HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Elwha River Summer/Fall Chinook Hatchery Program
Species or Hatchery Stock:	Elwha River Summer/Fall Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Elwha River / Puget Sound Strait of Juan de Fuca
Date Submitted:	
Date Last Updated:	November 21, 2012

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Elwha River Summer/Fall Chinook Program

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

Elwha Summer / Fall Chinook (*Oncorhynchus tshawytscha*) - listed as "threatened"

The Elwha Chinook have been identified as a needing to attain Low Risk status for the Strait of Juan de Fuca Major Population Group (MPG) and the greater Puget Sound Chinook Evolutionary Significant Unit (ESU) to be considered viable.

The Elwha co-managers have taken this recovery objective of low risk and aligned the long-term management of the Elwha Chinook with the "Primary" category, adopted by other recovery domains and the Hatchery Scientific Review Group (HSRG).

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:

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

Funding information	Operational Information
General Fund –local	Annual operating cost (dollars) $303,367 FTEs = 3.23
Annual operating cost applies to the Elwha Chinook Programs.	

Originally the program was funded as a mitigation program through the original Elwha dam owners, the Crown Zellerbach Paper Company. The pulp mill at Ediz Hook operated by Crown Zellerbach was sold to Daishowa America, and then to Nippon Paper Industries. The ownership of the Elwha dams has now transferred to the National Park Service (Federal government).

In January 1992 the U.S. Congress enacted the Elwha River Ecosystem and Fisheries Restoration Act (Public Law 102-495). The Elwha Act (http://www.nps.gov/olym/naturescience/elwha-

restoration-docs.htm) provided funding for the federal acquisition of the Elwha and Glines Canyon dams and required a specific plan to achieve full restoration of the Elwha River ecosystem and fisheries (Ward et al 2008). Operation and maintenance funding for the Elwha rearing channel and the Morse Creek facility is currently provided by a donation from the National Parks Foundation.

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

Broodstock Collection

Elwha Channel Adult Trap: Elwha River (WRIA# 18.0272) at RM 3.5
-All adults collected, at all locations, are brought and held at the Elwha Channel.

In-river Resistance-board Weir (RBW):
Elwha River (WRIA# 18.0272) at RM 3.7

Lower Elwha Klallam Tribal Hatchery Trap:
Elwha River (WRIA# 18.0272) at RM 1.0

Morse Creek Hatchery: Morse Creek (WRIA# 18.0185) at approximately RM 1.0

-Used as a back-up to Elwha River collections and to minimize treated water needs in the Elwha River.

Incubation and Rearing:

Hurd Creek Hatchery: Hurd Creek (WRIA#18.0028) at R.M. 0.2, tributary to Dungeness River (WRIA#18.0028) at RM 2.8.

Sol Duc Hatchery: Sol Duc River (WRIA#20.0096) at RM 29.

Acclimation and Release:

Elwha Channel: Elwha River (WRIA# 18.0272) at RM 3.5

Morse Creek Hatchery: Morse Creek (WRIA# 18.0185) at approximately RM 1.0

1.6) Type of program.

Integrated Recovery.

(See HGMP section 2.2.3 for details regarding estimated HOS-levels and HGMP section 6.2.3 for details of NOB-levels)

1.7) Purpose (Goal) of program.

Prior to the development of the *Elwha Fish Restoration Plan* (EFRP) (Ward et al. 2008), this program was operated as mitigation for the continued operation of the two mainstem Elwha River dams.

Goals and objectives [for the program] have been defined for four phases of restoration based upon Hatchery Scientific Review Group recommendations (HSRG 2012). The HSRG recommended developing biologically-based structure to the monitoring and adaptive management plan. We have generally followed their recommendations by creating four phases, but have modified the definitions of the phases as follows:

Preservation – the period during dam removal when elevated suspended sediment concentrations are expected, at times, to be lethal to all fish in the river; resulting in a high probability of complete loss of native fish populations and their associated genetic and life history diversity. Beginning with the start of dam removal, this phase is currently in progress (as of 2012). The goal of the Preservation Phase is to preserve the existing genetic and life history diversity of native salmonid populations until fish passage is restored and water turbidity is determined to be non-lethal to fish in the river.

Hatchery Program Role - Maintain adequate hatchery production to guarantee desired adult return levels. Maintain the genetic characteristics of the extant population.

Recolonization – the period after the dams are removed, passage is restored, and fish have access to refugia from lethal suspended sediment concentrations, or suspended sediment concentrations no longer reach lethal levels expected to negatively impact fish populations. The goal of the Recolonization Phase is to ensure that salmonids are continually accessing habitats above the old dam sites with some fish spawning successfully and producing smolts.

Hatchery Program Role - Continue operation of the hatchery program, allowing returning hatchery fish to escape to spawning grounds to supplement natural spawning abundance.

Local adaptation – the period during which 1) sufficient numbers of spawning adults (e.g., meeting or exceeding minimum VSP criteria) are accessing and using newly accessible habitats above the old dam sites and 2) they are successfully spawning at a rate that allows for population growth. The goal of the Local Adaptation Phase is to maintain or increase life history diversity of wild populations through local adaptation to the Elwha River ecosystem until minimum levels of spawner abundance, productivity, and distribution are met.

Hatchery Program Role - Modify hatchery program, annually if necessary, to allow the naturally produced component to develop local adaptations. This will be done through a controlled hatchery program size and composition of the natural spawning population—with goals of PNI>0.67 and increasing, and pHOS<0.30 and decreasing. The program operation will meet and exceed the "Primary" stock management guidelines recommended by the HSRG (HSRG 2012).

Self-sustaining population – the period when all aspects of the previous stages are met, and viable, self-sustaining populations exist that can sustain exploitation by fisheries. The goal of the Self-sustaining Population is to ensure that viable, self-sustaining and exploitable population levels continue once desired values for all VSP and habitat parameters have been met and hatchery programs are no longer needed to provide for recovery or exploitation.

Hatchery Program Role - The program will have been discontinued in order to attain this phase.

WDFW requests ESA coverage only through the Preservation and Recolonization Phases, as listed above, and believes that this HGMP will use data acquired during the operation of the hatchery and recovery of naturally-spawning Chinook to develop a renewed HGMP as the Elwha Chinook salmon population transitions to the Local Adaptation Phase. The details in the "Local Adaptation" and "Full Restoration" Biological Phases described above are supplied as context for potential management in the future, as the Chinook population transitions out of the Recolonization Phase.

See HGMP section 1.11 for discussion on the annual release goals for the program. See HGMP sections 1.10 and 11 for Monitoring, and Adaptive Management of this program.

1.8) Justification for the program.

This program is identified in the EFRP as essential to the conservation and restoration of the native Elwha Chinook population. It currently, and for the near-term, represents the vast majority of the Elwha Chinook in existence.

This hatchery program is included as part of the Elwha Chinook population ESU, which is listed as Threatened under the Federal Endangered Species Act (see HGMP section 2 for ESA listing information).

This program enhances the survival of Elwha Chinook, whose existence has been limited, for over a century, to the lower 5 miles of its historic range in the river. Upon dam removal (began in

September 2011), the program will provide a source of returning Elwha Chinook adults for recolonization of the interior Elwha Basin. This hatchery program will operate in a manner that is consistent with the ESA take authorization (pending), and the EFRP.

1.9) List of program "Performance Standards".

See HGMP section 1.10 for program "Objectives and Triggers" as outlined in the Artificial Production Review (APR) "Performance Standards and Indicators" (NPCC 1999).

1.10) List of program "Performance Indicators."

See HGMP section 11, Monitoring and Evaluation of Performance Indicators, for details

1.10.1) "Performance Indicators" addressing benefits.

See HGMP section 11 for trigger levels associated with objectives.

Restoration Phase	Hatchery Program Objectives
Preservation:	• Maintain properly sized hatchery program • Prevent extinction • Retain genetic diversity and identity of extant population
Recolonization:	• Maintain properly sized hatchery program • Achieve total spawner abundance (HOS/NOS) • Achieve stock productivity objectives (NOS) • Achieve spawner distribution targets (NOS)
Local adaptation:	• Maintain properly sized hatchery program • Begin broodstock management for "Primary" (HOS/NOB) (>0.67 PNI;<0.30 pHOS)
Full restoration:	• Program Discontinued • Re-initiation only if population fails to maintain "full restoration" standards

The details in the "Local Adaptation" and "Full Restoration" Biological Phases described above are provided as context for potential management in the future, as the Chinook population transitions out of the Recolonization Phase.

Performance standards and Indicators:

Benefits	
Performance Standard	**Performance Indicator**
3.1.1 Program contributes to fulfilling tribal trust responsibility mandate and treaty rights as described in applicable agreements under *US v WA*.	
3.1.3 Program addresses ESA responsibilities.	Program is authorized (pending) to operate under the US Federal Endangered Species Act as evidenced by the formal review and acceptance of this HGMP. The program is authorized under section 4 (d), limit 6 of the ESA.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	Annual number and type of mark applied, per release group, quality estimate of marks applied, by release group.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Program is instrumental to the restoration of the iconic Elwha River Chinook population. This population represents significant biological importance (Primary) to the Puget Sound Chinook ESU. It is also an immensely important social and cultural for the Lower Elwha Klallam Tribal people and the citizens

	of Washington State.

1.10.2) "Performance Indicators" addressing risks.

See HGMP section 11 for trigger levels associated with objectives.

Restoration Phase	Hatchery Program Objectives
Preservation:	• Maintain properly sized hatchery program • Prevent extinction • Retain genetic diversity and identity of extant population
Recolonization:	• Maintain Properly sized hatchery program • Achieve total spawner abundance (HOS/NOS) • Achieve stock productivity objectives (NOS) • Achieve spawner distribution targets (NOS)
Local adaptation:	• Maintain properly sized hatchery program • Begin broodstock management for "Primary" (HOS/NOB) (>0.67 PNI;<0.30 pHOS)
Full restoration:	• Program Discontinued Re-initiation only if population fails to maintain "full restoration" standards

The details in the "Local Adaptation" and "Full Restoration" Biological Phases described above are provided as context for potential management in the future, as the Chinook population transitions out of the Recolonization Phase.

Performance Standards:

Risks	
Performance Standard	**Performance Indicator**
3.1.3 Program addresses ESA responsibilities.	This program is authorized (pending) to operate under the US Federal Endangered Species Act as evidenced by the formal review and acceptance of this HGMP. The program is authorized under section 4 (d), limit 6 of the ESA.
3.2.2 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.	Appropriate coded-wire tag groups are released annually to monitor harvest rates on the Elwha Chinook stock. Currently these rates are monitored for adherence to exploitation rates limitations on the stock not fishery benefits.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	Annual release numbers and associated marks — CWT, Otolith, other — are reported.
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release, release type (forced, volitional or direct plant), location and dates.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Best available fish culture standards are utilized to maximize the production of the program and minimize risks associated with improper fish culture practices.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, WDFW Fish Health Policy, INAD, MDFWP).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.

3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit.
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals are compliant with WDFW water rights. Facility operates in compliance with applicable passage and screening criteria for juveniles and adults.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	All application State and Co-manager fish health policies and standards are followed. Certification of fish health during rearing and immediately prior to release, including pathogens presence and virulence.
3.7.5 Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines.	All applicable fish disease policies are followed.
3.7.8 Predation by artificially-produced fish on naturally–produced fish does not significantly reduce numbers of natural fish.	Dates, size and location of release. Annual estimates of dates and abundance hatchery juveniles trapped at the in-river smolt trap compared to size, date and abundance of natural-origin juveniles trapped.

1.11) Expected size of program.

Currently, up to 2,900,000 juveniles.

The program is currently contributing to the Genetic Conservation phase of the Elwha Restoration Plan, and as such, is releasing constant and significant numbers of juveniles to maintain high abundance of returning adult Chinook to the Elwha system.

The actual annual release number will vary around this expected number due to reliance on adults collected throughout the lower basin (see HGMP section 1.5) and due to the variance of annual in-hatchery survival rates (see HGMP sections 1.10 and 11 for Monitoring and Adaptive Management regarding annual production size).

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

During the dam removal period the National Park Service is authorized (2006 Dam Removal Biological Opinion - see HGMP section 2.1) to remove adult Chinook from the Elwha River as a conservation measure against the assumed lethal conditions of the Elwha River during dam removal. This removal authorization pertains to the operation of the resistance-board weir (WDFW), the trap at the Elwha hatchery (WDFW), the Lower Elwha Tribal hatchery trap (LEKT), any in-river seine net collection efforts (WDFW, LEKT) and hook and line collection (WDFW, LEKT).

Currently, up to 1,700 of the collected adults will be utilized for program broodstock. Fish collected in excess of hatchery broodstock needs will be transported and/or released to mainstem waters above the dam removal projects or to tributaries. See take table at end of HGMP for estimates of all Hatchery program related take. This maximum level will remain consistent throughout the two initial phases of the Elwha restoration plan: Preservation for genetic conservation, followed by Recolonization.

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

Current Program release levels and locations:

Life Stage	Release Location	Annual Release Level
Sub-yearling	Elwha River (18.0272)	2,500,000
Yearling	Elwha River (18.0272)	200,000
Yearling	Morse Creek (18.0185)	200,000

Subsequent to the transition from the Recolonization phase to the Local Adaptation phase, the Chinook production program will institute modifications to the size, composition, life phase and release location of the current program, through periodic evaluation of the program performance relative to objectives consistent with HSRG guidelines for an integrated recovery program.

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

Historic smolt-to-adult survival estimates for this program are limited due to the low number of brood years identified with coded-wire tags. In the mid 1990s, groups of sub-yearling and yearling releases were differentially tagged to compare survival rates of the two different age groups. The 1994 yearling release (1992 BY) survived at a rate of 0.24% while the sub-yearling release (1993 BY) survived at a 0.16% rate. Three tag groups were released from the 1994 brood. Two sub-yearling groups averaged 0.09% total survival. A third group of yearlings survived at a rate of 0.06%.

Beginning with the 2004 brood year, an origin-specific comparison of the survival and age-at-return was initiated. All Elwha River Chinook salmon from the 2004 brood year and later are recognizable as one of three out-migrant types natural-origin juvenile out-migrants, hatchery sub-yearling, or hatchery yearling. Chinook juvenile emigrants during the 2004 and 2005 were predominantly (84-93%) sub-yearling hatchery fish. In order to compare survival and age-at-return among these juvenile emigrant types, adult Chinook spawner carcasses were collected from the Elwha River during 2007-2011 summer/fall spawner surveys, brood stock collection, and operation of the resistance-board weir (RBW). Age-at-return differed among out-migrant types. Wild out-migrants returned primarily as age-4 spawners (61%), whereas hatchery yearling releases returned primarily as age-3 spawners (55%). Returns of hatchery sub-yearling out-migrants were evenly distributed among age-3 and age-4 spawners.

Survival-to-return for two hatchery release strategies (sub-yearling and yearling) and natural fish. (WDFW unpublished).

Return Year	Natural Production Adult Returns		Elwha Hatchery Sub-yearling to Adult Returns		Elwha Hatchery Yearling to Adult Returns	
	BY 2004	**BY 2005**	**BY 2004**	**BY 2005**	**BY 2004**	**BY 2005**
2007	27	3	197	41	20	0
2008	47	16	224	788	10	0
2009	0	62	21	2035	7	7
2010	0	21	0	581	0	5
Total Return	74	102	442	3,444	38	12
Total Out	166,639	106,312	2,750,000	3,026,091	173,409	140,900
Survival-to-Return	0.044%	0.096%	0.016%	0.114%	0.022%	0.008%

Survival-to-return for two hatchery release strategies (sub-yearling and yearling) is calculated as the number of spawners returning divided by the number released for that brood year. Survival-to-return for natural production is calculated as the number of spawners returning divided by the smolt trap estimate of natural juvenile emigrant production for that brood year.

For recent CWT-based smolt-to-adult rates (%), see HGMP section 3.3.1

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

Chinook releases into the Elwha River started in 1914, but consistent annual releases did not occur until 1953. The Elwha Channel, built in 1974, was originally designed to be a spawning channel, but because of difficulties in attracting adults onto the site, it was modified for use as rearing ponds.

1.14) Expected duration of program.

On-going.

This program will continue to contribute to the conservation and restoration of the Elwha River Chinook throughout the Preservation and Recolonization phases of Elwha chinook restoration. During the Local Adaptation phase, WDFW will begin managing for the proportion of natural-origin chinook in the broodstock (pNOB), as well as managing the proportion of hatchery-origin spawners (pHOS) in the naturally-spawning population. The intent is that the program will be eliminated upon attainment of the Self-sustaining phase of recovery. The focus and structure of the program will shift over time to meet the objectives outlined in the EFRP.

Consistent with the EFRP, the program's objectives are to preserve and restore the existing native Chinook salmon population. The program will first help ensure that the remnant native Elwha River Chinook population is preserved prior to and during the dam removal period (2007-2014) - this is the Preservation Phase identified in the HSRG review of the Elwha Fish Restoration Plan (2012). Post dam removal period, the program will continue to produce returning adult fish with the primary goal of bolstering (supplementing) natural recolonization of the newly accessible interior Elwha Basin: this is the Recolonization Phase identified in the HSRG review. The program will transition through several phases of operation, based on the resulting response of the natural-origin population, overtime, until it can eventually be discontinued, once the natural Chinook salmon population is restored to a self-sustaining and exploitable wild population.

Construction on Morse Creek Hatchery was completed in 2009. The facility will be operated for up to 12 years, as a genetic reserve and alternative broodstock source in the event of a catastrophic loss of the donor natural- or hatchery-origin components of the population in the Elwha River during and after dam removal. After 12 years the infrastructure will be removed and the site will be restored and re-vegetated to its condition before the hatchery was built.

1.15) Watersheds targeted by program.

Elwha River (18.0272) and Morse Creek (18.0185)

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

1.16.1) Brief Overview of Key Issues

A critical component of the overall restoration strategy is the preservation of existing populations during the time the dams are being removed. Although natural re-colonization is an integral part of the overall restoration strategy, sediment levels in the main stem Elwha River below Glines Canyon Dam are expected to reach levels that may cause direct mortality to fish. Hatcheries will be used to ensure an adequate number of fish survive the dam removal process to effectively preserve and restore currently extant fish populations in the watershed.

The Elwha Act calls for the removal of the dams and full restoration of the Elwha River ecosystem and native anadromous fisheries (Ward et al, 2008). The following are goals central to implementing the act:

- Re-establish self-sustaining anadromous salmonid populations and habitats throughout the Elwha River watershed and its nearshore as quickly as possible, using the most appropriate methods.
- Maintain the integrity of the existing salmonid genetic and life history diversity before, during, and after dam removal and the subsequent periods of elevated sediment levels.
- Maintain the health of fish populations before, during, and after dam removal.
- Restore the physical and biological processes of the overall ecosystem through dam removal, including the return of viable salmonid populations (VSPs).

1.16.2) Potential Alternatives to the Current Program

Generalized alternatives to artificial production to attain restoration of Chinook salmon in the Elwha River, as a goal of the EFRP:

1) *Discontinuation of the program when the dam removal process begins (2011)*. Currently the hatchery program contributes significantly to the overall abundance of Chinook adults returning to the Elwha River. Discontinuation of the program prior to confirmation of the Elwha Chinook population's ability to re-colonize and establish a self-sustaining stock of fish, would potentially risk the extirpation of the Elwha Summer/Fall Chinook.

2) *Discontinuation of the program once Dam removal is completed (2013).* Currently the hatchery program contributes significantly to the overall abundance of Chinook adults returning to the Elwha River. Discontinuation of the program prior to confirmation of the Elwha Chinook population's ability to re-colonize and establish a self- sustaining stock of fish, would potentially risk the extirpation of the Elwha Summer/Fall Chinook. The continuation of the program is essential until the establishment of a self-sustaining and viable natural-origin stock is verified.

3) *Discontinuation of the program once the predicted sediment load is reduced in the Elwha River (2017)*. Currently the hatchery program contributes significantly to the overall abundance of Chinook adults returning to the Elwha River. Discontinuation of the program prior to confirmation of the Elwha Chinook population's ability to re-colonize and establish a self-sustaining stock of fish, would potentially risk the extirpation of the Elwha Summer/Fall Chinook. The continuation of the program is essential until the establishment of a self-sustaining and viable natural-origin stock is verified.

The Hatchery Scientific Review Group (HSRG) completed a review of the Elwha River Fish Restoration Plan and associated HGMPs in January of 2012 (HSRG 2012).

4) HSRG observed, in section 2.1.3 of the review, that the current marking and tagging schedule for the program may result in inaccurate estimates of North Pacific (non-SUS) fishery harvest rate and consequently, inaccurate estimates of total stock exploitation rates, likely low.

   WDFW proposes in HGMP section 10.7 to begin marking Elwha hatchery chinook to efficiently identify the hatchery- or natural-origin of fish to aid in implementing broodstock management principals intended to reduce hatchery influence in the naturally spawning population, with the intent of developing a self-sustaining locally adapted stock.

5) HSRG stated, in section 2.2.2 of their review, that "Assumptions about survival by life stage should also be explicitly stated, especially in light of the poor survival observed for Chinook in recent years."

Alter the program release strategies to maximize the performance of the program toward its intended goal (phase-specific). Make adjustments to the ratio of sub-yearling: yearling releases accordingly.

6) HSRG Recommends, in section 2.2.5, to "Manage harvest, hatchery broodstock, and natural spawning escapement to meet HSRG standards appropriate to the affected natural population's designation."

Make adjustments to the program, so the population can meet the standards for broodstock management that the HSRG recommends for "Primary" population management. Namely, minimum of 10% pNOB for integrated programs for genetic continuity and objectives of >0.67 PNI and <0.30 pHOS. Currently, with the marking and tagging structure implemented, it is not possible to monitor pNOB levels in real time. Post-season evaluation of otoliths, from broodstock, generates the pNOB estimates. However, as recovery of Chinook in the Elwha proceeds, there will be a growing need to efficiently identify the hatchery or natural-origin of fish to aid in implementing broodstock management principals intended to reduce hatchery influence in the naturally spawning population, with the goal of developing a self-sustaining locally adapted stock. This recommendation will be addressed during the Local Adaptation phase of recovery.

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

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

Endangered Species Act – Section 7 Consultation Biological and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation (NMFS 2006). This exempts the National Parks Service its partner entities from ESA take prohibitions associated with the removal and transport of adult salmon and steelhead during the dam removal period.

For take associated with the operations of the hatchery program and adult removal and transport after the Dam removal period:

None, currently. This HGMP is submitted to the NOAA Fisheries for ESA consultation and take prohibition exemption under ESA section 4(d), limit 6.

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

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

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

Elwha River Summer/Fall Chinook salmon, part of the Puget Sound Chinook ESU (*Oncorhynchus tshawytscha*), listed as "threatened" on March 24, 1999 (64 FR 14308); threatened status reaffirmed on June 28, 2005 (70 FR 37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

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

Elwha River steelhead, part of the Puget Sound Steelhead DPS *(Oncorhynchus mykiss*), were listed as threatened under the ESA on May 11, 2007 (72 FR 26722); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Puget Sound Steelhead (*Oncorhynchus mykiss*): listed as threatened under the ESA on May 11, 2007 (72 FR 26722); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Hood Canal summer chum (*Oncorhynchus keta*): Listed as threatened on March 25, 1999 (64 FR 14507); threatened status reaffirmed on June 28, 20052005 (70 FR 37160); reaffirmed threatened by five-year status review, completed August 15, 2011 (76 FR 50448).

Southern Distinct Population Segment (DPS) of Pacific eulachon (*Thaleichthys pacificus)* were listed as "threatened" on May 17, 2010 (75 FR 13012).

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

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

Puget Sound Chinook

All Puget Sound Chinook populations are well below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner-recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Several of the risk factors identified by Good et al. (2005) are also still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat. Many of the habitat and hatchery actions identified in the Puget Sound Chinook recovery plan are expected to take years or decades to be implemented and to produce significant improvements in natural population attributes, and these trends are consistent with these expectations. Overall, the new information on abundance, productivity, spatial structure and diversity since the 2005 review does not indicate a change in the biological risk category since the time of the last Biological Review Team (BRT) status review (Ford 2011).

Puget Sound Steelhead

The counts of Elwha steelhead declined sharply in the late 1980s and early 1990s, and have been very low in recent years. The estimated probability that the Elwha River steelhead population would decline to 10% of its current estimated abundance (i.e., to 10 fish) is fairly high— ~ 90% within 40 years. With an estimated mean population growth rate of -0.092 (λ = 0.912) and process variance of 0.013, the BRT was highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 8-10 years (but will occur within 70 years), and that a 99% decline will not occur within 25-30 years (but might occur within 120-150 years). However, for intermediate years and other values of decline, the BRT was highly uncertain about the precise level of risk (Ford 2011).

Hood Canal summer chum

The ESU includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington, as well as eight artificial propagation programs: the Quilcene NFH, Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, Union River/Tahuya, Big Beef Creek Fish Hatchery, Salmon Creek Fish Hatchery, Chimacum Creek Fish Hatchery, and the Jimmycomelately Creek Fish Hatchery summer-run chum hatchery programs. Critical Habitat Designated September 2, 2005 (70 FR 52630).

Southern DPS eulachon

Use of the Elwha River by eulachon was first documented in 2005 when 58 adult eulachon were reportedly captured in the Elwha River between 18 March and 28 June. Since then, adult eulachon have been captured in the Elwha River annually.

This was the first formal documentation of eulachon in the Elwha River, although anecdotal observations suggest that eulachon were a regular, predictable feature in the Elwha until the mid 1970s.

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

Elwha Chinook

Puget Sound Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S). Trend over the intervals is also given.

Brood Years	1982-1986		1987-1991		1992-1996		1997-2001		2002-2006		Trend	
Populations	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**
Elwha Nat Spawners	2.92	0.9	1.14	0.17	1.99	0.79	2.37	0.5	1.46	0.27	-0.17	-0.09
ESU	***9.57***	***2.19***	***5.05***	***0.96***	***3.01***	***1.24***	***2.70***	***1.19***	***1.67***	***0.67***	***-1.81***	***-0.28***

Source Data: Ford 2011

Short and long term population trend and growth rate estimates for the Puget Sound Chinook ESU populations.

Regions and Populations	Years	Trend Natural Spawners w/CI	Hatchery Fish Success = 0 Lambda w/CI	p>1	Hatchery Fish Success = 1 Lambda w/CI	p>1
Elwha River Summer/Fall Run	1995-2009	0.973 (0.9 - 1.052)	0.944 (0.394 - 2.261)	0.28	0.781 (0.36 - 1.693)	0.08
	1986-2009	0.934 (0.896 - 0.974)	0.902 (0.717 - 1.135)	0.12	0.763 (0.624 - 0.931)	0.01

Source Data Ford 2011

Elwha Steelhead:

Estimates of exponential trend in the natural logarithm (ln) of natural spawners (lambda) for winter-run populations of steelhead in the Puget Sound DPS over the entire data series (1985 – 2009)

Steelhead Population Exp. Trend ln(nat. spawners) (95% CI)

Population	1985-2009	1995-2009
Elwha River winter-run	0.840 (0.749 - 0.943)	0.750 (0.020 - 28.503)

Source Data: Ford 2011

Hood Canal Summer Chum (Juan de Fuca):

Short and long term population trend and growth rate estimates for the Hood Canal Summer Chum ESU populations.

Population	Years	Trend Nat Sp w/CI	Hatchery Fish Success =0		Hatchery Fish Success =1	
			Lambda w/CI	p>1	Lambda w/CI	p>1
Juan de Fuca	1995-2009	1.184 (1.06 - 1.324)	1.139 (0.242 - 5.365)	0.76	1.009 (0.255 - 3.989)	0.53
Juan de Fuca	1971-2009	1.013 (0.984 - 1.043)	1.028 (0.872 - 1.211)	0.65	0.99 (0.867 - 1.129)	0.43

Source Data: Ford 2011

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

Elwha Chinook:

The following table provides total escapement estimates for Elwha River Chinook for 1998-2009 (includes hatchery volunteers, gaff/seine removals, in hatchery pre-spawning mortalities & natural spawners).

Elwha River Chinook total escapement 1999-2010.

Year	Broodstock collected/trapped	Total Natural Spawners	Pre-Spawn Mortality	Total Escapement
1999	699	903	23	1,625
2000	1,136	715	62	1,913
2001	1,553	655	38	2,246
2002	1,505	863	40	2,408
2003	1,182	1045	78	2,305
2004	1,325	2075	39	3,439
2005	1,396	835	7	2,238
2006	1,229	693	11	1,933
2007	757	380	9	1,146
2008	667	470	16	1,153
2009	1,514	651	16	2,181
2010	709	564	5	1,278
Average	**1,139**	**821**	**29**	**1,989**

Source: Data provided by Randy Cooper (WDFW Area Biologist), and Mike Gross (WDFW District Biologist).

Elwha Steelhead:

Recent available estimates of total Elwha steelhead spawner abundance.

Run Year	Natural Escapement Estimate
2004/05	100
2005/06	123
2006/07	88
2007/08	No est.
2008/09	45
2009/10	193
2010/11	246
Average	**133**

Source: Data provided by Randy Cooper (WDFW Area Biologist), and Mike Gross (WDFW District Biologist).

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

Note- Information provided in this section only pertains to the Elwha Hatchery Chinook Program. No estimates of hatchery-origin spawner levels are presented for other listed-species in the basin.

With only 1992-1994 brood years being adipose-fin clipped/coded-wire tagged at this time, monitoring NOR/HOR ratios on the spawning grounds has been limited (see HGMP section 10.7). It is assumed, though, that the majority of the Chinook on the spawning grounds are of

hatchery-origin. Recent analyses of otolith data collected from adult Chinook salmon that spawned in a lower river side channel area long thought to have sustained natural production of the species showed that first generation hatchery-origin fish comprised 76% (2008) and 96% (2009) of the total number of fish sampled from the area (Ward et al 2008).

Beginning with the 2004 brood year, an origin-specific comparison of the survival and age-at-return was enabled by a hatchery program that fully marks or tags hatchery releases and a smolt trap study that estimates the number of wild Chinook out-migrants. All Elwha River Chinook salmon from the 2004 brood year and later were recognizable as one of three out-migrant types: wild sub-yearling, hatchery sub-yearling, or hatchery yearling. Chinook out-migrants during this period were predominantly (84-93%) sub-yearling hatchery fish.

From 2007 to 2010, WDFW field staff collected mark, coded-wire tag and otolith information from returning adult Chinook from three sources, hatchery trap, collection of broodstock by gaffing adults in-river, and from stream surveys (Table). Origin is interpreted from CWT and otolith marking. Chinook origin was not statistically different among the different collections. For this reason, the composition of all samples was pooled together for an increase in precision resulting from the larger sample size.

Origin of returning Elwha River natural Chinook spawners, 2007-2010.

Number Sampled by Year (Hatchery Trap, Broodstock, Natural Spawner Combined)					**2009-10**	**2009-10**
Strategy	**2007**	**2008**	**2009**	**2010**	**Average**	**Percentage**
Hatchery Elwha Sub-yearlings	82	196	299	249	274	93%
Hatchery Elwha Yearlings	12	2	2	9	6	2%
Hatchery - Out of Basin Origin	1	0	2	2	2	1%
Natural-origin	9	12	10	15	13	4%
UNK *	235	11	0	0	0	0%
N/A **	41	6	2	0	1	0%
Total	380	227	315	275	272	

Source: Sampling data collected by R. Cooper and S. Williams; compiled by M. Zimmerman, WDFW

* Otolith data were collected but results could not be interpreted because some age classes of unmarked otoliths could be either natural or hatchery sub-yearlings. Not all age classes were marked for returns in 2007 and 2008. This is combination of unmarked hatchery sub-yearling and natural-origin.

** Data collected from these fish were not sufficient to determine an origin (i.e., otolith could not be read, tag lost, etc.)

Origin of all Chinook could only be interpreted for the 2009 and 2010 return years because otolith thermal-marking began with the 2004 brood year. Because of the significant number of unknown-origin fish in the 2007 and 2008 data, years 2009-2010 were averaged. About 95% of returning adults from 2008 to 2010 were identified as originating from Elwha hatchery programs.

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

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

Broodstock Collection and utilization:
Broodstock collection includes adults volunteering to the hatchery trap, adults collected at the Elwha River resistance-board weir (RBW), river beach seining, gaffing and hook and line activities to assure adult removal goals* are met.

Utilization for broodstock in this hatchery program will result in the intentional lethal take of adult Elwha Chinook salmon (see HGMP section 7 for broodstock utilization information).

* Endangered Species Act – Section 7 Consultation Biological and Conference Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation (NMFS 2006). This exempts the National Parks Service and its partner entities from ESA take prohibitions associated with the removal and transport of adult salmon and steelhead during the dam removal period.

Hatchery rearing: There are inevitable losses of juveniles associated with the artificial production. The program will utilize all available scientific knowledge and technique to minimize the mortality at all life-phases that occur in the hatchery. See HGMP sections 7-9 for "in-hatchery" mortality rate estimates.

Post-release Predation/Competition: Fish, produced in the artificial rearing environment of the hatchery and later released into a natural river system, present risks and take potential to listed populations in the form of density-related competition as well as direct predation risk. Hatchery Chinook will be released to replicate one of two life-history rearing strategies; sub-yearling or yearling. Sub-yearling smolts will be released in June to minimize in-river residence and reduce potential competition and predation on native, wild salmonids. Yearlings will be released in April as they are smolting, this will quicken their out-migration and reduce the potential predation and competition on wild salmonids (Steward and Bjornn 1990). Any future alterations to the composition and location of releases from this program, as described in the EFRP, will take into account the potential additional risks associated to completion and predation prior to implementation of changes.

Disease Effects: Artificial production of salmon brings with it the risk of fish pathogen amplification and can result in that risk being spread to the fish populations in the river system, resulting in potential take of listed fish. This risk is assumed to be low and minimized by following all applicable co-manager accepted fish health guidelines.

Hatchery facility operations: The environmental footprint of the facility, in the form of surface water intake structure and water withdrawal and the effluent water emitted from the facility have the capacity to impact take listed fish in the Elwha River watershed. There is no clear indication that take associated with these aspects of the hatchery operation is occurring. However, impacts are unknown and expected to be low due to compliant facility structures.

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

Past takes levels associated with adult Elwha Chinook collection and utilization as broodstock, as well as lethal take during the in-hatchery rearing period are available in HGMP sections 7 and 9.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See the "take" table at end of HGMP for estimates of potential take associated with the current and proposed program.

-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.

WDFW will notify and confer with the LEKT and NOAA Fisheries when any annual operating actions are likely to exceed the take–levels described in this HGMP.

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.

WDFW hatchery programs in Puget Sound operate under and adhere to *U.S. v Washington* which provides the legal framework for coordinating these programs and defining artificial production objectives *Comprehensive Management Plan for Puget Sound Chinook-Chinook Hatchery RMP* (2004); and the co-manager Hatchery Action Implementation Plan (HAIP) (draft) for the watershed (see HGMP section 3.4).

The *Elwha River Fish Restoration Plan* (2008) resulted in changes to the program to develop appropriate production goals and protocols. This is in response to the removal of the Elwha River dams, which began September 2011. Modifications to the program in consultation between WDFW, the Elwha Tribe, and USFWS may occur as additional information is collected and analyzed (see HGMP section 1.11).

Hatchery Reform- Principles and Recommendations of the Hatchery Scientific Review Group. This report provides a detailed description of the HSRG's scientific framework, tools and resources developed for evaluating hatchery programs, the processes used to apply these tools, and the resulting principles, system-wide recommendations, and program-specific recommendations to reform (HSRG 2004).

Hatchery program operation is consistent with the "Agreement Covering Contribution Toward Cost of Construction and Operation of Salmon Rearing Pond and Appurtenant Facilities on Elwha River" (Agreement, April 25, 1975). As of February 2000, with the purchase and operation of the dams by the federal government, WDFW has furnished all the management, planning, supervision, administration, personnel, materials, chemicals, tools, equipment, supplies transportation, facilities and for the operation and maintenance of the Morse Creek facilities, as funded by the NPS.

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

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* and the *Puget Sound Salmon Management Plan* (1985) which provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing rights through the court-ordered Puget Sound Salmon Management Plan (PSSMP) (1985).

The Annual Management Framework Plans and Salmon Runs' Status Reports for the Strait of Juan de Fuca, and the *Annual Winter and Summer Steelhead Forecasts and Management Recommendations*, are authored by WDFW, the Lower Elwha Klallam Tribe, the Point No Point Treaty Council, and Makah Tribe.

See also HGMP section 3.1.

3.3) Relationship to harvest objectives.

No direct relationship to any harvest objectives.

Presently, no harvest is directed on this stock. Terminal Chinook fisheries and terminal fisheries for other species as well, have been curtailed in the Elwha River and marine area in the proximity of the Elwha River (Freshwater Bay) to minimize impacts on Elwha Chinook. Adult fish are harvested in mixed stock marine waters, particularly the ocean and the Strait of Juan de Fuca as well as Canadian waters.

There are no plans for future fishery benefits from this program. Future fisheries may be directed toward wild Elwha Chinook, once a self-sustaining, viable and exploitable population is re-established in the basin. The hatchery program is intended to be discontinued when the Self-sustaining phase of recovery is achieved.

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

Fishery Augmentation is not a current goal of this program. Any harvest benefit is purely incidental. Harvest plans are designed to minimize interception of Elwha River Chinook.

Current harvest-rate management limits for Southern US (PFMC) managed fisheries encountering Elwha River Chinook are for <10.0% total harvest rate.

Under the Pacific Salmon Treaty, current management ceilings in Pacific Salmon Commission-managed fisheries have resulted in harvest rates on Dungeness River Chinook (used to represent Elwha River Chinook) ranging from 30% to 40% in recent years.

The tables below represent recent fishery-year averages of incidentally harvest on Elwha hatchery Chinook. These estimates are based on coded-wire tag (CWT) recoveries and calculated as the percent of total survival that the recoveries represent (WDFW).

Elwha River Hatchery sub-yearling fall Chinook fishery contributions.

Brood Years: 2002-2004 Fishery Years: 2005-2008		
	Average SAR%	**0.02**
Agency	***Non-WA Fishery***	***% of total Survival***
CDFO	All	*5.2*
Agency	***WA Fishery***	***% of total Survival***
UNK	50- Hatchery Escapement	*5.5*
WDFW	50- Hatchery Escapement	*40.0*
WDFW	54- Spawning ground	*49.3*
	Total	***100.0***

Source: RMIS 2012

Elwha River Hatchery yearling fall Chinook fishery contributions.

Brood Years: 2003-2004 Fishery Years: 2007-2008		
	Average SAR%	**0.03**
Agency	***Non-WA Fishery***	***% of total Survival***
CDFO	All	*12.7*
Agency	***WA Fishery***	***% of total Survival***
WDFW	15- Treaty Troll	*3.2*
UNK	50- Hatchery Escapement	*5.5*

WDFW	50- Hatchery Escapement	*21.5*
UNK	54- Spawning ground	*6.6*
WDFW	54- Spawning ground	*50.4*
	Total	***100.0***

Source: RMIS 2012

Morse Creek Hatchery yearling fall Chinook fishery contributions.

Brood Year: 2004 Fishery Years: 2003-2008		
	Average SAR% 0.01	
Agency	**Non-WA Fishery**	***% of total Survival***
CDFO	All	*23.3*
Agency	***WA Fishery***	***% of total Survival***
WDFW	45- PS Sport	*44.3*
Unk	50- Hatchery Escapement	*17.4*
WDFW	54- Spawning ground	*15.0*
	Total	***100.0***

Source: RMIS 2012

3.4) Relationship to habitat protection and recovery strategies.

Elwha Hatchery Chinook salmon are included as part of the listed Puget Sound Chinook ESU. The program currently represents the vast majority of the production in the basin. As the EFRP progresses with dam removal and into the Recolonization phase, the hatchery program will be an integral part of the restoration effort, supplying adult Chinook salmon to utilize newly accessible and recovering habitat both above historic dam sites and in the lower reach of the river. Below are several of the habitat and recovery planning processes and entities that have a connection to the hatchery program:

Puget Sound Salmon Recovery Plan (2007). An ESU-wide recovery planning effort was undertaken by Shared Salmon Strategy for Puget Sound, a collaborative group dedicated to restoring salmon throughout Puget Sound (online at http://www.sharedsalmonstrategy.org). Strait of Juan de Fuca Chinook salmon populations and Elwha Chinook salmon are specifically included. Beyond dam removal, the Shared Strategy Plan includes actions adopted through the WRIA 18 Watershed Plan (Elwha-Dungeness Planning Unit 2005), the North Olympic Peninsula Lead Entity Group (NOPLE) Strategy (NOPLE 2008), and the NOPLE Draft Nearshore Strategy (Barkhuis 2005). Recovery actions included in the Shared Strategy Plan that are not in the EFRP include: water use planning, additional habitat restoration actions, near shore restoration actions, and land use planning.

Dam Removal. The EFRP is the primary component of the effort to recover the Elwha Chinook salmon population included in the ESA listing of the Puget Sound Chinook salmon ESU. However, the jurisdiction of this plan is directly linked to removal of the two dams on the Elwha River, and therefore cannot address all factors influencing the abundance of Elwha Chinook salmon or, more broadly, Puget Sound Chinook salmon. Removal of both dams, beginning in September 2011 will create access to over 70 miles of potential anadromous fish habitat for Chinook and other salmonid species. The hatchery programs will preserve and bolster Chinook abundance for the recovery program prior to, during, and post-dam removal. The long-term future of the hatchery program will depend, at least in part, upon how successfully Chinook re-colonize the Elwha River.

Hatchery Action Implementation Plans (HAIPs) are watershed-level documents developed by the western Washington Treaty Tribes (Tribes) and WDFW, which consolidate descriptions of

hatchery programs from each watershed into a single document. This document addresses co-manager priorities, legal requirements of the Puget Sound Salmon Management Plan (PSSMP) and Endangered Species Act (ESA), and recommendations of the Hatchery Scientific Review Group (HSRG). It describes the adaptation of general principles for hatchery management to the unique genetic and ecological setting of each watershed. The HAIPs also describe how hatchery programs will operate in conjunction with harvest management, habitat restoration, and habitat protection to achieve near- and long-term goals for natural and hatchery production of salmon in each watershed, as well as listing funded and unfunded capital and operating/monitoring needs for all state and tribal hatchery programs and facilities. Each HAIP will also outline the monitoring and evaluation needs and describe the co-manager's adaptive management approach.

Salmon Recovery Funding Board (SRFB). Created by the Legislature in 1999, the SRFB is composed of five citizens appointed by the Governor and five state agency directors, the Board provides grant funds to protect or restore salmon habitat and assist related activities. It works closely with local watershed groups known as lead entities (see below). The Board supports salmon recovery by funding habitat protection and restoration projects, and related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities. The Lead Entity (LE) that includes the Elwha River watershed is the North Olympic Peninsula LE (NOPLE). NOPLE's geographic area encompasses 3 WRIAs (19, 18, and a portion of 17), including 526 miles of fish-bearing streams and 177 miles of shoreline with management under two counties (Clallam & Jefferson), three cities (Sequim, Port Angeles and Forks), native tribes (Jamestown S'Klallam, Lower Elwha, and Makah), a National Park, a National Forest, a Marine Sanctuary, extensive State trust lands, large private timber companies, and, of course, individual ownership.

3.5) Ecological interactions.

(1) *Salmonid and non-salmonid fishes or other species that could negatively impact the program.* Negative impacts by fishes and other species on the Elwha Hatchery Chinook program could occur directly through predation on program fish, or indirectly through food resource competition, genetic effects, or other ecological interactions. In particular, fishes and other species could negatively impact Elwha Chinook survival rates through predation on newly released, emigrating juvenile fish in the freshwater and marine areas. Certain avian and mammalian species may also prey on juvenile Chinook while the fish are rearing at the hatchery site, if these species are not excluded from the rearing areas. Species that could negatively impact juvenile Chinook through predation include the following:

- Avian predators, including merganser, cormorant, Belted Kingfishers, Great Blue Herons, and Night Herons
- Mammalian predators, including mink, river otters
- Cutthroat trout

Rearing and migrating adult Chinook originating from the program also serve as prey for mammalian predators in marine areas, nearshore marine areas and in the Elwha River to the detriment of population abundance and the program's success in restoration. Species that may negatively impact program fish through predation may include:

- River otter
- Harbor seal
- Sea lion
- Orca whale

(2) Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program (focus is on listed and candidate salmonid species).

- Chinook salmon
- Steelhead

- Eulachon
- Bull Trout

(3) *Salmonid and non-salmonid fishes or other species that could positively impact the program.* Fish species that could positively impact the program may include Chinook salmon and other salmonid species present in the Elwha River watershed through natural and hatchery production. Juvenile fish of these species may serve as prey items for the Chinook during their downstream migration in freshwater. Decaying carcasses of spawned adult fish may contribute nutrients that increase productivity in the watershed, providing food resources for the emigrating Chinook. Many watersheds in the Pacific Northwest appear to be nutrient-limited (Gregory et al. 1987; Kline et al. 1997) and salmonid carcasses can be an important source of marine derived nutrients (Levy 1997). Carcasses from returning adult salmon have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Addition of nutrients has been observed to increase the production of salmonids (Slaney and Ward 1993; Slaney et al. 2003; Ward et al. 2003). The returns of adult Chinook will provide carcasses contributing marine derived nutrients to organisms in the river and tributaries.

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program*. The Chinook program could positively impact freshwater and marine fish species that prey on juvenile fish. Nutrients provided by decaying Chinook carcasses might also benefit fish in freshwater. These species include:
- Northern pikeminnow
- Chinook salmon
- Steelhead
- Pacific staghorn sculpin
- Eulachon
- Bull trout
- Numerous pelagic marine fish

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.

Elwha Rearing Channel. Surface and well water are both used in the production of Elwha Chinook. The City of Port Angeles completed construction of a water treatment facility in 2010 that provides Elwha River ("surface") water for the hatchery program. The Elwha Water Treatment Plant facility is designed to treat water diverted from the Elwha River through an intake structure by removing suspended sediments. It is designed for a maximum treated water capacity of 37,000 gallons per minute (gpm). The facility consists of an influent pump station, influent/chemical mix tanks, sedimentation tanks, chemical feed and storage building, effluent flow distribution structure, slurry pump stations, office/laboratory building and associated pipelines. The plant will be operated during periods of high sediment release resulting from the removal of Elwha Dam and Glines Canyon Dam. The intake includes a concrete control weir, intake structure, supplemental diversion pump structure, fish screen structure; tunnel; piping; electrical; mechanical; utilities and site work (NPS 2010).

Up to 1,200 gpm of well water is available and used for adult holding, incubation and initial rearing. Surface water is used in later rearing (up to 16,000 gpm) and for adult attraction.

Hurd Creek. Water from five (5) wells provides up to 2,000 gpm water for eyeing, incubation and rearing. Water quality is excellent, requiring only passage through a de-nitro tower to improve dissolved oxygen content. Hurd Creek surface water is available as an emergency back-up supply.

Sol Duc. Gravity-fed spring water is used for both incubation and initial rearing of Elwha Chinook.

Morse Creek Hatchery. Pumps in Morse Creek provide the rearing ponds with 1,600 to 2,400 gpm for fish rearing.

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.

Elwha Rearing Channel. The four revolving screens on the water intake meet state and federal intake screen standards (NMFS, 1995, 1996). Prior to the beginning of dam removal (September 2011), the City of Port Angeles constructed a new intake structure slightly upstream from an existing diversion structure at RM 2.8. Water collected from this intake is treated during spikes of turbidity at an Elwha water treatment plant. The new plant (completed in 2010) supplies treated water to the Lower Elwha Klallam Tribe's Lower Elwha Fish Hatchery, the Elwha Rearing Channel, and acts as a back-up to a new municipal Port Angeles Water Treatment Plant (PAWTP) during and following dam removal.

Hatchery discharge results are monitored and reported per NPDES guidelines and are in compliance with NPDES guidelines under permit number WAG13-1043. The surface and well water are used in the production of Elwha Chinook. The water right permit number is G2-29018

Sol Duc. Spring water is used for both incubation and initial rearing of Elwha Chinook (water right permit #S2-21118). Monitoring and reporting of effluent discharge results are in compliance with NPDES guidelines under permit number WAG13-1045.

Hurd Creek. Well water is used at this facility for eyeing Elwha Chinook eggs. The water right permit is #G2-24026. The Hurd Creek Hatchery produces a relatively small amount of fish each year, well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit.

Morse Creek Hatchery. Surface water is used to acclimate and rear Elwha Chinook (water right permit #S2-30527). Intake screening meets current screening and passage criteria and poses no threat to native populations. Monitoring and reporting of effluent discharge results have been in compliance with NPDES permit number WAG13-1013.

Period	Flow (cfs)
October 1 through April 30	5.8
May 1 through June 30	4.4
July 1 through September 30	0.88

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Due to poor attraction and trapping capabilities, less than 50% of the broodstock needs are typically met with volunteers into the Elwha Channel adult trap.

Broodstock collection methods include:

1. Beach seining at two specific adult holding areas in the Elwha River;

2. Capture of adult fish returning to the Elwha River Spawning Channel side-channel weir and trap;
3. Gaffing of spawning adults from the Elwha River.
4. Gill netting at specific adult holding areas in the Elwha River (used in the past for adult collection);
5. Capture of adult fish at the resistance board weir (RBW) installed in 2010 on the mainstem Elwha River at RM 3.7;
6. Capture of adult fish volunteering to the Lower Elwha Hatchery ladder and trap;
7. Capture of adult fish returning to the Morse Creek Hatchery weir and trap.

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

Green adults (those not ready to spawn) are transported from various broodstock collection locations to the Elwha Channel facility in a 400-gallon tank mounted on a flatbed truck.

Trucks available to transport juvenile Elwha Chinook

Type	Capacity
Tanker Trailer	6000 gallon
	5000 gallon
Truck-mounted tanks	2500 gallon
	2200 gallon
	1800 gallon

5.3) Broodstock holding and spawning facilities.

The Elwha Rearing Channel is 1400' x 50' and is divided into two sections, each approximately 700’ in length, by means of screens and stop logs. It was originally built as a spawning channel, but was later modified to its current rearing channel configuration. A 125' x 50' adult trapping/holding area is located directly below the Channel outfall and is equipped with a 20' x 15' spawning shed. The adult holding pond is supplied with well water.

5.4) Incubation facilities.

Hurd Creek. Eggs and milt are transported from the Elwha Channel facility (see HGMP section 8.3). They are then fertilized and incubated to the eyed stage in both vertical incubators and isolation incubation buckets.

Sol Duc. Eyed-eggs transferred from Hurd Creek are incubated from the eyed stage to ponding in Heath vertical incubators. These eggs and fry are isolated from other fish groups at Sol Duc and are checked daily. There are 35 full vertical incubator stacks that can be used to isolate individual egg takes.

Elwha Channel. A 16 half-stack incubation system is set up each year at the head of the rearing channel. It is protected from the elements by 28' X 21' canvas Quonset hut. This system is used for incubation of eggs that cannot be transferred off-station.

5.5) Rearing facilities.

Hurd Creek Hatchery. Fish are initially reared in a 20' X 20' X 2' section of the rearing channel. As the fish begin to outgrow this section of the channel, the screens are pulled and the fish are allowed to enter the upper half of the main channel, an area measuring 700' X 50' X 3'.

Sol Duc Hatchery. Elwha Chinook are started in two Burroughs ponds that are 20' X 120' and hold 45,000 gallons of water each. These ponds are supplied with spring water as needed (up to 900 gallons per minute each). This component of the hatchery population is held at Sol Duc until the fish reach a size of about 400-600 fish per pound (fpp), then are shipped to Elwha Channel for

rearing to sub-yearling or yearling smolt size. Fish destined for release as yearlings at Morse Creek are shipped at 20 fpp.

5.6) Acclimation/release facilities.

Elwha Channel. Chinook are acclimated to Elwha River water. When fish are started at the head end of this channel, however, they may be supplied exclusively with well water. The juvenile Chinook are released directly from the channel through the adult holding area and into the Elwha River.

Morse Creek Hatchery. The facility was completed in 2009. Located near the U.S. Highway 101 bridge (approximately R.M 1.0) just east of Port Angeles, it includes four "portable" fiberglass rearing ponds (100' x 10' x 5'), and a 1,350- square foot fiberglass pollution control board.

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

No operational difficulties have led to significant fish loss.

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.

Elwha channel: gravity feed river water can be used as a backup in the event of loss of power to the well pumps.

Sol Duc Hatchery: all rearing water is gravity fed to the ponds.

Hurd Creek Hatchery: a generator supplies back-up power in the event of power loss.

Morse Creek Hatchery: a generator supplies back-up power in the event of power loss and two gas powered pumps supply water in the event of pump failure.

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.

Adult Chinook salmon collected from the Elwha River, represent the extant, native population delineated by the Puget Sound TRT.

6.2) Supporting information.

6.2.1) History.

The Elwha Channel Hatchery program has been sustained for decades through the collection of broodstock from the adult salmon population returning to the Elwha River. The TRT identified Chinook salmon spawning in the Elwha River as geographically distinct from other populations in east Puget Sound and Hood Canal and genetically distinct from all other Puget Sound Chinook populations (Ruckelshaus et al 2006). The hatchery- and natural-origin components of the Elwha population are genetically indistinguishable and are thought to represent the remnant, genetically-unique Elwha Chinook population. Recent natural-origin Chinook productivity data suggests that Elwha Chinook would be extinct without supplementation from the Elwha Channel hatchery program for more than 35 years.

6.2.2) Annual size.

To achieve current juvenile release goal of 2.5 million sub-yearlings and 400,000 yearlings, approximately 1,700 adult Chinook are needed; this assumes a female fecundity of 4,600, a 50:50 sex ratio and a 10-11% holding mortality rate for adults.

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

The past proportion of natural-origin fish incorporated as broodstock is unknown. Recent data from mass-marked (CWT, Otolith) hatchery-origin adult returns indicate that hatchery-origin fish compose the majority of the current returning Elwha Chinook salmon population. Considering long-standing blockage of the mainstem river limiting natural production, and operation of the hatchery program consistent with proposed production levels since 1976 broodstock collection operations in the mainstem river and at the hatchery facility for the past 20-30 years have likely incorporated a mix of predominately first generation hatchery fish, with natural-origin fish accounting for a low proportion of totals. The program will continue to collect the required number of adult fish from the run-at-large, representative of the current annual total return.

Current levels of natural-origin adults in the broodstock will be passively attained. There are no methods for consistent, accurate, real-time identification of natural-origin fish. This will hold true for both the current genetic Preservation Phase as well as the Recolonization Phase to follow.

Future levels of natural-origin brood will be determined at the time the "Local Adaptation Phase" of the restoration is entered. This is the first phase involving active broodstock management and will require a real-time, live, detectable method of marking for all hatchery produced fish. The goals during this phase are to manage the program, at a minimum, to attain the HSRG standards for a "Primary" population: PNI >0.67; pHOS <0.30, pNOB ≥0.10.

6.2.4) Genetic or ecological differences.

No genetic difference exists between the current Elwha hatchery and natural-origin Chinook populations.

6.2.5) Reasons for choosing.

This stock is the indigenous Elwha River Chinook population.

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

Broodstock is selected randomly from all adult returns to the Elwha Channel trap, the mainstem RBW trap, and from fish collected in the river efforts. In selecting adults randomly from all returns, natural-origin adults will be included in the broodstock, keeping the hatchery and naturally-produced fish genetically similar and reducing the risk of divergence of the populations.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Only 4.9 miles of river have historically been available to anadromous fish, and the Elwha Channel (at R.M. 2.9) is located approximately half way from the mouth of the river to the lower dam site. Consequently, all adult capture currently takes place within 2.5 miles of this facility. The Elwha Chinook broodstock are collected throughout the return period from volunteers to the Elwha Channel trap, in-river gaffing and in-river netting/seining operations. Additionally, a resistance-board weir (RBW) installed by WDFW during the Chinook salmon migration period beginning in 2010 will be used to collect additional adults for broodstock.

Seining operations begin in August and may run into early September and take place just below the hatchery in two main adult holding areas. Adult Chinook begin volunteering into the hatchery trap in August and continue into early or mid-October. Gaffing starts in early to mid-September and continues to mid or late-October and is conducted seven days a week, one to two miles above

and below the hatchery facility. Gaffed fish are normally fully mature and are spawned as they are collected. Between 75-80% of the adults needed to meet the programmed egg take have been collected by gaffing and/or seining. This will likely diminish due to the use of the RBW for adult collection. All netted, volunteer, and gaffed fish are used in the spawning operation, thereby reducing sources of bias that could lead to a non-representative sample of the broodstock. See HGMP section 7.4.2 for a breakdown of the number of fish collected by year.

For all years, most losses of adult fish collected as broodstock are associated with holding adults through maturation and as a result of *Dermocystidium* infestation. Only two to three fish per year are lost in the process of collecting adults on the river.

Per the EFRP, in 2010, a resistance board weir was installed at approximately RM 3.7 (upstream from the spawning channel) to enable Chinook broodstock collection prior to and during dam removal (began September 2011). The trap is operated by WDFW's Wild Salmon Production/Evaluation Unit (WSPE) from (tentatively) March through May, and August through October, according to fish movement and flow conditions. The adult Chinook are transported to the WDFW rearing channel in a 400-gallon tank for holding and spawning in well water. No broodstock were collected at the RBW in 2010; Chinook and pink salmon broodstock were collected in 2011. Until the weir proves to be a reliable collection site, most of the broodstock will continue to be collected by the previous methods. The spacing for the holding box is 1-inch, small enough to collect essentially all life-history strategies of Chinook returning to spawn including precocious individuals (jacks) for use in hatchery broodstock.

7.3) Identity.

Since the 2004 brood year, there has been a consistent release of CWT and otolith-marked fish from this program. Beginning with the 2010 brood year releases in 2011, all sub-yearlings and yearlings produced through the program are also tagged with a blank wire tag ("agency wire") While otolith mark only fish cannot be identified while alive, their contribution to both broodstock and naturally spawning groups in the Elwha can be estimated upon return. Fish that receive a wire tag prior to release can be identified as hatchery-origin, both as juvenile out-migrants and as returning adults, with the use of a CWT detection device.

7.4) Proposed number to be collected:

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

Up to 1,700 adults collected annually.

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

Elwha channel spawn records

Year	Gaffed	Seined/Trap Volunteers	Total	Loss	Percent	Upstream/ Surplus
1998	702	987	1,689	51	3.02	0
1999	517	182	699	16	2.29	7
2000	732	404	1,136	21	1.85	41
2001	958	595	1,553	38	2.45	0
2002	952	561	1,513	40	2.64	0
2003	490	692	1,182	78	6.60	0
2004	849	480	1,329	39	2.93	0
2005	1,192	204	1,396	7	0.50	0
2006	861	366	1,227	7	0.57	4
2007	574	183	757	9	1.19	0

2008	578	89	667	16	2.40	0
2009	1,307	207	1,514	16	1.06	11
2010*	644	65	709	5	0.71	0
Average	**797**	**386**	**1,182**	**26**	**2.17**	**5**

Source: Data provided by Randy Cooper (WDFW Area Biologist), and Mike Gross (WDFW District Biologist).
* Preliminary.

Sex composition of broodstock collected (hatchery, natural, and unknown-origin combined) for Elwha Chinook program.

Year	Hatchery		
	Male	**Female**	**Jack**
1999	293	406	0
2000	509	627	0
2001	729+3[a]	824	0
2002	670+8[a]	835	0
2003	562	620	0
2004	573	752	0
2005	604	792	0
2006	487	745	0
2007	286	471	0
2008	306	361	0
2009	537	977	0
2010	334	376	7
Average	492	649	<1

Source: WDFW Hatchery Database, 2009, *FishBooks* 2011, (2010-11 data preliminary).
[a]"+" indicates live spawned males

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

There have been very few if any fish in excess of program needs. The collection table in HGMP section 7.4.2 shows the annual total of fish returned to the river that were surplus to program needs. In years when large numbers of volunteers have entered the trap on their own, gaffing has been reduced accordingly to prevent excess from occurring.

In collection years during the Preservation and Recolonization phases, adults collected in surplus to the hatchery broodstock needs, will be transported above the dam removal project area. Various monitoring needs may be fulfilled by these fish, in the early phases of the restoration plan.

7.6) Fish transportation and holding methods.

Adults netted from the river are placed in 5-ft diameter ring nets and gently maneuvered to a location where they can be transferred to a 400-gallon tank truck. From the ring nets, the fish are placed head first in a half inner tube (tube is sealed at the bottom end and contains a small amount of water), carried via the tube, and placed in a tank, containing a salt solution, on the truck. Transportation to the hatchery takes 5-15 minutes. The fish are removed from the tank, injected with Liquamycin and placed in the holding pond. Pond covers and sprinklers within the holding area keep the fish relatively calm as they mature and become ready for spawning. Adult fish are held on well water, which has an ambient temperature considerably cooler than the river. HGMP section 7.7 further describes adult holding.

In 2010, a resistance board weir was installed at approximately RM 3.7 (upstream from the spawning channel) to collect Chinook broodstock prior to and during dam removal. Captured adult Chinook are held in "fish boots" for transport by truck in a 400-gallon tank to the Elwha Channel facility, and held in well water before spawning.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adult fish are held on well water, which has an ambient temperature considerably cooler than the river, and assumed relatively pathogen free. The historic practice was to hold adults that volunteer to the hatchery on ambient river water. Significant mortalities (approaching 30%) of adults in the trap and river have occurred, due to the parasite *Dermocystidium* sp. ("*Dermo*"). The pre-spawn mortalities of trapped adults mirrored that which occurred in the wild. Therefore trapping does not appear to exacerbate the mortality rate. Adult fish are held on well water, which has an ambient temperature considerably cooler than the river, and assumed relatively pathogen free. The use of well water has significantly reduced mortality from *Dermo* to a level of about 5%.

Adults are treated daily with formalin, at a rate not exceeding 25 parts per million (ppm) at the pond outfall, as a precaution against fungus infection.

Eggs at Sol Duc Hatchery are incubated on spring water and are received from Hurd Creek Hatchery so close to hatching that formalin treatments are not administered.

7.8) Disposition of carcasses.

In recent years all carcasses have been returned to the river as part of a nutrient enhancement program.

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

Broodstock collection from the river is random occurring across the entire breadth of the adult return. In-river activity is minimized to reduce negative impacts on actively spawning fish and redds. Netted or gaffed adults are held in well water if they are not ready to spawn, which enhances their survival to spawning. Typically, water from the Elwha River is not used to hold adults, due to the high water temperatures and the presence of the parasite *Dermocystidium* (sometimes surface water is used when water temperatures are low and extra flow may attract more volunteers).

SECTION 8. MATING

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

8.1) Selection method.

Broodstock are spawned, as they ripen, across the entire maturation time frame. In-river collection, via gaffing, occurs 7-days/week, with a focus on collecting females for egg-take. If there are not enough males collected by gaffing, males from the pond may be used. On pond-spawning day, all females collected from the river, plus the females in the pond are spawned primarily with males in the pond, plus a few males gaffed from the river.

8.2) Males.

All males collected, including jacks (when present), are used in the spawning operation. Males used for spawning are collected randomly from the available spawners (see also HGMP section 8.1).

The RBW, installed at approximately RM 3.7, has a picket-spacing of 1-inch, which is small enough to be jack-tight, and could provide jacks for broodstock, per HSRG recommendations (2004).

8.3) Fertilization.

Fertilization takes place at Hurd Creek Hatchery; eggs are not fertilized at the Elwha egg-take sites (although some fertilization may take place at Elwha Channel for eggs that cannot be transferred). Eggs are collected in three- or four-fish pools, depending upon the volume of the eggs. Sperm is collected in one-fish units (no pooling), in plastic bags with oxygen. Eggs and sperm are then iced and transported to Hurd Creek Hatchery, where eggs are fertilized in a "modified factorial" design, where each bucket of pooled eggs is split into three to four aliquots, depending upon the number of females, and each aliquot of eggs is fertilized with sperm from one male. After a few moments, the eggs are recombined and placed into isolation incubation units for water hardening in iodophor and incubated until virus-free certification is completed.

8.4) Cryopreserved gametes.

Not applicable.

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.

Adults to be spawned will be chosen at random from the available gene pool. Out-of-basin strays will not be knowingly spawned or incorporated into the gene pool. Every attempt will be made to ensure that the egg-take is representative of the entire Chinook run in the Elwha River.

In an effort to minimize directed, artificial selection of traits that could negatively affect this listed population, proper spawning protocols are implemented to maximize the representation of each individual adult into the entire brood.

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:

Elwha Chinook eggs (approximately 3.5+ million) are shipped, unfertilized, to Hurd Creek for eyeing and virus certification. Upon certification, 3.3-million eyed eggs are shipped to the Sol Duc Hatchery for incubation and initial rearing. The fry are returned to Elwha at 400-600 fish per pound (fpp) by April of each year (often as early as late February if the fish are large enough to return to Elwha) for final rearing and imprinting on Elwha river water prior to release. A total of 200,000+ eyed-eggs are kept at Hurd Creek for rearing, before transfer at 20-60 fpp (October) to Elwha Channel for release as yearlings.

There are minimal incubation facilities available at Elwha Channel and no facilities at Morse Creek Hatchery. Eggs/fish destined for grow-out and planting from these facilities are incubated and initially reared at Hurd Creek and Sol Duc hatcheries.

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

Egg-to-incubation survival of Chinook eggs collected at Elwha Channel.

Brood Year	Eggs Collected (Elwha Channel)	Survival Rates (%)*	
		Green-to-Eyed Up (Hurd Cr Hatchery)	Eyed-Up-to-Ponding (Sol Duc Hatchery)
2001	4,158,000	94.79	98.04

2002	4,305,000	95.13	97.20
2003	3,447,000	95.14	97.24
2004	3,674,000	91.31	99.40
2005	3,931,000	92.16	95.30
2006	3,598,000	91.66	99.10
2007	2,201,000**	94.79	97.80
2008	1,429,000	96.13	99.40
2009	4,194,000	90.70	99.40
2010	1,886,000	92.05	97.70
Average	3,282,000	93.39	98.06

Source: WDFW Hatchery Database, 2009; *FishBooks* 2011, (2010-11 data preliminary); Hatchery Records, 2011.

* Rates are for both the sub-yearling and yearling components of the program.

** Does not include off-station egg collection.

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

There are no surplus eggs associated with this recovery program.

9.1.3) Loading densities applied during incubation.

Elwha Spawning Channel: Elwha Chinook eggs average 1300 per pound (/lb) with a range of 1,200/lb to 1,400/lb.

Hurd Creek Hatchery: Elwha eggs are incubated in vertical style incubators (FAL) at 5 lbs (6,000 – 7,000 eggs) per tray with a flow of 4 gallons per minute (gpm).

Sol Duc Hatchery: Eyed eggs are incubated at 8,000 eggs per tray or an average of about 6 lbs per tray. Flows are 4 gpm.

9.1.4) Incubation conditions.

Hurd Creek Hatchery: Eggs are incubated on pathogen free ground water at constant 47°F. All effluent water is discharged through a ultra-violet treatment unit. No silt removal is required. Dissolved oxygen remains constant at 11.2 mg/l, provided by a de-gassing tower on the well water supply.

Sol Duc Hatchery: Eggs are incubated on Vexar™ substrate. The gravity-fed spring water provides very clean water at a constant 46°F. Dissolved oxygen levels stay well within normal incubation levels.

9.1.5) Ponding.

Sol Duc Hatchery: Ponding of Elwha Chinook occurs in December and January when the fish are 95%+ buttoned up. The fry are placed directly into the Burroughs pond for rearing. Fish are transferred to Elwha Channel at 400-600 fpp (February-April) for rearing acclimation and release. Fish destined for release as yearlings at Morse Creek Hatchery are transferred in October at 20 fpp.

Hurd Creek Hatchery. Fish are initially reared in a 20' X 20' X 2' section of the rearing channel. As the fish begin to outgrow this section of the channel, the screens are pulled and the fish are allowed to enter the upper half of the main channel, an area measuring 700' X 50' X 3'. Fish are transferred to Elwha Channel at 20-60 fpp for rearing acclimation and yearling release.

9.16) Fish health maintenance and monitoring.

Elwha channel: There are no incubation facilities at the Elwha Channel; fish are incubated at Hurd Creek and Sol Duc hatcheries.

Hurd Creek Hatchery: All eggs are fertilized and water hardened in an iodophore solution. Fungus in incubators is controlled by formalin drip (at a nominal 1,667 ppm) throughout incubation to just prior to hatch. Fungus control is by formalin injection directly into the water supply header for each row of stacks. Application rate is one 15-minute injection per day at a target dose of 1,667-ppm formalin. At approximately 500 TU's the eggs are shocked and dead eggs removed by hand picking prior to laying eggs down to hatch. After mortality removal, around 3.3-million eyed eggs are inventoried and are transferred to the Sol Duc Hatchery for hatching and initial rearing; around 200,000 eyed-eggs are retained at Hurd Creek Hatchery and reared for yearling release at Elwha Channel.

Sol Duc Hatchery: Eggs are incubated on spring water to minimize fungus growth.

Morse Creek Hatchery: There are no incubation facilities at Morse Creek Hatchery. Fish reared at Morse Creek are incubated at Hurd Creek and Sol Duc hatcheries.

9.17) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Hurd Creek Hatchery: Eggs are incubated on well water to avoid loss due to silt and pathogens. All systems are alarmed with 24-hr/day monitoring and an emergency backup generator.

Sol Duc Hatchery: Sol Duc is able to incubate using very clean spring water. Siltation is never a problem during incubation.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Survival rates of Elwha Chinook sub-yearlings reared at Sol Duc Hatchery, released at Elwha Spawning Channel.

Brood Year	Sub-yearling Survival Rates (%)	
	Solduc Ponding to Elwha Transfer	Elwha ponding to release
1999	98.1	N/A
2000	98.4	N/A
2001	98.0	N/A
2002	97.2	N/A
2003	96.9	N/A
2004	98.2	99.52
2005	94.6	N/A
2006	98.1	98.9
2007	98.2	99.8
2008	99.4	99.6
2009	99.4	99.7
2010	97.7	99.4
Average	**97.9**	**99.5**

Source: Hatchery Records 2011.
N/A = Data not available.

Survival rates of Elwha Chinook yearlings, reared at Hurd Creek Hatchery, released at Elwha Spawning Channel

Brood Year	Hurd Creek Hatchery Survival Rates (%)		Elwha Ch Survival Rate (%)
	Ponding to Sub-yearling	Sub-yearling to Yearling (transfer to Elwha)	Acclimation to Release*
1999	N/A	N/A	N/A
2000	N/A	N/A	N/A
2001	N/A	N/A	N/A
2002	N/A	N/A	N/A
2003	N/A	N/A	98.1
2004	N/A	N/A	80.7
2005	N/A	N/A	41.7
2006	N/A	N/A	N/A
2007	N/A	N/A	81.1
2008	N/A	N/A	97.8
2009	N/A	N/A	98.3
2010	N/A	N/A	N/A
Average	**N/A**	**N/A**	83.0

Data source: WDFW hatchery records

N/A = Data not available.

* Survival rates are a combination of fish received from Hurd Creek, Bear Springs and Sol Duc, not solely from Hurd Creek

Low survival rates for brood years 2004, 2005, and 2007 are due to fish loss from fish transferred from Sol Duc Hatchery (40,000, 77,000 and 78,000, respectively). Mortalities were associated with bacterial gill disease (BGD), cold water disease (CWD), erythrocytic inclusion body syndrome (EIBS), bacterial kidney disease (BKD) and fungus.

Survival rates of Elwha Chinook yearlings reared at Sol Duc Hatchery, released at Morse Creek Hatchery.

Brood Year	Sol Duc Hatchery Survival Rates (%)		Morse Cr Survival Rate (%)
	Ponding to Sub-yearling	Sub-yearling to Yearling (transfer to Morse Cr)	Acclimation to Release
1999	98.1	N/A	N/A
2000	98.4	N/A	N/A
2001	98.0	N/A	N/A
2002	97.2	N/A	N/A
2003	96.9	N/A	N/A
2004	98.2	N/A	N/A
2005	94.6	N/A	N/A
2006	98.1	N/A	N/A
2007	98.2	N/A	N/A
2008	99.4	N/A	N/A
2009	99.4	N/A	N/A

2010	97.7	N/A	N/A
Average	**97.9**	**N/A**	**N/A**

Source: WDFW hatchery records
N/A = Data not available.

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

Fish rearing densities are maintained at maximum of under 3 lbs of fish/gpm at release and under 0.35 lbs /cu. ft.

9.2.3) Fish rearing conditions

Elwha channel: Fish are transferred from Sol Duc Hatchery at an individual size of 400-600 fpp, usually in February. Fish are started on 49°F well water, but are soon shifted to surface water from the Elwha River (see table below). Dissolved oxygen levels in the rearing pond are at least 10 ppm, as measured at the outflow.

Morse Creek Hatchery: Fish are transferred into the facility in October, and are reared in surface water from Morse Creek (see table below).

Average water from surface water at Elwha Channel and Morse Creek Hatchery

Month	Average Water Temperature ºF	
	Elwha Channel	Morse Creek Hatchery
October	n/a	41-53
November	n/a	34-44
December	n/a	33-44
January	37-41	33-42
February	38-42	33-42
March	40-45	36-45
April	42-47	38-45
May	45-50	n/a
June	49-54	n/a

n/a = "not applicable"

Sol Duc Hatchery: Early rearing at Sol Duc utilizes spring water at a constant 46°F.

Hurd Creek Hatchery: Early rearing uses water from five (5) wells.

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.

Average size (fpp), by month, of juvenile Chinook sub-yearlings reared at Elwha rearing channel and Sol Duc Hatchery

Month	Average Size (fpp)	
	Elwha Channel	Sol Duc Hatchery
January	625	900
February	485	500
March	310	n/a*
April	175	n/a
May	105	n/a
June	80	n/a

n/a = "not applicable"
* Fish are shipped back to rear at Elwha channel.

Morse Creek Hatchery: Fish are transferred into the facility from Sol Duc Hatchery in mid-October at an individual size of approximately 20 fpp and are reared to release at 8 to 10 fpp in early April.

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

Not available.

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

Fish feeding frequencies begin at 8 feedings/day and end at 2 feedings/day. Depending on fish size and water temperature, feed rates vary from 1.75% to 2.25% B.W./day. An overall season food conversion rate of approximately 1.2:1 is considered normal.

Bio Diet Starter #3 is fed to the Elwha Chinook while at Sol Duc. Pelleted Bio-Diet feeds are fed as a daily grower diet.

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

Fish health is monitored on a daily basis by hatchery staff and at least monthly by a state Fish Health Specialist (FSH). Hatchery personnel carry out treatments prescribed by the FHS. Procedures are consistent with the Co-Manager's Fish Health Policy (1998).

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

The migratory state of the release population is determined by fish behavior. Aggressive screen and intake crowding, leaner condition factors, a more silvery physical appearance and loose scales during feeding events are signs of smolt development. ATPase activity is not measured.

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

No "natural" rearing methods are applied through the program.

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.

All reasonable and prudent measures will be employed to minimize rearing and incubation losses. These include the use of high quality spring or well water for incubation, use of high quality feeds for rearing, rearing densities and loadings that conform to best management practices and frequent fish health inspections.

SECTION 10. RELEASE

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

10.1) Proposed fish release levels.

Age Class	Facility	Maximum Number	Size* (fpp)	Release Date	Location
Sub-yearling	Elwha Hatchery	2,500,000	80	June	Elwha River
Yearling	Elwha Hatchery	200,000	10	April	
	Morse Creek Hatchery	200,000	10	April	

***** 80 fpp ~ 80 mm fork length; 10 fpp ~ 155 mm fork length

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

Primary:

Stream, river, or watercourse: Elwha River (18.0272)

Release point: RM 2.9

Major watershed: Elwha River

Basin or Region: Strait of Juan de Fuca

Auxiliary:

Stream, river, or watercourse: Morse Creek (18.0185)

Release point: RM 1.0

Major watershed: Morse Creek

Basin or Region: Strait of Juan de Fuca

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

Release Year	Elwha Hatchery				Morse Creek Hatchery	
	Sub-yearling	Avg. size (fpp)	Yearling	Avg. size (fpp)	Yearling	Avg. size (fpp)
1999	4,025,000	78				
2000	1,803,000	64				
2001	2,583,000	60				
2002	3,962,493	71	1,500[a]	10		
2003	3,965,000	73				
2004	2,782,666	79	72,400	8		
2005	2,750,000	78	318,150	8	106,100	11
2006	2,957,000[b]	62	174,500	8	181,400	11
2007	2,609,000	65	140,900	7	206,500	12
2008	1,868,400	71	276,950	7	208,000	10
2009	926,000	61	340,946	9	0[c]	
2010	3,266,130[d]	54	201,517	9	200,500	10
2011	1,230,562[e]	64	200,824	8	202,731	12
Average	**2,671,404**	**68**	**193,465**	**8**	**184,205**	**11**

Source: WDFW Hatchery Plants database, 2011, *FishBooks* 2011

[a] Fish were initially to be used for Captive Brood program. Project discontinued.

[b] Sub-yearling releases in 2006-10 do not include 13,000 fish released by the Lower Elwha Tribe to calibrate their screw trap. In May 2006, an estimated release of 60,000 small fish (176 fpp) that arrived from Sol Duc Hatchery not included.

[c] No release into Morse Creek in 2009, fish released as part of 340,946 yearling releases from Elwha.

[d] Includes 228,000 sub-yearling reared at Morse Creek; does not include 10,000 fish released to calibrate the trap.

[e] Does not include 6,000 fish released to calibrate the trap.

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

Release Type: Volitional/Forced	Elwha Creek Hatchery		Morse Creek Hatchery
Release Year	**Sub-yearling**	**Yearling**	**Yearling**
1999	6/8-6/18	----	----
2000	6/15-6/28	----	----
2001	6/10-6/17	----	----
2002	6/11-6/14	11/14	----
2003	6/10-6/17	----	----
2004	6/13	5/1-8	----
2005	5/10-5/15; 6/10-6/15	4/1-4/5	----
2006	5/2:5/12;5/26;6/14-15	4/7-4/18	----
2007	6/6-6/14	4/7	----
2008	6/4	4/1-4/3	----
2009	6/2-6/4	3/25-3/31; 4/1	----
2010	6/2; 6/3	4/7	4/7-4/10
2011	6/7	4/13	4/1-4/12

Source: WDFW Hatchery Plants database, 2011, *FishBooks* 2011

Visible signs dictate fish release dates, i.e. working edges of ponds and screens etc. Screens are pulled to start a volitional release while those remaining are forced to leave after feed has run out or very few remain. Also, release fish in late afternoon into the evening and on a low exchange tide to prevent stranding caused by extreme low tides. From the 2002 brood year population, 70,000 Chinook yearlings were to be planted into Morse Creek. Acclimation sites had not been secured so these fish were eventually planted into the Elwha River in the spring of 2004.

10.5) Fish transportation procedures, if applicable.

The above described numbers of sub-yearling and yearling fish will be released on-station from either Elwha Channel Hatchery or Morse Creek Hatchery. Any transportation of juveniles for off-station release will be consistent with schedules specified in the EFRP.

10.6) Acclimation procedures

All Elwha Chinook are acclimated on Elwha River water prior to release.

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

Facility	Release Type (number)	Brood Year(s)	Marking
Elwha Channel	Sub-yearling (250,000)	2012 and subsequent years	Ad + CWT (and otolith mark until all sub-yearling production is ad-clipped)
	Sub-yearling (2,250,000)	2012 and subsequent years until ad-clipping initiated	otolith mark
	Sub-yearling (2,250,000)	Beginning no earlier than 2015	Ad-clip
	Yearling (200,000)	2011	otolith mark, CWT
	Yearling (200,000)	2012 and subsequent years until ad-clip initiated	otolith mark

	Yearling (200,000)	Beginning no earlier than 2014	Ad-clip
Morse Creek Hatchery	Yearling (200,000)	2011	otolith mark, CWT
	Yearling (200,000)	2012 and subsequent years until ad-clip initiated	otolith mark
	Yearling (200,000)	Beginning no earlier than 2014	Ad-clip

WDFW, Future Brood Document 2011

For 2002 through 2006 brood years, approximately 200,000 sub-yearlings were coded-wire tagged only (CWT-only) for release in the spring of 2003, 2004, 2005, 2006 and 2007, respectively, into the Elwha River. No fish from the 2007 brood year were tagged and released in the spring of 2008. No adipose-fin clipped/coded-wire tagged (Ad+CWT) fish have been released since the 1994 brood year. At that time, 10.65% of the population was identified with an Adipose clip + CWT mark. Hoko River fall Chinook are used as the indicator stock for the Straits of Juan de Fuca.

For the 2003 brood year yearling Chinook program, approximately 106,100 were coded-wire tagged (CWT) only and released in the spring of 2005 into Morse Creek while 112,500 CWT-only Chinook (out of the 318,150 total release) were released into the Elwha River. For the 2006 release (2004 BY), 181,400 CWT-only yearling Chinook were reared and transferred from the Sol Duc Hatchery and planted into Morse Creek while 174,500 CWT-only yearling Chinook were released into the Elwha River. For the 2007 release, 206,500 CWT-only yearling Chinook were planted into Morse Creek via Sol Duc Hatchery while 140,900 CWT-only yearling Chinook were planted from the Elwha Hatchery into the Elwha River. For the 2008 release, 208,000 CWT-only yearling Chinook were planted into Morse Creek via Sol Duc Hatchery while 276,950 CWT-only yearling Chinook were planted from the Elwha Hatchery into the Elwha River. In 2009, 340,946 yearling Chinook released from the Elwha Hatchery were CWT-only. The 2004 and 2005 brood year fish have also been 100% otolith-marked.

Current Elwha Chinook production released into the Elwha River and Morse Creek is not adipose clipped because there has been no need to differentiate hatchery- and natural-origin fish on the spawning grounds for the purpose of broodstock management. However, as recovery of Chinook in the Elwha proceeds, there will be a growing need to efficiently identify the hatchery or natural origin of fish to aid in implementing broodstock management principals intended to reduce hatchery influence in the naturally spawning population, with the goal of developing a self-sustaining locally adapted stock. Activities to this end will include targeting specific hatchery/wild proportions in the hatchery broodstock, and reducing the number of returning hatchery adults allowed to spawn naturally. The total exploitation rate on Elwha Chinook in 2011 and 2012 pre-season planning as predicted by the Fishery Regulation Assessment Model (FRAM), used by the Pacific Fisheries Management Council for assess fishing regulations, averaged a 50.1% total Exploitation Rate (ER) and a river escapement of 1,738 fish. With the conversation of the Elwha Hatchery Chinook release to a 100% adipose fin clip, using the same fishing regimes from the 2011 and 2012 final FRAM model runs, the resulting total ER increases to 51.5% with a river escapement of 1,690 fish. This equates to an overall reduction of river escapement of 2.8% as a result of adipose fin clipping.

Sub-yearlings

Beginning with brood year 2012, 250,000 sub-yearling releases of Elwha Chinook will be adipose-clipped and CWT-tagged to enable quick recognition of hatchery-origin adults, to estimate fishery exploitation rates, and verify the FRAM predictions of the potential reduction in escapement associated with adipose clipping Elwha hatchery production.

Beginning no earlier than brood year 2015, sub-yearling releases of Elwha Chinook will be adipose clipped at a 100% rate, while otolith marking will be discontinued. Adipose fin-clipping may be delayed if sediment levels in the river remain high, natural production is low, it is judged unlikely that broodstock management will be initiated with the adult return of the 2015 brood of sub-yearling Chinook, and analysis of CWT recoveries indicates a substantially higher mortality rate of clipped Chinook in mark-selective fisheries than projected by FRAM.

Assuming that adipose fin-clipping is initiated with the 2015 brood of sub-yearling Chinook, the benefits of adipose clipping will begin in 2018 with the return of 3 year old fish, and by 2020 essentially all hatchery returns will be clipped. This timing is intended to correspond to the period when turbidity has decreased, estimated at up to 5 years post dam removal (Randle et al. 1996, as referenced in NMFS's Re-initiation of the Elwha River Ecosystem and Fisheries Restoration, Biological Opinion and Consultation, 2012, pg. 25). As turbidity and sediment transport decline, Chinook will be able to successfully re-colonize, and monitoring the proportion of hatchery-origin fish on the spawning ground becomes necessary to inform changes in hatchery production.

Yearlings

Beginning no earlier than brood year 2014, sub-yearling releases of Elwha Chinook will be adipose clipped at a 100% rate, while otolith marking will be discontinued. Adipose clipping may be delayed if sediment levels in the river remain high, natural production is low, it is judged unlikely that broodstock management will be initiated with the adult return of the 2015 brood of sub-yearling Chinook, and analysis of CWT recoveries indicates a substantially higher mortality rate of clipped Chinook in mark-selective fisheries than projected by FRAM.

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

No program surplus exists in this recovery program.

10.9) Fish health certification procedures applied pre-release.

Prior to release, fish health is monitored and the fish health status of the population is certified by a WDFW Fish Health Specialist.

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

Emergency release procedures in case of water system failure involve removal of screens and stop logs, switching to a gravity water system, and allowing fish to migrate. If an emergency occurred at the Sol Duc hatchery the fish would be placed on an alternative water source and then transported back to Elwha. During a flood or drought event, fish may be released early directly into the Elwha River to prevent possible fish loss.

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

The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with listed Chinook. To minimize the risk of residualization and impact upon natural fish, hatchery sub-yearlings are released in June (80 fpp) while yearling smolts are released in April (10.0 fpp).

Hatchery Chinook will be liberated as sub-yearling smolts in June to minimize in-river residence and reduce potential competition and predation on native, wild salmonids. Yearlings will be released in April as smolts to speed their out-migration and reduce the potential predation and competition on wild salmonids (Steward and Bjornn 1990). Hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearlings) may have different food and habitat preferences than listed natural-origin fish, and hatchery-origin fish will be unlikely to out-compete natural-origin listed fish (Steward and Bjornn 1990). The location of the hatchery in the lower portion of the river (RM 2.9) also acts to reduce interactions with rearing natural-origin listed fish, including newly emerged fry present in the upper portion of the drainage.

In addition, a rearing parameter of the program is to attain a coefficient of variation (CV) for length of 10.0% or less in order to increase the likelihood that most of the fish are ready to migrate (Fuss and Ashbrook 1995). Such fish would be less likely to residualize in fresh water and interact with listed wild fish. The average CV for release years' 1995-2002 (excluding the year 2000) was 7.30%.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

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

Summary of Restoration Phases, Objectives and Hatchery Program Indicators and Triggers.

Phase	Objectives	Indicators	Triggers
Preservation:	• Prevent extinction. • Retain diversity and identity of existing population.	• Abundance of HOR and NOR to the river. • Total broodstock collected for program. • Program broodstock representatively sampled. • Multiple age-class releases.	See Performance and trigger table below. **Initiate Recolonization phase when:** • No migrational barriers exist at dam removal project site. • Active utilization of the upper watershed is observed. • Measurable productivity from the natural system is observed.
Recolonization:	• Achieve Total spawner abundance goals • Increasing NOS abundance. • Stock Productivity observed at target level. • Spawning observed distributed throughout suitable spawning habitat.	• Abundance of HOR and NOR to the river. • Total broodstock collected for program. • Program broodstock representatively sampled. • Multiple age-class releases.	See Performance and trigger table below. **Initiate local adaptation phase when:** • Adult abundance reaches target levels. • HOR + NOR returns achieve target levels. • NORs abundance reaches target levels. • Spawning/redd distribution and density reach target levels. • Natural-origin smolts encountered at critical location at target levels. **Revert to Preservation if:** • Migration barriers develop and upstream and downstream migration of all life history phases is halted. • Naturally-spawning

			adults numbers decline below identified target threshold levels. • Redd density and distribution declines
Activities described in this HGMP are applicable only during the Preservation and Recolonization Phases described above. The "Local Adaptation" and "Full Restoration" Biological Phases listed below are supplied as context for potential monitoring in the future, as the Chinook population transitions out of the Recolonization Phase. Refinement of the metrics and triggers for those phases is anticipated as additional information is collected.			
Local adaptation:	• Increasing abundance. • Increasing diversity and distribution. • Begin broodstock management (pHOS and pNOB) through active program management (size and composition) .	• NOR abundance. • pHOS levels achieved. • pNOB levels achieved. • PNI levels achieved.	**Initiate Full Restoration when:** • Abundance achieves. • Broodstock management goals achieved. • Determination of program discontinuation is made. **Revert to Recolonization if:** • NOR returns fall below identified target threshold levels. • Reduced distribution observed. • Reduced diversity observed.
Full restoration: • Program Discontinued	Achieve full potential of the restored habitat (express in terms of VSP parameters: • Abundance • Spatial distribution • Diversity • Productivity	• NOR recruitment and spawning escapement maintained	**Revert to Local Adaptation if:** • Adult abundance declines below target threshold levels. • Spatial distribution declines. • Diversity declines.

Table 1.11.1.2: Elwha Monitoring and Adaptive Management - Performance and Triggers.

	Phase:	Preservation	Recolonization	Local Adaptation	Self-Sustaining Population
Chinook Salmon *Oncorhynchus tshawytscha*	**Goals:**	*Prevent extinction and preserve the existing genetic and life history diversity of its native salmonid populations until fish passage is restored and water turbidity is determined to be non-lethal to fish in the river*	*Salmonids are continually accessing habitats above the old dam sites while fish are successfully spawning and producing smolts*	*Maintain or increase life history diversity of wild population through local adaptation to the Elwha River ecosystem until minimum levels of spawner abundance, productivity, and distribution are met*	*Ensure that self-sustaining and exploitable population levels continue once desired values for all VSP and habitat parameters have been met and hatchery programs are no longer needed*
Abundance *Weir, Sonar, foot & boat surveys, aerial surveys*	Natural Spawners	1,000	>1,000 or < 5,000	>5,000 or <10,000	>10,000
	Hatchery Spawners	1,700	≤1,700	≥0 or ≤1,700	0
	Spawner Escapement Duration	4 years	4 years	4 years	4 years
	Harvest	*	*	*	*
Stock Composition *Otoliths, CWT, Scale samples, external marks*	pNOS (natural-origin spawner)	*	*	0.24	1.0
	PNI	*	*	0.76	1.0
Spatial Distribution *Spawner surveys, Radio-telemetry, Snorkel surveys*	Extent	Below Elwha Dam	Above Elwha Dam 33% of Intrinsic Potential	Above Glines Canyon Dam 66% of Intrinsic Potential	100% of Intrinsic Potential
	Barriers	No migration barriers exist below Elwha Dam	No 'artificial' migration barriers exist in Aldwell reach	No 'artificial' migration barriers exist in Mills reach	No 'artificial' barriers exist within Intrinsic Potential
Diversity *Weir Genetic sampling, scale samples*	Stream-type proportion	*	*	Positive trend	Stable, > historical
	Entry timing variance	*	*	Positive trend	Stable, > historical
	Number of alleles	No change from baseline	No change from baseline	Decrease, then stable	No change from previous
	Expected heterozygosity	No change from baseline	No change from baseline	Decrease, then stable	No change from previous
Productivity *Weir, Sonar, Spawner surveys, Smolt trap, otoliths, CWT, harvest*	Number of juvenile migrants/female	200	200	200	200
	# Pre-fishing recruits/spawner (h+w)	>1.56	*	*	*
	# Spawners/spawner	>1.0	*	*	*
	# Pre-fishing recruits/spawner (W)	*	>1.56	>1.56	>1.85
	# Spawners/spawner	*	>1.0	>1.0	~1.0
	Productivity Trend	4 years	4 years	4 years	4 years

The triggers for each performance indicator were developed to identify whether the goals and objectives for each phase of fish restoration have been achieved. The triggers, developed by the Elwha Monitoring Group (EMG), are based on data, analyses, and inferences by scientists with specific expertise in the Elwha River restoration. The WDFW recognizes that there is uncertainty in the trigger points and supports additional scientific review and the collection of additional data. To ensure that the trigger points are fully informed by a broad range of scientific expertise, WDFW will convene a forum of scientists by March 2013 to review the abundance trigger points relative to the goals and objectives of the Elwha River Fish Restoration Plan. Such review will occur on an appropriate time-frame (usually annually). Our expectation is that, after additional review of the triggers, WDFW and LEKT will provide any recommended changes in the triggers for NMFS concurrence, based on any new information and analyses.

Additional Indicators and M&E associated with Performance Standards (see HGMP section 1.10)

Indicators and M&E:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
3.1.3	Program is authorized (pending) to operate under the US Federal Endangered Species Act as evidenced by the formal review and acceptance of this HGMP. The program is authorized under section 4 (d), limit 6 of the ESA.	Annual updating of all program information. Submittal to NOAA Fisheries for re-evaluation under terms of the permit.
3.3.2.	Annual number and type of mark applied, per release group, quality estimate of marks applied, by release group.	Annual release number estimates and mark and tag numbers and associated error rates are recorded in the WDFW hatchery data system and will be updated in this HGMP regularly.
3.8.3	Program is instrumental to the restoration of the iconic Elwha River Chinook population. This population represents significant biological importance (Primary) to the Puget Sound Chinook ESA. It is also an immensely important social and cultural for the Lower Elwha Klallam Tribal people and the citizens of Washington State.	

Performance Standards:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
3.1.3	This program is authorized (pending) to operate under the US Federal Endangered Species Act as evidenced by the formal review and acceptance of this HGMP. The program is authorized under section 4 (d), limit 6 of the ESA.	Annual updating of all program information. Submittal to NOAA Fisheries for re-evaluation under terms of the permit. Monitor juvenile hatchery fish size, number, date of release and mass-mark quality; monitor contribution of hatchery adult fish to fisheries and escapement.
3.2.2	Appropriate coded-wire tag groups are released annually to monitor harvest rates on the Elwha Chinook stock. Currently these rates are monitored for adherence to exploitation rates limitations on the stock not fishery benefits.	Annual tag groups released. Number and associated tag codes are entered into the RMIS system for use in fishery related mortality estimates. Annual estimates of both harvest rates and total exploitation rates are calculated.
3.3.2	Annual release numbers and associated marks (CWT, Otolith, other) are reported.	All releases and mark types are recorded in the WDFW hatchery data system and reported through the RMIS system.
3.5.5	Level of smoltification at release, release type (forced, volitional or direct plant), location and dates.	Release location, dates and release type are all recorded in the WDFW hatchery data system. Smoltification rates are not specifically estimated. Morphologic and behavioral changes are used to judge smoltification levels.

3.6.1	Best available fish culture standards are utilized to maximize the production of the program and minimize risks associated with improper fish culture practices.	All aspects of holding, spawning, rearing and release are recorded in the WDFW hatchery data system, including all mortality and fish health treatments. All aspects of the program operation are managed to the highest level of fish culture standards.
3.7.1	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Fish health reports and records of any needed treatment and recorded in the WDFW hatchery data system.
3.7.2	Discharge water quality compared to applicable water quality standards by NPDES permit.	Weekly, monthly and quarterly effluent water quality sampling is completed and submitted under the NPDES program.
3.7.3	Water withdrawals are compliant with WDFW water rights. Facility operates in compliance with applicable passage and screening criteria for juveniles and adults	
3.7.4	All application State and Co-manager fish health policies and standards are followed. Certification of fish health during rearing and immediately prior to release, including pathogens presence and virulence.	Fish health reports and records of any needed treatment and recorded in the WDFW hatchery data system. Any needed variances from policy are discussed with all parties. All releases receive a pre-release fish health assessment.
3.7.8	Releases are made at a time that poses the least risk of competition and predation of listed fish as possible.	Dates, size and location of release. Annual estimates of dates and abundance hatchery juveniles trapped at the in-river smolt trap compared to size, date and abundance of natural-origin juveniles trapped.

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

Currently, funding is available for the in-hatchery monitoring associated with the APR-based Performance Standards and Indicators. Funding for all other M&E associated with this program will be based on needs and priorities outlined in the terms and conditions of the Biological Opinion for the Elwha River and Fisheries Restoration Project (NMFS 2012). Currently, no long-term funding is established for these likely needs.

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.

All efforts to limit the level of unnecessary take associated with monitoring and evaluation of this hatchery program will be utilized. Currently, the aspects of hatchery monitoring associated with the later two phases of restoration — Local adaptation and Self-sustaining population — are under development.

SECTION 12. RESEARCH

Currently, there is no research linked specifically to this program. There is a high likelihood that there will be future research project that utilize this program. Any research needs associated with this program will be developed through the Elwha Monitoring and Adaptive Management Plan.

12.1) Objective or purpose.

Not applicable

12.2) Cooperating and funding agencies.

Not applicable

12.3) Principle investigator or project supervisor and staff.

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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.

Not applicable

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).

Not applicable

12.10) Alternative methods to achieve project objectives.

Not applicable

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

Not applicable

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.

Not applicable

SECTION 13. ATTACHMENTS AND CITATIONS

Barkhuis, S. 2005. North Olympic Peninsula Lead Entity Salmon Habitat Recovery Project Strategy. NOPLE Clallam County, Port Angeles, Washington.

Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquatic Sci. 53: pp 164-173.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date: _____

Philip Anderson
Director, Washington Department of Fish and Wildlife

ADDENDUM A. SECTION 15. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2)

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

The WDFW and the USFWS have a Cooperative Agreement pursuant to section 6(c) of the Endangered Species Act that covers the majority of the WDFW actions, including hatchery operations.

> *"The department is authorized by the USFWS for certain activities that may result in the take of bull trout, including salmon/steelhead hatchery broodstocking, hatchery monitoring and evaluation activities and conservation activities such as adult traps, juvenile monitoring, spawning ground surveys..."*

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

Elwha Bull Trout *(Salvelinus confluentus):* Bull trout were listed as a threatened species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910). The USFSW identified the Elwha River as a core area with one local population and one potential local population in Little River (USFWS 2004). The construction of two dams on the Elwha River during the early 1900s isolated bull trout populations in the upper, middle and lower river, limiting the viability of this population. Bull trout in the Elwha system are thought to exhibit anadromous, adfluvial, fluvial and resident life histories and the population in the lower river is thought to be primarily anadromous (WDFW Bull Trout SaSI 2004). Few abundance data are currently available for bull trout in the Elwha drainage. Anglers have reported hooking bull trout in the lower river over the years, but snorkel surveys have shown low numbers, averaging <1 bull trout per 100m of river from 1995 to 2004 (Brenkman et al. 2008). Bull trout have been observed spawning immediately upstream of Lake Mills and appear to be most abundant in this section of the river.

Summary of core area rankings for population abundance, distribution, trend, threat, and final rank.

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Elwha River	unknown	25-125	Unknown	Substantial, imminent	At Risk

Source Data: USFWS 2008

Other listed or candidate species:

Not Applicable

15.3) Analyze effects.

There are no activities associated with this hatchery program that would directly impact the Elwha bull trout population. WDFW Hatchery personnel at the Elwha Channel have reported seeing 5 to 10 bull trout each year, mainly from 1986 to 1996 (G. Travers, Washington Department of Fish and Wildlife, pers. comm. 2002). There is the possibility for indirect "take" associated with hatchery program operations—up to and including unintentional lethal take. Any observations of bull trout encountered during any hatchery activity, up to and including lethal take associated with hatchery activities, are reported annually by WDFW to USFWS under the ESA section 6 operating agreement. See HGMP section 15.1.

15.4 Actions taken to minimize potential effects.

All adult trapping facilities are regularly checked at consistent short intervals while actively trapping. All efforts are made to minimize any holding time listed fish remain in any traps.

All off-station collection activities attempt to minimize interaction with and effects to listed bull trout.

15.5 References

U.S. Fish and Wildlife Service (USFWS). 2004. Draft recovery plan for the Coastal-Puget Sound distinct population segment of bull trout (*Salvelinus confluentus*). Olympic Peninsula Management Unit, Portland OR. 277 + xvi p.

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Washington State salmonid stock inventory bull trout/ Dolly Varden, Washington State Department of Fish and Wildlife - October 2004.

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

Listed species affected: Elwha Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound Chinook		**Activity:** Elwha Chinook Program
Location of hatchery activity: Elwha Channel, Hurd Creek Hatchery, Sol Duc Hatchery, Elwha weir, in-river collection efforts	**Dates of activity:** August-June		**Hatchery program operator:** WDFW

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)			Up to 1,000*	
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)			Up to 5,000**	
Removal (e.g. broodstock) e)			Up to 1,750	
Intentional lethal take f)			Up to 1,700	
Unintentional lethal take g)	Up to 225,000	Up to 70,000	Up to 70†	
Other Take (specify) h)				

* This number represents the trigger level for transitioning from the Preservation phase to the Recolonization phase.
**This number represents the trigger level for transitioning from the Recolonization phase to the Local Adaptation phase.
† Contains up to 50 unintentional lethal takes from broodstock holding mortality and up to 20 unintentional lethal takes from transport mortality.

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.

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

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Puget Sound /Elwha Steelhead			**Activity:** Elwha Chinook Program
Location of hatchery activity: Elwha River, Elwha Weir, Elwha Channel trap	**Dates of activity:** August-June			**Hatchery program operator:** WDFW
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)	No take likely			
Collect for transport b)				
Capture, handle, and release c)				
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.

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	Number of fish/pound	SIZE/CRITERIA Grams/fish
X	Chinook Yearling	≤20	≥23
X	Chinook (Zero) Yearling	>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 Fry	≤1000	≥0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	≤20	≥23
X	Sockeye Fingerling	>20 to 8000	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 Fry	≤1000	≥0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	≤10	≥0.45
X	Steelhead Yearling	≤20	≥23
X	Steelhead Fry	>20 to 150	3 to <23
X	Steelhead Unfed Fry	>150	<3
X	Cutthroat Yearling	≤20	≥23
X	Cutthroat Fingerling	>20 to 150	3 to <23
X	Cutthroat Fry	>150	<3
X	Trout Legals	≤2.5	≥225
X	Trout Fry	>2.5	<225

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.