had entered the facility. Also, at the time of SUS collections, listed steelhead should not be in the vicinity of the hatchery. Any salmonid species entering the holding ponds, whether ESA listed or not, will be immediately returned to the river (other than hatchery-origin SUS).

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

Since this is an entirely new program, utilizing a different species, this data is currently not available. Also see last section.

- 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).

None expected. Although no "take" of ESA listed fish is expected, the potential exists for listed SCS adults to enter the holding ponds. Any salmonid species entering the holding ponds, whether ESA listed or not, will be immediately returned to the river.

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

The USFWS will attempt to adhere to the changes, management targets, and take levels provided in this HGMP. If these recommendations are found to be unfeasible or unobtainable the USFWS will as a contingency consider programmatic changes including the release of fish in this program at sites outside the Entiat River Basin.

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 Columbia River Fish Management Plan is an outcome from US v Oregon and identifies production and harvest program goals and other program considerations such as rates of marking for stocks of salmon and steelhead originating above Bonneville Dam. Many of the changes to the ENFH summer Chinook program that are described in this HGMP concerns aspects of the program that are also covered under the Columbia River Fish Management Plan and would require coordination with the US v Oregon parties.

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

Purpose of the Hatchery Program -Legal
The legal mandate for this program is mitigation for the permanent barrier created by construction of Grand Coulee Dam via the Grand Coulee Fish Maintenance Project on April 3, 1937. The Bureau of Reclamation, the funding agency for this proposal, has a continuing obligation to restore, to pre-construction levels of abundance, the salmon resources impacted by the construction of Grand Coulee Dam. This legal obligation has been confirmed in the following Federal statutes:

- Grand Coulee Dam Project, 49 Statute 1028,08/30/1935
- Grand Coulee Fish Maintenance Project, 04/03/1937
- Mitchell Act, 52 Statute 345, 05/11/1938
- Columbia Basin Project Act, 57 Statute 14, 03/1 0/1943
- Mitchell Act (amended), 60 Statute 923, 08/1411946
- Fish and Wildlife Coordination Act, 60 Statute 1080, 08114/1946

Purpose of the Hatchery Program -Societal and Biological
The purpose of this program is to provide spring Chinook salmon for tribal, sport, and commercial harvest consistent with the following Federal treaties and orders:
- Treaty with the Walla Walla, Cayuse, Umatilla Tribes, 06/09/1855
- Treaty with the Yakama, 06/09/1855
- Treaty with the Nez Perce, 06/11/1855
- Treaty with the Tribes of Middle Oregon, 06/25/1855
- Executive Order (Treaty with Bands of Colville), 04/08/1872
- US. v. Oregon (Sohappy v. Smith, "Belloni decision", Case 899), 07/08/1969
- Endangered Species Act of 1973,87 Statute 884,12/28/1973
- Salmon and Steelhead Conservation and Enhancement Act, 94 Statute 3299, 12/22/1980
- Pacific Salmon Treaty Act of 1985 (US./Canada Pacific Salmon Treaty), Public Law 995,16 U.S.C. 3631, 03/15/1985

3.3) Relationship to harvest objectives.
The program is intended to function as a segregated program for harvest benefits. Fish from this program are not intended to spawn naturally and are not intended to establish, supplement, or support any summer Chinook salmon populations occurring in the natural environment.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.
Since this is a new program, no harvest data are currently available. Fisheries potentially benefitting from this program include ocean, mainstem Columbia River, and possibly the Entiat River.

Potential Program Performance/Contribution:
The initial brood source for this program will be Wells Fish Hatchery stock. The Wells program has had a pNOB average (1989-2006) of 0.62 and a PNI average of 0.57 for the Okanogan/Similkameen program. Entiat NFH summer Chinook yearlings will be reared to a

targeted release size range of 15 – 20 fpp with an expected production of 350,000 smolts released annually. We anticipate that this program will be similar to the current CPUD Okanogan/Similkameen program. Therefore the average survival, harvest and straying rates from this program (Hillman et al 2009, Table 3) were applied as a theoretical surrogate to a 350,000 yearling release program.

Similkameen rearing parameters (see Table 3 below):

Brood source:	Wells Stock (0.62 pNOB, 0.57 PNI,
Program:	Yearling
Rearing Water:	Initial wells/ final 6 months = river
Release size:	16.7 fpp (11 – 22) BY's 1989 – 2006
Release date:	April 1st – May 9th (date range 1989 – 2006)
Smolt-Adult Return:	0.01026 (0.00006 – 0.03271) BY's 1989 – 2002
Total Harvest:	45.1% (13.3% - 75.7%)
Stray Rate:	0.56% (0.00% - 1.76%)

Entiat NFH performance applying above performance values to a release of 350,000.

Adult return:	3,591 (21 – 11,449)
Harvest:	1,619 (3 – 8,668)
Hatchery;	1,952 (18 – 2,580)
Strays:	20 (0 – 201)

The above harvest estimate does not include an Entiat River fishery. A high priority of this new program is to support a sport and/or tribal fishery in the Entiat River.

Table 3. Performance of Okanogan/Similkameen summer Chinook rearing program, brood years 1989 – 2002. Data obtained from 2008 CPUD M & E Annual Report (Hillman et al., 2009).

Brood	Yearling	Adult	%	Total	%	Ocean	Columbia River Harvest			Target	Strays		
Year	Release	Return	SAR	Harvest	Harvest	Harvest	Tribal	Commercial	Sport	Hatchery	Stream	Hatchery	% Strays
1989	202,125	4,297	2.13%	2,972	69.2%	2,344	351	200	77	1,328	2	31	0.77%
1990	367,207	973	0.27%	402	41.3%	356	27	7	12	291	0	1	0.10%
1991	360,380	978	0.27%	257	26.3%	220	37	0	0	453	0	0	0.00%
1992	537,190	2,301	0.43%	481	20.9%	441	24	6	10	572	8	1	0.39%
1993	379,139	117	0.03%	30	25.6%	24	6	0	0	32	0	1	0.85%
1994	217,818	1,532	0.70%	411	26.8%	379	17	8	7	203	16	1	1.11%
1995	574,197	2,845	0.50%	692	24.3%	647	3	18	24	271	50	0	1.76%
1996	487,776	30	0.01%	4	13.3%	4	0	0	0	0	0	0	0.00%
1997	572,531	18,727	3.27%	7,271	38.8%	6,683	92	80	416	309	34	3	0.20%
1998	287,948	7,603	2.64%	4,847	63.8%	4,334	14	238	217	99	31	2	0.43%
1999	610,868	2,759	0.45%	1,973	71.5%	1,342	14	241	376	18	10	0	0.36%
2000	528,639	6,751	1.28%	4,552	67.4%	3,137	35	719	661	29	94	15	1.61%
2001	26,315	420	1.60%	318	75.7%	183	0	111	24	2	0	0	0.00%
2002	245,997	1,960	0.80%	1,302	66.4%	815	15	251	221	12	6	0	0.31%

3.4) Relationship to habitat protection and recovery strategies.

As previously mentioned, ENFH is a mitigation facility constructed to compensate for lost fish production due to the construction of Grand Coulee Dam. This program has no direct linkage to habitat protection efforts.

3.5) Ecological interactions.

1) Populations that could negatively impact ENFH summer Chinook salmon.

Both introduced (e.g. walleye, *Sander vitreus* and smallmouth bass, *Micropterus dolomieu*) and native predators (e.g. northern pikeminnow, *Ptychocheilus oregonensis*) consume large numbers of juvenile spring Chinook as they migrate through the Columbia River system (Poe et al. 1991, Rieman et al. 1991, Tabor et al. 1993). Exacerbating this impact of predation are observations that northern pikeminnow are able to rapidly adjust their diet and foraging habits to key in on the opportunity presented by the release and seaward migration of large numbers of hatchery fish (Shively et al. 1996). Furthermore, pikeminnow predation is typically concentrated downstream of mainstem hydropower facilities where juvenile fish are less dispersed than normal, and potentially disoriented and/or stressed following navigation through the hydro facility. Ongoing programs designed to control the size of predator populations and to redesign juvenile bypass facilities to avoid the aggregation of large numbers of predators below mainstem dams are attempting to minimize the impacts of predation and increase the survival of seaward migrating juvenile salmonids.

2) Populations that could be negatively impacted by ENFH summer Chinook salmon.

The potential ecological effects of ENFH fish on natural salmonid populations is broken down into two sections; A) effects associated with juvenile releases, and B) effects associated with adult returns. Little is known about potential effects to non-salmonid species.

A) Juvenile Releases

Hatchery origin juvenile Chinook salmon released from ENFH can potentially interact with listed spring Chinook salmon and steelhead juveniles. Both of these species are present year round in the Upper Columbia River mainstem and tributary areas. Spring Chinook fry emerge from the gravel in late winter or early spring at an average size of approximately 30 mm (FL) and most fry immediately move downstream to mainstem rearing areas (NMFS 2001). Natural origin spring Chinook salmon in the upper Columbia River initiate seaward migration as yearling fish between April and June at an average size of 87 to 127 mm FL (NMFS 2001). Steelhead fry emerge from the gravel in the late spring through August at a size of 30 to 33 mm (FL; NMFS 2001) and disperse to downstream rearing areas in the late summer and early fall. Upper Columbia River steelhead begin seaward migration as age 2+ (43.2%) or 3+ (46.4%) smolts (Peven 1990) during April and May at an average size of 136 to 188 mm (Chapman et al. 1994).

Inter and intra-specific competition between juvenile hatchery and natural origin salmonids has the potential to negatively impact natural populations through density dependent mechanisms resulting in habitat displacement, competition for critical resources such as food and cover, and even reduced growth or survival of individual salmonids from natural populations (Fresh et al. 1997). Conversely, the presence of hatchery fish in the estuary and the mainstem migratory

corridors may act to buffer migrating natural origin salmonids from the effects of piscine and avian predation (Fresh et al. 2005).

Whether the release of juvenile Chinook salmon from ENFH negatively impacts natural origin salmonids is not completely understood but is thought to be unlikely or minimal. Other studies examining the impact of hatchery releases of Chinook salmon (both stream and ocean type) on natural salmonid populations have found little if any evidence for negative interactions (for review see Flagg et al. 2000). Riley et al (2004) were able to demonstrate that the release of hatchery fall Chinook (ocean type) into two coastal Washington streams had little if any effect on the density, microhabitat use, and size of natural origin coho salmon and steelhead juveniles. Similarly, in a larger river system (Sacramento River) in California, Weber and Fausch (2004) saw no effect of large scale hatchery releases of fall Chinook salmon on the abundance and size distribution of natural origin Chinook salmon. Authors in both of these studies attribute this lack of an effect to the fact that migrating salmonids typically occupy habitats distinct from the rearing areas occupied by natural origin fish and to the practice of releasing hatchery fish that are prepared to begin downstream migration that actively migrate out of the system thereby minimizing temporal and spatial overlap.

There is a risk that hatchery juveniles released from ENFH may prey on smaller natural origin salmonids that they encounter in the Entiat basin. Newly emerged Chinook salmon fry are at most risk of predation by hatchery fish. The possibility of residualism and or upstream migration by hatchery juveniles is minimized by the release of fish ready to undergo downstream migration, and any effect of residual hatchery fish would be concentrated in areas near the hatchery rather than upstream in the Entiat River. Furthermore, downstream migrating hatchery juveniles are thought to utilize different habitats than smaller steelhead and Chinook fry and fingerlings (Dauble et al. 1989, Weber and Fausch 2004) minimizing the possibility of negative interactions or predation (Flagg et al. 2000) during downstream migration.

The estuarine portions of the Columbia River are increasingly being recognized as key rearing areas for juvenile salmonids notably listed populations of ocean-type chum, Chinook, and coho salmon from the lower Columbia basin (Fresh et al. 2005, Bottom et al., 2005). Competition with salmonids released from hatcheries throughout the basin may negatively impact these listed populations during estuary rearing (Fresh et al. 2005). These negative density dependent interactions are unlikely in the case of Chinook salmon released from ENFH as stream-type Chinook salmon smolts spend little time in the estuary and are thought to occupy deeper mid channel habitats distinct from the shallow low velocity near shore rearing areas preferred by fry and sub-yearling fall Chinook and chum salmon (Bottom et al 2005).

B) Adult Returns:

Little is known about individual stocks of Chinook salmon and steelhead between the time they leave the estuary and return as adults to spawn. Available information is inferred from Coded-Wire Tag (CWT) data taken from fish harvested from sea. These data, however, do not give us insight into fish behavior nor inter-specific interactions among stocks in the ocean.

Adults returning to ENFH are trapped as volunteers to the hatchery. There is the potential that listed, natural-origin spring Chinook could enter the holding ponds. All non-hatchery salmonids found during brood collections will be immediately returned to the river.

The straying of hatchery-origin salmonids into watersheds with depressed ESA populations can have a deleterious affect on those populations. Since summer Chinook are a non-ESA listed species, the effect to natural populations should be minimal. For years 2004 to 2008, the average percent of hatchery SUS strays spawning in the Entiat River is 36% (Appendix A).

When both spring and summer Chinook salmon spawn in the same river system, redd superimposition on spring Chinook redds by summer Chinook can occur. The listed SCS stock in the Entiat Basin spawns mainly in the upper watershed, whereas SUS tend to spawn in the lower watershed. For years 2000 to 2008, approximately 80% of SCS spawning has been between rms 18.7 to 28.1 in the Entiat River. For the same years, 85% of SUS spawning has occurred below rm 18.7 (Appendix A). Therefore, some spawning area overlap does occur between the two species. While superimposition could occur, the full extent is unknown.

C) Summary

Recently, NOAA in their 2008 BiOp (NOAA, 2008) proposed a list of appropriate management practices to minimize the risk of negative ecological interactions to natural populations. Measures that will be implemented in the ENFH program including: 1) "release fish at a size and condition factor that leads to their prompt emigrations to the ocean," 2) "releasing fish away from populations that are important to salmon and steelhead recovery," and 3) "mark fish externally so they can be distinguished for harvest purposes and collected for hatchery broodstock." The use of these practices minimizes the risk of negative ecological interactions between ENFH summer Chinook salmon juveniles and natural salmonid populations.

The FWS currently conducts Chinook salmon redd surveys in the Entiat River Basin. The collection of post-spawn adults (carcasses) and determining their identity/origin is a key component of the surveys. Although 36% of the spawning population of SUS is made up of out-of-basin strays (2004 to 2008), the FWS will make every attempt to minimize the pHOS of ENFH origin. This data, obtained through carcass recoveries, will determine potential future actions to control or reduce the number of ENFH adults passing the facility to areas where natural spawning occurs (i.e., construction of a weir, etc). The adult collection ladder will operate throughout the SUS run, and all hatchery-origin adults will be retained. Those in excess of brood needs will be donated to pre-approved sources.

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.

In 1943, the U.S. Fish and Wildlife Service / Entiat NFH was granted a surface water use Certificate for 22.5 cubic feet per second (cfs) (Surface Water Certificate No. 3058) and a spring Certificate (No. 3059) for 7.0 cfs. The river water intake is located at river mile 7.2,

approximately 0.33 miles upstream of the hatchery's effluent discharge. Water is conveyed to the hatchery through a buried 36 inch pipe system. This water enters a pre-settling basin via inclined 3/32 inch screens. Screened debris and downstream migrants are diverted through an 18 inch line back to the Entiat River. The water intake structure consists of a diversion dam, intake sump, and bar trash racks (3 inch spacing). Non-hatchery fish and other aquatic organisms that enter the system can return to the river via the 18 inch water line that diverts screened debris and water from the stations surface water screen chamber building. The screen chamber meets the standards for screening criteria described in the *1994 Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* developed by NOAA Fisheries.

Years after production started, it was determined that Entiat River water contained high organic loads and a detrimental parasite (*Myxobolus sp*.) which had a negative impact on hatchery spring Chinook salmon production. Ground wells were drilled as an alternative to try to resolve the parasite problem and in 1994 the service requested to change the point of diversion authorization under Certificate No. 3058, to include the six wells on the existing Certificate and the request change was granted in 1996 (Table 4).

Table 4: The following table represents current water use rights for the Entiat National Fish Hatchery.

Certificate Number	Source	Priority Date	Amount
Surface & Ground Water 3058	Entiat River and/or Wells 1- 6	June 4, 1943 Amended Feb.21, 1996	22.5 CFS 10,098 GPM
3059	Limekiln (Packwood Spring)	June 4, 1943	7.0 CFS 3,142 GPM

Surface water is used on a limited basis. Currently, surface water is used to supply adequate amounts of water to operate the station's fish ladder during spring Chinook adult returns. Surface water is also used in case of long-term loss of ground water supplies (emergency). Since 1990, hatchery production has relied primarily on ground and spring water for fish production. The availability of ground water determines fish production at Entiat NFH. An average of 2000 gpm is available at an average temperature of 50° F year round.

Entiat NFH operates off its National Pollutant Discharge Elimination System (NPDES) permit number WA-000188-1, issued in 1976. Effluent discharge is monitored, reported, and currently complies with applicable standards. The Environmental Protection Agency Region 10 is currently publishing notice in the Federal Register for the issuance of the NPDES general permit for wastewater discharges for federal aquaculture facilities within the boundaries of the State of Washington. Entiat NFH has recently submitted the Notice of Intent to discharge under General Permit No. WAG-130000. When approved, this permit will be in effect through July 31, 2014.

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

Hatchery intake screens conform to NOAA Fisheries screening guidelines to minimize the risk of entrainment of juvenile fish. Screens are cleaned at least twice per day. Deflectors were

installed in the screen chamber to divert sufficient amounts of water through and over 3/32 inch holed screens when water demand from the river is low. These deflectors simply shunt water over the screens so that downstream migrants and debris washes off the screens. Additionally, spray nozzles were installed to prevent algae from plugging holes on the screens. The nozzles were mounted on the underside of the screens spraying a jet of water up through the screen holes allowing the algae to continue flowing out of the screen chamber into the discharge pipe.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

There are two adult holding ponds measuring 16 x 120 feet that are supplied with a mixture of surface and ground water for attraction and operation of the ladder leading to the holding ponds. One of the ponds will be used to collect and hold summer Chinook salmon broodstock. The other pond may be used to hold coho salmon.

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

Adult summer Chinook salmon will be transported in an insulated stainless steel fish transportation tank. The tank is equipped with micro bubble ceramic plate oxygen diffusers and aerators. In addition to the large transportation tank, a limited number of adult summer Chinook salmon may be transported in a 200 gallon insulated fish tote equipped with one or two oxygen diffusers.

5.3) Broodstock holding and spawning facilities.

As stated in section 5.1, all summer Chinook salmon adults will be held in one 16 x 120 foot concrete pond. The spawning building sits next to the holding ponds. This area has access to pathogen-free well water which is used in the spawning process. After the gametes have been mixed in a spawning bucket, the egg buckets will be taken inside the hatchery nursery building for cleaning and disinfection.

5.4) Incubation facilities.

Chinook eggs will be incubated in Marisource Heath tray stacked incubators with approximately 4,000 eggs per tray. Eggs from individual females will be kept separate until fish health tests have been completed. Total incubation capacity for Chinook salmon at ENFH is 900,000 eggs. The hatchery uses ground/spring water for incubation and effluent is pumped into the hatchery pollution abatement pond. From fertilization to the eyed stage, eggs will be incubated in trays receiving 4-5 gallons per minute. Developing eggs will be treated every other day with 750 ppm of formalin for fungus control until they reach 600 temperature units. Chinook production will be incubated on 100% ground/spring water, chilled with a Carrier chiller, at 44 ^{0}F until “eyed”. The eggs will be shocked, picked, inventoried and mixed by egg take and loaded back into the incubation trays at approximately 4,000 eggs per tray. Eggs will be returned to incubation and chilled on 100% ground/spring water. Planned fry emergence is delayed until late April, early May.

5.5) Rearing facilities.

Rearing facilities include 30 – 8 foot x 80 foot raceways, 16- 3 foot x 40 foot starter tanks, and 2-16 foot by 120 foot adult ponds. Button-up fry will be moved to outside raceways and reared on first pass ground/spring water after prior year summer Chinook salmon smolts have been released off station in late April early May. Raceways will be loaded pending scheduled fish marking. Fry will be counted and "split" into raceways for final summer and fall rearing during marking activities.

5.6) Acclimation/release facilities.

Yearlings (smolts) will be forcibly released directly from the raceways. Dam boards will be removed, and smolts travel through an underground pipe system, which empties at the base of the collection ladder into the Entiat River. The juveniles holding in the adult ponds will be forced out down the hatchery ladder into the Entiat River.

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

In mid April 1992, 18,000 spring Chinook salmon were lost due to human error and advanced smoltification. Historically, early smoltification was typical at ENFH which results in significant stress place on the fish as they await the release date. Water was drawn down to remove a pond screen without first checking the dissolved oxygen level in that holding pond. This can be avoided with the summer Chinook salmon program by personnel paying close attention to the signs of smolting (i.e. loss of parr marks, streamlined bodies and noses, loss of appetite, and frenzied activity the fish display) and checking dissolved oxygen levels when dealing with smolting fish. Also, having a flexible release date to accommodate summer Chinook salmon smolt condition would be warranted.

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.

The hatchery is staffed full-time eight hours per day. One person is living in residential quarters on the hatchery grounds. The station has a centrally located alarm, which is connected to an automatic dialer in the case of low water or high temperatures. If this system fails, the station is still supplied with between 350 and 450 gpm of gravity fed spring water. This is the failsafe. This water will keep production alive, albeit a relatively short time, until corrective measures can be made. With regards to the "take" of listed fish, the only event that would have some effect would be an emergency release of non-smolting fish. As stated above, the water and alarm systems currently in place reduce the possibility of an emergency release to nearly zero. If power is lost to the facility, there is an emergency back-up system that automatically engages to restore power.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.
Hatchery broodstock will be from the Wells Hatchery summer Chinook salmon program. This is a commingled Upper Columbia River stock.

6.2) Supporting information.

6.2.1) History.
The broodstock used to start the ENFH summer Chinook salmon program will be from Wells Hatchery which is commingled stock destined for the upper Columbia River Basin.

6.2.2) Annual size.
The summer Chinook program at ENFH will be a segregated population, thus natural origin adults will not be incorporated into the broodstock. Annually, approximately 300 hatchery origin adults will be collected from Wells Hatchery or when sufficient returns are available as volunteers to ENFH.

6.2.3) Past and proposed level of natural fish in broodstock.
As a segregated hatchery population, incorporation of wild brood will not be a goal of the ENFH summer Chinook program. The Wells FH summer Chinook program is operated as an integrated program and has an average proportion of natural origin broodstock of 0.62 (Hillman et. al 2009).

6.2.4) Genetic or ecological differences.
Unknown, but FWS is currently conducting a study (see Appendix B) evaluating the genetic population structure of SUS adults in the Entiat River basin and how this population compares with other UCR SUS stocks.

6.2.5) Reasons for choosing.
Availability and proximity to the Entiat River basin are the main factors consider in choosing Wells Fish Hatchery stock to initiate this program. Another factor is the positive health record history of the Wells Fish Hatchery SUS.

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.
Hatchery summer Chinook salmon with adipose fin-clip will be the only fish targeted for broodstock.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).
Initially, in 2009 we plan on a partial program of 200,000 eggs. Summer Chinook salmon eggs will be collected from the Wells Hatchery facility. Eggs will be transported to ENFH and placed into Heath trays and incubated.

In 2010, we plan to collect 50 pair of summer Chinook salmon adults from Wells Hatchery and transport them to ENFH for holding until they are ripe to spawn (approximately 200,000 eggs).

In 2011, we propose to collect a full program of up to 150 pair of summer Chinook salmon adults (approximately 400,000 eggs) from Wells Hatchery and transport them to ENFH to hold for spawning. The number needed for brood may be decreased as the program is established and more information concerning individual fecundity is obtained.

In 2012 (estimated first jack return) through the life of the program, we will open our adult ladder at ENFH for collection of returning summer Chinook salmon adults/jacks. We will supplement with returning adults from Well Hatchery until 150 adult pair have been met. Eventually, adults returning to ENFH should suffice for full production and Wells Hatchery adult collections, for us, will be phased out.

7.2) Collection or sampling design.

To maximize genetic diversity, ENFH will collect a representative sample of returning summer Chinook salmon from throughout the run initially at Wells Hatchery. Wells summer Chinook salmon will be trapped from July through September. Based on previous year's experience, the first summer Chinook salmon arrives at Wells Hatchery as early as the first week of July and continues through early September. Migration peaks in mid-August. Weekly broodstock collection goals will be developed on an annual basis based on the average distribution of returning summer Chinook salmon. If, during any week, the broodstock collection goal is not met, the deficit will be carried over to the following week.

Once an ENFH summer Chinook salmon run is established, then collecting adults that voluntarily migrate back through the hatchery fish ladder will be the preferred method of collection. The adult trap will be opened the beginning of July through November each year. ENFH adults collected in excess of broodstock needs will be provided to local Native American Tribes for subsistence and ceremonial purposes or other pre-approved sources.

7.3) Identity.

All adults used as broodstock will be identified by an adipose fin clip.

7.4) Proposed number to be collected:

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

To initiate this production program the Service plans to use adult summer Chinook salmon collected at Wells Hatchery for broodstock. This broodstock collection effort will entail transfer of eggs in the first year of partial production (BY 2009), and transfer of adults in all subsequent years. Full production will require the collection of up to 300 hatchery origin summer Chinook adults (enough to provide up to 400K eggs). As the progeny of the initial Wells Hatchery collections return as adults (to ENFH) they will be used as broodstock and the number of adults needed from Wells Hatchery will be

reduced. It is anticipated that by brood year 2016 the Entiat summer Chinook salmon program will utilize hatchery volunteers to ENFH for 100% of broodstock needs.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:
This will be a new program at ENFH no information is available for broodstock collection of summer Chinook salmon.

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
Under an agreement with Bureau of Indian Affairs, adults collected in excess of broodstock needs will be donated to various tribes for ceremonial and subsistence purposes. A small portion may also go to non-profit groups. We may also utilize excess hatchery fish in nutrient supplementation programs in the Entiat River subbasin.

7.6) Fish transportation and holding methods.
Initially (2010-2016), adult summer Chinook salmon will be transported in an insulated stainless steel fish transportation tank. The tank will be equipped with micro bubble ceramic plate oxygen

diffusers and aerators. In addition to the large transportation tank, a limited number of adult summer Chinook salmon may be transported in a 200 gallon insulated fish tote equipped with one or two oxygen diffusers. These fish will be in the transport tank for approximately two hours. Adults will be transported and placed into a 16 foot X 120 foot adult holding pond at ENFH. Adults may be held up to three months before spawning. A flow-through formalin treatment is administered every other day to help control parasites and fungus.

7.7) Describe fish health maintenance and sanitation procedures applied.
Fish health services will be provided by staff from the USFWS Olympia Fish Health Center (OFHC) which is a full service aquatic health facility capable of monitoring, diagnostic, and certification procedures that meet or exceed all national, international, IHOT or co-manager requirements.

Pathogen and disease monitoring starts with adult testing of captured populations for all reportable aquatic viruses and bacteria at the minimum assumed pathogen prevalence level of 5% (i.e. 60 individuals). In addition, all females spawned will be specifically and individually tested for *Renibacterium salmoninarum*, the causative agent of Bacterial Kidney Disease (BKD). This is essential to determine the pathogen levels and eliminate or segregate the resulting eggs from different risk levels. This process greatly reduces the impact of transmitting the disease from infected females to progeny. All eggs and accompanying containers will be disinfected with iodine solution during the water hardening process following fertilization.

7.8) Disposition of carcasses.
All broodstock carcasses that have been exposed to anesthetic (MS-222) will be buried in an earthen pit on ENFH grounds.

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 appropriate US Fish and Wildlife Service Fish Health Policy concerning the collection, handling, and holding of adult broodstock.

All adipose present salmonids encountered will be immediately returned to Entiat River.

SECTION 8. MATING

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

8.1) Selection method.
The fish ladder at Wells Hatchery and eventually at ENFH is operated and adult trapping is conducted throughout the entire run making it a natural random selection. If run size is large, excess fish will be periodically removed and broodstock moved to a sectioned part of the holding pond in proportion to the run size. Wire mesh panels will be used to partition off areas of the

holding pond. This enables us to retain adults from the entire run spectrum. All ripe females will be spawned weekly.

8.2) Males.
Milt from the primary male is used first for fertilization. A secondary male (backup), which was the primary male in the prior mating, is used again about one minute after the primary male. Three year-old (jacks) returning males will be used randomly throughout spawning at a rate relative to the total return.

8.3) Fertilization.
A 1:1 female to male spawning ratio is the objective. Due to the continuous number of fish removed, and separate male and female staging areas, there is no selectivity in mating. The abdomen of a female is opened, egg's flow freely into a colander where the ovarian fluid is decanted. Eggs are transferred to a bucket where fertilization takes place. After milt from the primary and secondary male is added to the eggs, pathogen-free well water is added. Eggs are destroyed if the female displays gross BKD lesions. Each female is given a number, which corresponds to an individual incubator and the fish health tissue sample. The ELISA (Enzyme-Linked Immunosorbent Assay) method is used to detect BKD, which takes about 30 days to process. Eggs are not combined until fish health reports are complete. Egg lots will be categorized via the ELISA method, ranging from very high to no detection. Egg lots, depending on their numeric value, will be segregated from others. Eyed eggs will be physically shocked before egg picking begins. The undeveloped or infertile eggs remain tender and will rupture when shocked. Within a few hours, these eggs turn white and will be easily identified.

8.4) Cryopreserved gametes.
Due to the large number of fish returning to Wells Hatchery, cryopreserving gametes is felt to be unnecessary.

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.
No measures will be applied as no adverse effects are foreseen. During years of low broodstock collection (less than 60 females), we will supplement adults with Wells Dam summer Chinook salmon.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.
Table 6 describe egg take and survival information for spring Chinook salmon (SCS)

reared at ENFH. We anticipate that the new SUS program will perform similarly.

Table 6. Entiat NFH SCS number egg taken and egg survival rates.

Year	# Eggs	Survived to Eyed	Percent(%)
1988	612,188	548,520	89.6
1989	878,245	828,185	94.3
1990	804,660	768,450	95.5
1991	896,000	876,976	98.1
1992	885,400	861,494	97.3
1993	1,196,000	1,169,688	97.8
1994	168,000	162,120	96.5
1995	232,000	222,488	95.9
1996	387,600	378,685	97.7
1997	500,400	483,887	96.7
1998	441,000	423,801	96.1
1999	1,067,800	1,029,359	96.4
2000	756,000	706,104	93.4

9.1.2) Cause for, and disposition of surplus egg takes.
Historical data will be used to determine egg collection levels. Surplus eggs will be taken to allow for the culling of moderate to high risk BKD infected eggs. The culled eggs will be disposed of in an earthen pit on station property.

9.1.3) Loading densities applied during incubation.
The dry-weight method will be used to enumerate eggs. Only one female per tray will be incubated until the eggs reach the "eyed" stage. Egg lots will be categorized via the ELISA method, ranging from very high to no detection. Egg lots, depending on their numeric value, will be segregated from others. Eyed eggs will be shocked and mortalities will be picked. A combined average weight will be used for groups of 10 females. Eyed eggs will be returned to incubation trays, loaded at 4000 eggs per tray. Incubation continues on chilled spring/ground water. Water flow will be set at a minimum of 4 - 5 gallons per minute. Eggs will be treated every other day with 750 ppm of formalin for fungus control until approximately 600 Temperature Units (TUs) are achieved.

9.1.4) Incubation conditions.
Eggs will be incubated in chilled pathogen free (spring/well) water. Water temperature will be continuously monitored every thirty minutes and logged by a remote temperature sensor. Water temperatures will be converted to temperature units for each spawning day. Historically, the Entiat SCS stock took about 600 temperature units to reach the eyed stage and 1750 temperature units to the button-up stage or initial feeding. We expect the same for summer Chinook salmon.

Well water passes through an aeration chamber prior to entering the nursery. Water

oxygen levels have been at or near saturation. When cleaning the nursery, the effluent passes through a pollution abatement facility prior to entering the Entiat River via a pump back system. Non-cleaning effluent flows directly into the Entiat River.

9.1.5) Ponding.
Fry will be removed from incubators when they are 99% buttoned-up. After a few days of acclimation and when all fish are on or near the surface, feeding commences. Fry will be "ponded" directly from incubation trays to outside raceways.

9.1.6) Fish health maintenance and monitoring.
Disease monitoring will be accomplished through daily observations by hatchery staff and monthly monitoring by fish health biologists/pathologists from the OFHC.
Any abnormal situations observed by hatchery personnel will be called to the attention of the OFHC, which performs diagnostic and confirmatory clinical tests before recommending appropriate treatments. Treatment procedures may include environmental manipulation to control stresses and enhance the fish's ability to recover from infectious agents and/or appropriate chemicals or antibiotics. Antibiotics and chemicals that are registered for fish disease treatments will be applied as per labeled instructions. Other therapeutic drugs and chemicals may be applied through appropriate INAD permits or by allowable extra-label prescription by staff Veterinary Medical Officer or local veterinarian.

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.
The Wells Hatchery summer Chinook salmon stock is not listed. Eggs will be incubated using well/spring water only to minimize the risk of catastrophic loss due to siltation.

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, or for years dependable data are available.

This is a new summer Chinook program however; we don't expect survival to be much different than spring Chinook salmon raised in the past at ENFH. See Table 7.

Table 7. Percent survival estimates for juvenile SCS, ENFH.

Brood year	Fry to Fingerling (%)	Fingerling to Smolt (%)
1989	99.8	99.8
1990	99.6	95.4
1991	97.8	96.4
1992	89.9	96.5
1993	97.3	95.8
1994	99.8	81.9

1995	99.0	84.5
1996	98.2	98.3
1997	98.8	97.1
1998	99.0	96.8
1999	98.8	98.1
2000	96.3	95.8

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

The targets will be to maintain a density index below 0.17 and a flow index below 0.75 while achieving production targets. Actual data are unknown because this is a new program. Table 8 displays data from the ENFH SCS program, we will rear SUS under similar conditions.

9.2.3) Fish rearing conditions

Table ? describes expected monthly monitoring variables collected during the rearing of a single brood year of spring Chinook salmon. Values will be collected monthly from a random sample of separate rearing units unless otherwise indicated. The table presents approximate values that should be indicative of a "normal" production year. The monitoring values of dissolved oxygen, carbon dioxide and total gas pressure are not indicated, however, reference to the exclusion of these variables is footnoted below in Table 8.

Table 8. Example of monthly production monitoring density and flow indexes for yearling SCS brood years.

Month	**Development Stage**	**Temp[1] Avg. ^{0}F**	**Water Source[2]**		**Flow (GPM)**	**Flow Index[3] Lbs./L(in)GPM**	**Density Index[3,4] Lbs./L(in)cuft**
			% River	% Ground			
August	EGG	48.5	0	100	40	4000/tray	Na
September.	EGG	48.8	0	100	40	4000/tray	Na
October	EGG	50.5	0	100	40	4000/tray	Na
November	EGG/Alevin	50.5	0	100	40	4000/tray	Na
December	Alevin/Fry	50.0	0	100	1800	0.23	0.05
January	Fry	48.0	0	100	1800	0.37	0.08
February	Fry	47.0	0	100	1800	0.52	0.11
March	Fry	47.0	0	100	1800	0.56	0.14
April	Fingerling	47.0	0	100	5400[5]	0.53	0.11
May	Fingerling	46.7	0	100	5400	0.32	0.06
June	Fingerling	46.7	0	100	5400	0.40	0.08
July	Fingerling	47.6	0	100	5400	0.49	0.10
August	Fingerling	48.5	0	100	5400	0.58	0.12
September	Fingerling	48.8	0	100	5400	0.60	0.09
October	Fingerling	50.5	0	100	5400	0.66	0.09
November	Fingerling	50.5	0	100	5400	0.70	0.10
December	Yearling	50.0	0	100	5400	0.74	0.11
January	Yearling	49.0	0	100	5400	0.77	0.11
February	Yearling	48.5	0	100	5400	0.72.	0.11
March	Yearling	47.5	10	90	5940	0.70	0.12
April	Yearling/Smolt	47.0	20	80	6480	0.72	0.12

Dissolved oxygen is measured during critical periods of disease, elevated temperatures, restricted flows, or fouled water. Minimum $d0_2$ standards for salmonids are 5 mg/L (Piper et al 1982)*.

[1]Temperature data is electronically measured every .5 hours and averaged for the month.

[2]Data indicates approximate water source usage. Actual usage depends on a variety of factors including disease and

maintaining water temperatures (through well /river mixing) to minimize the formation of slush ice in winter and not to exceed 68^0F in summer.

[3]Estimated GPM used by brood including re-use. Calculated by dividing total weight (lbs.) by the average length (in.) X FI.

[4]Index averaged from Entiat NFH lot history records from brood years 1997 and 1998.

*Piper, R.G., I.B. McElwain, L.E. Orme, J.P. McCraren, L.G. Fowler, & J.R. Leonard. 1982. Fish Hatchery Management. US Department of Interior. Pp. 503. Washington DC.

[5] Serial Re-use; water is re-used twice; 1st pass, 2nd pass and 3rd pass rearing.

Additional parameters that will be monitored at Entiat NFH:

• *Total Suspended Solids (TSS)* — 1 to 2 times per month on composite effluent, maximum effluent/influent samples and once per month on pollution abatement pond influent and effluent samples.
• *Settleable Solids (SS)* — 1 to 2 times per month on effluent and influent samples and once per week on pollution abatement influent and effluent samples.
• *In-hatchery Water Temperatures* — maximum and minimum daily.
• *In-hatchery Dissolved Oxygen* — as required by stream flow and weather conditions.

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.

As this in a new program growth data is not available, however, we anticipate that rearing conditions will be similar to the previous ENFH SCS program (Table 9).

Table 9. Entiat NFH spring Chinook salmon number, size, growth and condition values. These are average values for broods reared since 1990. Fish began feeding the end of the second week in December.

MONTH	Inventory (#fish)	Weight (lbs.)	Size (#/lb)	Size (gms)	Length (mm)	Length (in)	Condition Factors K= g/mm^3	Growth Rate (mm/mth)	Growth Rate (gms/mth)
Start	**410,000**	**342**	**1200**	**0.38**	**33.9**	**1.33**			
Dec	396,681	537	738.5	0.62	39.9	1.57	0.922	12.2	0.46
Jan	393,586	1,126	349.5	1.30	51.0	2.01	0.949	11.1	0.69
Feb	390,266	1,861	209.7	2.16	60.7	2.39	0.966	9.7	0.86
Mar	382,818	2,796	136.9	3.33	70.1	2.76	0.967	9.4	1.17
Apr	379,062	3,969	95.5	4.78	78.9	3.11	0.970	8.9	1.45
May	376,810	5,683	66.3	6.82	88.9	3.50	0.971	9.9	2.04
Jun	379,829	8,081	47.0	9.70	99.8	3.93	0.941	10.9	2.80
Jul	379,579	10,814	35.1	12.9	109.9	4.33	1.010	10.2	3.20
Aug	379,119	13,786	27.5	16.5	119.4	4.70	1.013	9.4	3.6
Sept	377,685	16,140	23.4	19.4	125.9	4.96	1.060	6.6	2.9
Oct	376,945	18,661	20.2	22.6	132.6	5.22	1.020	6.6	3.2
Nov	374,664	20,252	18.5	24.5	136.1	5.36	1.002	3.5	1.9
Dec	372,534	21,914	17.0	26.7	140.2	5.52	0.988	4.1	2.2
Jan	368,733	23,789	15.5	29.2	144.5	5.69	0.988	4.3	2.5
Feb	365,130	25,009	14.6	31.1	147.6	5.81	0.991	3.1	1.9

Mar	361,306	27,372	13.2	34.4	152.4	6.00	0.955	4.8	3.3
Apr	Fish released 1st week in April								

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

We anticipate that the growth of SUS at ENFH will be similar to values observed for the ENFH SCS program (Figure 1). As indicated, predominant growth occurs during the first spring and summer, from May through September. Minimal growth occurred during the fall and winter followed by a secondary period of increased growth just prior to release in April. Additional measures of fish performance are described in Tables 8 and 9.

Energy reserve data through routine monitoring of body fat content is not conducted on a routine basis. On a quarterly basis fish health profiles will be conducted through the collection of a Goede Index that ascribes qualitative values to external and internal observations of fish health. Data is available through ENFH.

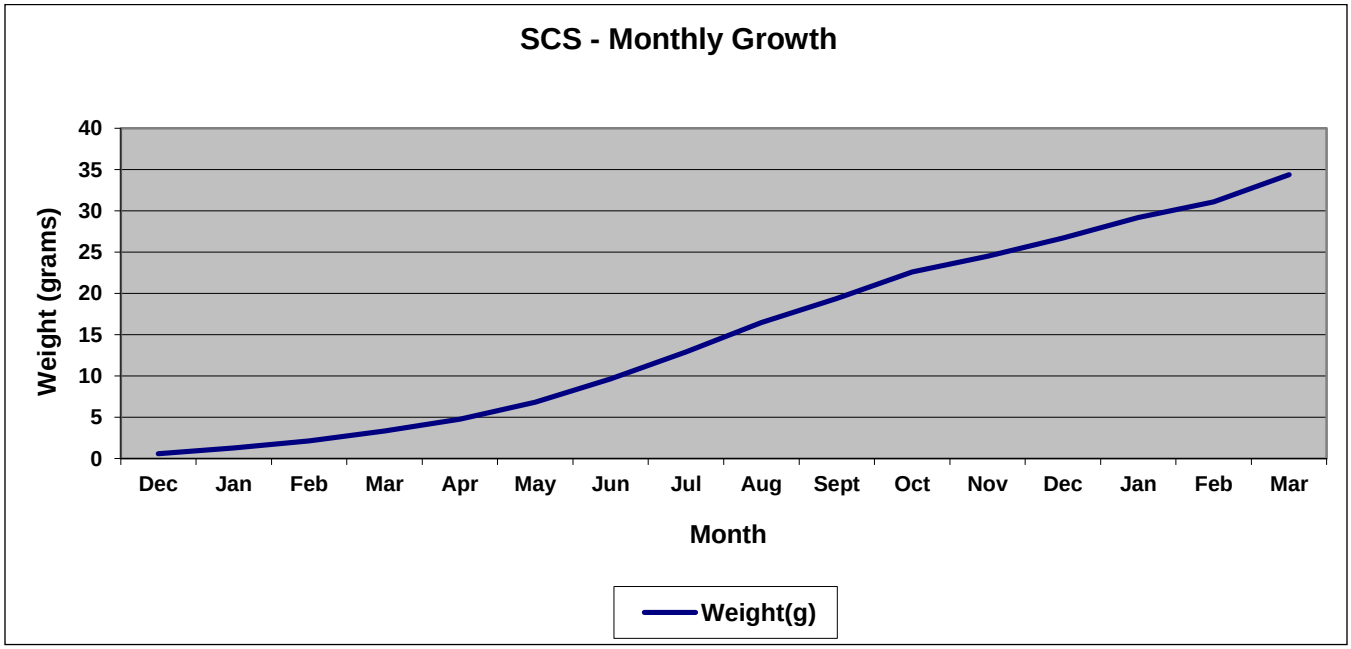

Figure 1. Average monthly growth for spring Chinook salmon, Entiat NFH.

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*).

The table below shows spring Chinook salmon once raised here. We expect similar results from summer Chinook with the months changing by two months. Instead of starting fry on feed in December we'll start them in February (Table 10).

Table 10. Entiat NFH feed type, application rates, and food/length conversion rates for an average production year for spring Chinook salmon.

MONTH	Feed Type	Feed Fed Per Day (lbs.)	Total Feed (lbs./mo)	Feeding Rate % BW/day[1]	Food Conversion (lbs. Fed/lbs. Gain)	Conversion Temp. Units Per in. growth[2]
December	**BioVita Starter #0**	**14**	**209**	**2.6**	**1.07**	**35**
January	**BioVita Starter #1**	**21**	**534**	**1.9**	**0.91**	**37**
February	**BioVita Starter #2**	**28**	**710**	**1.5**	**0.97**	**42**
March	**BioClark's Fry 1.0 mm**	**49**	**1078**	**1.8**	**1.15**	**41**
April	**BioClark's Fry 1.5mm**	**70**	**1408**	**1.8**	**1.20**	**42**
May	**BioClark's Fry 1.5mm**	**87**	**1738**	**1.5**	**1.01**	**37**
June	**BioClark's Fry 2.0mm**	**100**	**2000**	**1.2**	**0.83**	**35**
July	**BioClark's Fry 2.0mm**	**163**	**2612**	**1.5**	**0.96**	**41**
August	**BioClark's Fry 2.5mm**	**190**	**3035**	**1.4**	**1.02**	**47**
September	**BioClark's Fry 2.5mm**	**197**	**3149**	**1.2**	**1.34**	**70**
October	**BioClark's Fry 2.5mm**	**181**	**2892**	**1.0**	**1.15**	**68**
November	**BioClark's Fry 2.5mm**	**204**	**2647**	**1.0**	**1.66**	**113**
December	**BioClark's Fry 3.0mm**	**201**	**2610**	**0.9**	**1.57**	**96**
January	**BioClark's Fry 3.0mm**	**168**	**2187**	**0.7**	**1.17**	**82**
February	**BioClark's Fry 3.0mm**	**149**	**2382**	**0.6**	**1.95**	**111**
March	**BioClark's Fry 3.0mm**	**155**	**3411**	**0.6**	**1.44**	**73**

1- Factor utilized to determine feed application rates calculated as the % of body weight (BW) in total mass divided by total pounds fed.
2- temperature units per inch of growth are calculated by subtracting 32^0F from the average monthly temperature and length gain.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.
The OFHC provides fish health monitoring. Fish health examinations will occur on a monthly basis. If fish health conditions warrant, the frequency of examinations will be increased as needed. Specific health monitoring activities that will take place at ENFH include the following:

• On at least a monthly basis, both healthy and clinically diseased fish from each fish lot will be given a health exam. The sample includes a minimum of 60 fish per lot.
• Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit. This sample consists of a minimum of 60 fish per lot.

• Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.
• Reporting and control of specific fish pathogens will be conducted in accordance with the USFWS Fish Health Policy and Implementation Guidelines.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.
At ENFH we estimate the degree of smoltification by classifying pre-smolts as either parr, transitional, or smolt based on physical appearance. ATPase activity is not typically measured.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.
Natural rearing methods will not be utilized.

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.
Listed fish will not be reared at this station.

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
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	400,000	18-20	Around the first week in May	Entiat River

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

Stream, river, or watercourse: Entiat River (WRIA 46)
Release point: RM 6.7
Major watershed: Entiat River

Basin or Region: Mid Columbia River

10.3) Actual numbers and sizes of fish released by age class through the program.
New program, no historical data available.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
Average								

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

10.4) Actual dates of release and description of release protocols.
Fish will be forced from the rearing units in late April or early May which coincides with favorable environmental emigration conditions and spill at Columbia River mainstem dams.

10.5) Fish transportation procedures, if applicable.
Fish will not be transferred off station.

10.6) Acclimation procedures.
Fish will be reared for about 18 months in the hatchery, and released directly from the facility

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.
ENFH summer Chinook salmon will be 100% adipose clipped with a minimum of 200,000 fish

receiving CWT's annually. To evaluate post release migration PIT tags will be used as appropriate.

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

Production goal numbers will be adjusted by number of adults spawned. If too many eggs are taken, numbers will be adjusted prior to hatching.

10.9) Fish health certification procedures applied pre-release.

Pre-release certification procedures will be selective grab samples of moribund fish in the population followed by non-selective grab samples to make up a minimum of 60 fish (to statistically satisfy the assumed pathogen prevalence level of 5%) of each production group of fish. Kidney and spleen samples will be tested for the presence of reportable viruses and bacteria.

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

Only under the most severe circumstance would fish be released early. If the problem causing the emergency cannot be remedied and catastrophic loses are eminent, part or all of production would be forced out into the river. It would be an unlikely event to release all production fish, but a partial or "thinning" release may occur. If an emergency release occurred, the appropriate contacts would be notified as per instructions in the BiOp.

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.

Rearing and release strategies will be designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish will be reared to sufficient size that smoltification occurs within nearly the entire population and released when river flow are increasing or high, which reduces retention time in the streams after release. Listed stocks in this basin are well upstream of ENFH. Smolts released from ENFH may mix with these stocks in the lower Entiat and Columbia Rivers, but specific impacts are thought to be minimal.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

Monitoring and Evaluation activities for ENFH are currently shared by the USFWS Mid-Columbia River Fishery Resource Office (MCRFRO), the OFHC, and the ENFH. Staff from these three USFWS offices form the ENFH Hatchery Evaluation Team (HET). The HET meets two – four times a year and is the responsible entity for evaluation of the performance of fish reared at ENFH. Collection of data regarding fish rearing, water quality, and other facility metrics is the responsibility of ENFH staff. Data regarding fish health and pathogen prevalence is collected and reported on by OFHC staff. Data concerning migratory behavior, adult returns,

fishery contributions, and impacts to fish populations in the Entiat River basin is the responsibility of the MCRFO.

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

Legal Mandates

Performance Indicators 1a and 1b:

- Estimate tribal and sport harvest in the various fisheries, when applicable; and maximize distribution of surplus adults to the tribes.

Performance Indicator 2a:

- Ensure, when possible, that production numbers meet those negotiated through *U.S. v. Oregon.*
- Estimate ENFH's contribution to harvest through CWT recoveries.

Performance Indicator 3a:

- ESA consultations under section 7 and 10 have been submitted for the previous program, and accepted. Modifications to existing BA's are completed to cover any program changes.

Harvest

Performance Indicators 4a – 4d:

- Estimate number of fish released and associated harvest through CWT recoveries.
- Estimate number of non-target listed fish taken in the harvest through CWT recoveries, analysis of scales taken, and creel surveys.
- Estimate angler hours/days through creel surveys.

Performance Indicators 5a – 5c:

- Mark production sufficiently to obtain statistically valid evaluation data. Marking will consist of 100% adipose fin-clipping, with a portion also receiving a CWT and/or a PIT tag.

Conservation of Wild/Naturally Spawning Populations

Performance Indicators 6a and 6b:

- Conduct SUS spawning ground/redd surveys. Estimate number of ENFH adults on the spawning grounds (see appendix A).
- See 5 above.

Life History Characteristics

Performance Indicators 7a – 7c:

- Release numbers do not exceed mitigated requirement, or level as stated in the Hatchery BiOp.
- No juvenile releases occur outside Entiat River.
- Ensure release dates coincide with wild fish migration timing.

- Smolts are released during or just prior to smoltification, which promotes a rapid migration.
- Estimate travel time and survival through the Columbia corridor using data obtained from PIT tag recoveries at mainstem hydroelectric dams.

Genetic Characteristics

Performance Indicators 8a – 8c:

- Juveniles are released directly from the hatchery to promote homing back to the facility.
- Mark juveniles sufficiently to obtain valid stray-rate estimates.
- Stray rates are calculated through CWT recoveries on the natural spawning grounds.

Performance Indicator 9a:

- Estimate optimal release time using historical emigration data and hatchery records.

Research Activities

Performance Indicators 10a, 11a and 11b:

- Promote and conduct experiments as stated in the 2001, NMFS Hatchery BiOp, when feasible. Study designs are peer reviewed when applicable.
- Annual reports are prepared covering bio-sampling of hatchery adults (brood stock), return estimates by brood year, harvest, and straying rates.

Operation of Artificial Production Facilities

Performance Indicators 12a, 12b, 13a, 14a-c, 15a, 15b, 16a, and 16b:

- Produce annual reports indicating level of compliance with applicable standards and criteria.
- Effluent is monitored weekly to ensure compliance with NPDES guidelines.
- Conduct monthly fish health monitoring and a pre-release examination. Adherence to regional fish health protocols is strictly maintained.
- Ensure rearing densities are within designed ranges.
- Release juveniles at size range as stated in IHOT, 1995.

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 funding fully supports the evaluation program as is. The BOR has been supportive of funding as necessary.

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.

Hatchery monitoring and research activities that may lead to take include adult enumeration, genetic sampling, smolt trapping, juvenile snorkel surveys, stock assessment, and spawning

surveys. Much of the current smolt trapping, juvenile assessment, and spawning ground surveys is conducted as part of a larger Integrated Status and Effectiveness Monitoring Program (ISEMP, BPA project # 2003-017) funded by BPA. The goal of the ISEMP project in the Entiat River is to experimentally measure the effectiveness of habitat restoration efforts on wild salmonid populations particularly listed summer steelhead and spring Chinook salmon. Restrictions to minimize impacts to NOAA ESA listed species and allowable take levels for the ISEMP project are detailed in the appropriate scientific collection permit (NOAA Scientific Research Permit 1119). We have implemented a number of measures to prevent impacts to natural origin fish including appropriate measures to minimize the stress of handling (e.g. anesthesia, water to water transfers, etc.), restrictions to the timing and conditions for when fish handling can occur (e.g. water temperatures $\geq 21°C$ would preclude handling), and restrictions to minimize disturbances to naturally spawning fish and their redds.

SECTION 12. RESEARCH

12.1) Objective or purpose.
The goal of this project is to understand the population structure of naturally spawning summer Chinook salmon in the Entiat River basin and the relationship(s) between summer Chinook salmon hatchery programs in the Upper Columbia River basin and natural populations of summer Chinook salmon in the Entiat basin. This information is needed to inform management decisions regarding the direction and efficacy of a proposed summer Chinook salmon hatchery program at ENFH.

12.2) Cooperating and funding agencies.
This is a cooperative project between two USFWS offices, the MCRFRO and the Abernathy Fish Technology Center (AFTC). Funding for this project is provided by the USFWS and BOR.

12.3) Principle investigator or project supervisor and staff.
William Gale, Principal Investigator MCRFRO
Christian Smith, Co-Principal Investigator, AFTC
Dave Carie, MCRFRO
Chuck Hamstreet, MCRFRO

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.
Upper Columbia River SUS are not ESA listed, the SUS population in the Entiat River basin are considered a stabilizing population by the HSRG (2009). This population is thought to have originated from translocation and hatchery activities that occurred as part of the Grand Coulee Fish Maintenance Project and hatchery releases from ENFH. The HSRG (2009) listed the current habitat capacity for the Entiat River basin as 375 adults, though this will likely increase as habitat restoration activities are fully implemented in the basin.

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

This project utilizes genetic samples collected from SUS carcasses during annual spawning ground surveys. See attached study plan (Appendix B) for details.

12.6) Dates or time period in which research activity occurs.
Annual redd surveys in the Entiat basin occur during the months of September, October and November.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.
Not applicable.

12.8) Expected type and effects of take and potential for injury or mortality.
There is the potential that during the SUS spawning ground surveys adult spring Chinook salmon will be scared off of redds or out of spawning areas. There is also the possibility that redds could be disturbed while surveyors wade in the creek.

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 1).
We do not anticipate any direct take (lethal take, injury, handling) of NOAA ESA listed species as result of this research project.

12.10) Alternative methods to achieve project objectives.
If a weir or other adult management facility were available in the Entiat River that allowed the collection and handling of SUS, the genetic samples for this project could be collected prior to spawning. This strategy would likely allow a greater sample rate, though the impact of handling and sorting at such a facility has a greater potential to lead to injury or impaired performance. Through spawning ground surveys in the past we have been able to sample 20-30% of the estimated spawning population, and for the purposes of this study this is a sufficiently high sample rate.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.
None anticipated.

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.
As part of the Entiat River ISEMP project we have implemented a number of measures to avoid impacts to natural origin fish including restrictions to minimize disturbances to naturally spawning fish and their redds. We will adhere to these restrictions during both SCS (ISEMP) and SUS spawning ground surveys.

SECTION 13. ATTACHMENTS AND CITATIONS

Bottom, D.L., C.A. Simenstad, J. Burke, A.M. Baptista, D.A. Jay, K.K. Jones, E. Casillas, and M.H. Schiewe. 2005. Salmon at river's end: the role of the estuary in the decline and recovery of Columbia River salmon. U.S. Department of Commerce, NOAA (National Oceanic and Atmospheric Administration) Technical Memorandum NMFS-NWFSC (National Marine Fisheries Service – Northwest Fisheries Science Center) -68.

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Appendix A: See attached pdf file of the following citation:

Hamstreet, C.O. 2009. Spring and Summer Chinook Salmon Spawning Ground Surveys on the Entiat River, 2008. U. S. Fish and Wildlife Service, Leavenworth, WA.

This report can also be found at the following internet address:
http://www.fws.gov/midcolumbiariverfro/pdf/Spawning%20Grd%20survey%202008.pdf

Appendix B

Summer Chinook Salmon in the Entiat River: Genetic analysis of hatchery and natural origin adults spawning in the wild.

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Background

Salmon runs in the Entiat River are thought to have been functionally extirpated in the early first quarter of the 20th century following the construction of dams across the Entiat River that blocked adult emigration and spawning (Craig and Soumela 1941). It is unknown if summer Chinook salmon (*Oncorhynchus tshawytscha*) were endemic to the Entiat basin prior to dam construction but Chinook runs of an unknown race had been documented. With the construction of Grand Coulee Dam in 1939, mitigation efforts were implemented (1939-1943) with a program of adult Chinook salmon trapping at Rock Island Dam and translocation to tributaries and hatchery programs throughout the Upper Columbia River basin. This included the planting of summer Chinook (3,015 adults) into spawning areas in the Entiat River in both 1939 and 1940. The rearing and release of juvenile summer Chinook at ENFH began in 1941 and continued until 1964 (Mullan 1987). Furthermore the spawning of summer Chinook in the lower Entiat River was monitored by aerial survey from 1957 – 1991. Throughout this period the total number of redds identified was low, perhaps due to the difficulty of visualizing redds aerially, with a maximum of 55 redds observed in 1967. For the period of 1972 – 1991 aerial counts averaged just 5 redds.

Overall little effort has been made to reintroduce spring Chinook into the Entiat River using hatchery production. In the early 1940's (1942 – 1944) ENFH did release yearling and sub-yearling spring Chinook salmon obtained as progeny from adults of mixed stock origin collected at Rock Island dam (Mullan 1987). However the production of spring Chinook salmon was halted at ENFH and did not resume until 1974. In 1956 it was first noted that natural origin spring Chinook salmon were spawning in the Entiat River above Stormy Creek (French and Wahle 1960). Using out of basin egg sources the USFWS initiated a spring Chinook production program at ENFH in 1974 with the goal of mitigating for losses due to the construction of Grand Coluee Dam. Initially this program used eggs obtained from production programs located in the lower Columbia river including: Cowlitz (1974), Carson NFH (1975 – 1982) and Little White Salmon NFH (1976 – 1979, 1981). Eggs were also obtained from other upper Columbia River hatcheries (Leavenworth NFH 1979-1981, 1994; Winthrop NFH 1988) however these programs were largely based on Carson NFH stock as well. The strong influence of lower river stocks on the hatchery spring Chinook stock at ENFH is thought to pose a significant genetic risk to the natural spawning populations of listed spring Chinook salmon in the Entiat River.

Beginning in 1994 the USFWS as part of standard monitoring efforts associated with the hatchery programs at ENFH began annual redd surveys for both spring and summer Chinook salmon in spawning areas in the Entiat River. The number of summer Chinook salmon redds observed has ranged from a low of 15 (1994) to a maximum of 309 (2003). During that time the survey methodology and area has changed to better reflect the spawning distribution throughout the entire Entiat basin. In the last five years (2004-2008) we observed an average number of 157 summer Chinook redds in the survey area with a data range of 228 (2006) to 102 (2007) redds. Using a standard expansion factor this yields an estimated spawning population of 250 adults with a range of 547 (2006) to 245 (2007) adults.

Both natural origin and hatchery origin (strays from nearby hatchery programs) summer Chinook adults are known to contribute to the spawning population in the Entiat basin. Indeed, 36 % (five year average, 2004-2008) of the carcasses recovered during annual spawning ground surveys are known hatchery origin adults (data range of 27 to 58%). These stray hatchery adults predominately (≥ 95%) originated from hatchery programs in the Methow and Wenatchee River basins. Furthermore, there appears to be a shift in spatial distribution between hatchery and natural origin adults with hatchery adults selecting spawning locations lower in the Entiat basin. Indeed, 51% (five year average 2004-2008) of the carcasses recovered below McKenzie Ditch (Fig 1; X rkm) are of hatchery origin whereas only 8% of carcasses recovered above McKenzie Ditch were of hatchery origin.

In the spring of 2007 the USFWS halted the production of spring Chinook salmon at the Entiat National Fish Hatchery (ENFH) citing the risk of the current program to listed spring Chinook and steelhead (*O. mykiss*) in the Entiat River basin. This decision was reached based on a series of benefit-risk assessments and subsequent

recommendations from a Service initiated hatchery review process (USFWS 2007). Since that time ENFH has served as a backup rearing facility for the Leavenworth Complex as well as assisting the Yakama Nation (YN) with the rearing and reintroduction of coho salmon (*O. kisutch*) in the upper Columbia River basin. However, the primary goal of the ENFH has always been to help the Bureau of Reclamation (BOR) satisfy their mitigation requirements by providing salmon for local and regional harvest. To help determine the future direction of ENFH the USFWS, BOR and other Co-managers (YN, Colville Confederated Tribes (CCT), NOAA-fisheries and, Washington Department of Fish and Wildlife (WDFW)) have held a series of meetings to discuss the possible alternatives for future hatchery programs at ENFH. The result of these discussions was the determination that the addition of a summer Chinook program at ENFH might best satisfy both the mitigation requirements of BOR and the concern for minimizing the impact of the hatchery production on listed stocks of spring Chinook salmon and steelhead trout in the Entiat River basin.

There are several information gaps concerning natural populations of summer Chinook salmon in the Entiat River basin that must be answered before a hatchery program can be initiated. Namely the size, origin, and viability of any naturally occurring populations of summer Chinook salmon in the Entiat River basin must be determined. A key consideration is whether naturally spawning summer Chinook salmon in the Entiat River are distinct from the large number of spawners straying into the Entiat basin from nearby summer Chinook hatchery programs in the Methow, Wenatchee and Okanogan basins. Without this information it will be difficult for the Service and it's Co-managers to make informed decisions concerning the best strategies (e.g. integrated vs. segregated hatchery program) for creation of new summer Chinook program at ENFH.

Project Goal

The goal of this project is to understand the population structure of naturally spawning summer Chinook salmon in the Entiat River basin and the relationship(s) between summer Chinook salmon hatchery programs in the Upper Columbia River basin and natural populations of summer Chinook salmon in the Entiat basin. This information is needed to inform management decisions regarding the direction and efficacy of a proposed summer Chinook salmon hatchery program at ENFH.

Methods

Sample Collection

Genetic samples will be obtained from post spawn summer Chinook salmon carcasses encountered during annual Entiat River spawning ground surveys. Samples and data from surveys conducted in 2008 as well as upcoming surveys in 2009 and 2010 will be used for this study. Survey methods are as described in Hamstreet (2008). The Entiat River is divided into a series of survey reaches (Fig 1) starting near the confluence with the Columbia River to the ENFH (Entiat rkm 0.5 - 11) and above ENFH starting at rkm 26 and ending at rkm 45. A small reach where the Mad River enters the Entiat River is also surveyed. Each reach is surveyed by a pair of experienced biologists 2-3 times during the course of the spawning season by walking or rafting downstream. The location and number of redds are noted as well as numbers of live fish. Carcasses found during the survey are measured for fork length and length post orbital to hypural plate (POH), gender identified, spawning success (females only) recorded, scales collected and tissue samples taken for later genetic analysis. Tissue samples will be stored in 100 % ethanol prior to DNA extraction. Snouts are removed from those carcasses possessing a coded wire tag (CWT) for later retrieval and decoding of the tag. Information obtained from CWT's will be used to validate later genetic determinations of hatchery origin. Scale samples will be viewed under a microfiche reader to determine age and origin (hatchery or natural). Adipose fin presence is also used as a secondary indicator to distinguish carcasses of hatchery origin. However, because marking rates differ between hatchery programs within the Upper Columbia River basin the lack of an adipose fin cannot be viewed as an absolute measure of hatchery origin. During spawning ground surveys in 2008 a total of 60 carcasses were sampled out of an estimated total adult escapement of 319 adults (as determined from expanded redd counts).

Genetic analysis

DNA will be extracted from a small (~2mm^2) piece of fin using a DNAeasy-96 Tissue Kit (QIAGEN). The 13 microsatellite loci standardized for use in Chinook salmon (Seeb et al. 2007) will be amplified by polymerase chain reaction (PCR). Loci will be amplified in 10µl reaction volumes consisting of 5.0µl 2x QIAGEN Multiplex PCR Master Mix (final concentration of 3 mM $MgCl_2$), and 0.2µl oligonucleotide PCR primer mix. Liquid handling will be performed using a JANUS Automated Workstation (Perkin Elmer). PCR products will be size-fractionated using an AB3130 DNA Sequencer (Applied Biosystems), and raw microsatellite data (electropherograms) analyzed using GENEMAPPER 4.0. Amplified products will be binned into alleles used in the

standardized coastwide Chinook salmon baseline. All genotypes will be scored by two independent readers (double-scoring). Following completion of the data collection, 10% of all samples will be re-analyzed as part of Abernathy Fish Technology Center's (AFTC's) QA/QC protocol.

Columbia River genetic baseline
The Columbia River portion of the standardized multi-agency baseline will be used for this work. Additionally, we may use unpublished data for several Columbia River populations provided to us for this analysis by NOAA, and or WDFW researchers.

Annual Budgets

FY 2009 (Redd surveys and analysis of 2008 genetic samples)

Salary and benefits	
GS 7 Bio Tech (3 PP x $1470/PP)	$ 4,410
GS 7 Bio Tech (3 PP x $1470/PP)	$ 4,410
GS 8 Bio Tech (1 PP x $2110/PP)	$ 2,110
GS 11 Supv Fish Biologist (1 PP x $2820/PP)	$ 2,820
Benefits (35% salary costs)	$ 4,815
Total Salary and Benefits	$18,565

Supplies and Services	
Analysis of 2008 genetic samples (100 samples x $40/sample)	$ 11,110†
Field and Lab Supplies	$ 1,500
Vehicle and Fuel Costs	$ 1,000
Total Supplies and Services	$ 13,610
Total Costs	**$32,175**

†Funds for the genetic analysis will be transferred to the Abernathy Fish Technology Center (US Fish and Wildlife Service).

FY 2010 (Redd surveys and analysis of 2009 samples)

Salary and benefits	
GS 7 Bio Tech (3 PP x $1544/PP)	$ 4,630
GS 7 Bio Tech (3 PP x $1544/PP)	$ 4,630
GS 8 Bio Tech (1 PP x $2215/PP)	$ 2,215
GS 11 Supv Fish Biologist (1 PP x $2390/PP)	$ 2,390
Benefits (35% salary costs)	$ 4,855
Total Salary and Benefits	$18,720

Supplies and Services	
Analysis of 2009 genetic samples	$ 11,110†
Field and Lab Supplies	$ 1,500
Vehicle and Fuel Costs	$ 1,000
Total Supplies and Services	$ 13,610
Total Costs	**$32,330**

†Funds for the genetic analysis will be transferred to the Abernathy Fish Technology Center (US Fish and Wildlife Service).

FY 2011 (Analysis of 2010 samples and final data analysis)

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Salary and benefits	
GS 8 Bio Tech (2 PP x $2325/PP)	$ 4,650
GS 11 Supv Fish Biologist (1 PP x $2390/PP)	$ 2,510
Benefits (35% salary costs)	$ 2,505
Total Salary and Benefits	$ 9,665
Supplies and Services	
Analysis of 2010 genetic samples and final data summary for all three years	$17,460†
Lab Supplies	$ 500
Total Supplies and Services	$17,960
Total Costs	**$27,625**

†Funds for the genetic analysis will be transferred to the Abernathy Fish Technology Center (US Fish and Wildlife Service)

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

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

Listed species affected: *Spring Chinook Salmon* ESU/Population: *Upper Columbia River / Entiat River* Activity: *Brood Collection / Adult Management*				
Location of hatchery activity: *Entiat NFH* Dates of activity: *July to November* Hatchery program operator: *USFWS*				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			Up to 5	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

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.

Instructions:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Natural origin recruit (NOR) - See *natural fish* .

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

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

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

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

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

Stock - (see “Population”).

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

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

Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.

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

	SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	SIZE CRITERIA Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Fingerling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fed Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 800	0.6 to <23
X	Sockeye Fall Releases	<150	>2.9
X	Sockeye Fry	> 800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fed Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fingerling	>20 to 150	3 to <23
X	Steelhead Fry	>150	<3
X	Cutthroat Trout Yearling	<=20	>=23
X	Cutthroat Trout Fingerling	>20 to 150	3 to <23
X	Cutthroat Trout Fry	>150	<3
X	Trout Legals	<=10	>=45
X	Trout Fry	>10	<45

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria and 1 year old.