HATCHERY AND GENETIC MANAGEMENT PLAN

Hatchery Program:	Elwha River Pink Salmon Preservation and Restoration Program
Species or Hatchery Stock:	Elwha River odd- and even-year pink salmon; *Oncorhynchus gorbuscha*
Agency/Operator:	Lower Elwha Klallam Tribe and Washington Department of Fish and Wildlife
Watershed and Region:	Elwha River (WRIA 18.0274); Strait of Juan de Fuca Region, Puget Sound
Date Submitted:	July 31, 2012
Date Last Updated:	July 31, 2012

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Elwha River Pink Salmon Preservation and Restoration Program

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

Elwha River Odd- and Even-year Pink Salmon (*Oncorhynchus gorbuscha*).

The National Marine Fisheries Service (NMFS) designated odd- and even-year pink salmon in the Elwha River as parts of the Washington Odd- and Puget Sound Even-year Pink Salmon ESUs, respectively (Hard et al. 1996). NMFS determined that ESA listing for the two ESUs was not warranted (60 FR 192, October 4, 1995). However, both Elwha River populations are at a critically low abundance, and are in danger of extirpation.

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:

National Park Service: program planning, guidance, and regulation under the ESA through

Elwha Fish Restoration Committee; and funding for captive broodstock program.
NMFS Northwest Region: program planning, guidance, and regulation under the ESA through Elwha Fish Restoration Committee.
NMFS Northwest Fisheries Science Center: scientific guidance for program objectives, planning, implementation, and research, monitoring and evaluation actions.
U.S. Fish and Wildlife Service (FWS): scientific guidance for program planning and implementation through Elwha Fish Restoration Committee; and funding for mainstem weir operation.
Bureau of Indian Affairs (BIA): funding of the facility operating and maintenance budget for the tribal portion of the program (PL-638)
Northwest Indian Fisheries Commission: diagnostic fish health and fisheries management support services for the tribe.

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

This program currently has partial funding for actions proposed in this HGMP. Funds are obtained through numerous sources.

Operation of Lower Elwha Hatchery is funded from the BIA 638 Contract with the Lower Elwha Tribe. Annual operating costs are $75,000 per year for pink salmon adult holding and spawning; egg incubation; fry rearing; and, fed fry release and transport in support of the supplementation and captive broodstock programs. There are four FTEs associated with operation and maintenance of the tribal hatchery.

Captive rearing at the NMFS Manchester Research Station is supported by the National Park Service from funds allocated to The Elwha restoration initiative. Annual cost is approximately $80,000. The program will require 0.75 FTE.

Broodstock collection at the weir is supported (through 2012) by WDFW, using EPA funds under a cooperative agreement with USFWS, Annual operation and maintenance cost for the weir is $281,362, WDFW may assist with other broodstock collection. There are six FTEs associated with WDFW's broodstock collection effort.

Research, Monitoring, and Evaluation will be conducted collaboratively by WDFW, NMFS Northwest Fisheries Science Center, USGS, and Lower Elwha Tribe staff. :

USGS: Funding for pink salmon stock assessment and productivity research conducted by the UGSS is obtained from USGS NRPP and base funds, with an estimated cost of $65,000 in FY 2012 for Elwha River weir project support and 0.1 FTE (if no other outside funds are obtained) in out years to assist with program development and monitoring in out years.

USFWS: Broodstock collection is partially funded through a cooperative agreement with EPA and USFWS using fish and wildlife management base funds. The USFWS will spend approximately $20,000 assisting with program development, broodstock collection, and monitoring with 0.25 FTEs.

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

The Lower Elwha Hatchery is located at RM 2.5 on the Elwha River (WRIA 18.0274).

The Hurd Creek Hatchery is located at 955 Fasola Rd, Sequim, WA, 98382

The NMFS Manchester Research Station is located at 7305 East Clam Beach Driver, Port Orchard, Washington 98366.

The weir is located at RM 4.0 on the Elwha River.

1.6) Type of program.

Integrated Recovery

1.7) Purpose (Goal) of program.

The goal of this program during the preservation phase of recovery is to preserve the native populations of odd- and even-year pink salmon in the Elwha River during and following removal of the Elwha and Glines Canyon dams, when turbidity and unstable habitat conditions will cause the lower mainstem to be inhospitable to natural production. Post-dam removal, during the remainder of the preservation phase and continuing into the recolonization phase, the program will increase abundance of odd- year pink salmon, while maintaining the genetic integrity of the native stock, and promote recovery to abundance approaching estimated historic levels. The goal for even-year pink salmon is simply to preserve the population through the dam removal period, and then allow the population to increase naturally as it re-colonizes the watershed. This plan maintains the option for supplementation of even-year pinks, contingent on river conditions and observed adult return abundance.

Table 1.1 Recovery Objectives for the four phases of pink salmon recovery.

Phase	Objectives
Preservation: Conserve abundance	• Prevent extinction • Retain genetic identity and diversity • Hatchery returns increase adult abundance • Successful natural production in mid- and upper basin MS & tribs • Supplement spawning (outplants)
Recolonization: Increase abundance and spatial distribution	• Abundance & productivity increasing • Supplement spawning (outplant) • Spatial distribution increasing • Stable run timing and maturation rates • Population supports directed terminal harvest
Local adaptation: Viable abundance, increased productivity and life history diversity	• Increasing abundance • Spatial distribution throughout mainstem and tributary habitat • Improve genetic integrity & fitness • Tribal & recreational harvest
Self-sustaining: Population at optimum abundance, productivity, distribution, and diversity	• Abundance stable, at capacity • Productivity exhibits density dependence • Spatial distribution stable, at capacity • Genetic diversity stable • Population sustains harvest

Specific, in some cases quantified, performance indicators are being developed to identify the endpoint for each recovery phase. Example indicator metrics include population abundance, productivity, diversity, and spatial distribution characteristics. Hatchery management strategies, production objectives, and protocols may change as each phase endpoint is reached. All benchmark indicators for a given phase must be achieved to transition to the next phase. Transition to a new phase may occur over two or more years. Recovery measured by all indicators may not exhibit a constant positive trend, so if indicators fall below phase benchmarks, management may revert to the appropriate objectives, protocols, and strategies. The co-managers will incorporate recovery phase benchmarks in the Elwha monitoring and adaptive management plan (MAMP) being developed by the Elwha fish recovery workgroup. The MAMP will initially project the recovery trajectory for different species with very limited historical data on the Elwha populations, but phase benchmarks will be revised as information accumulates to assess the actual recovery potential and performance of the population, in terms of abundance, productivity, diversity, and distribution.

1.8) Justification for the program.

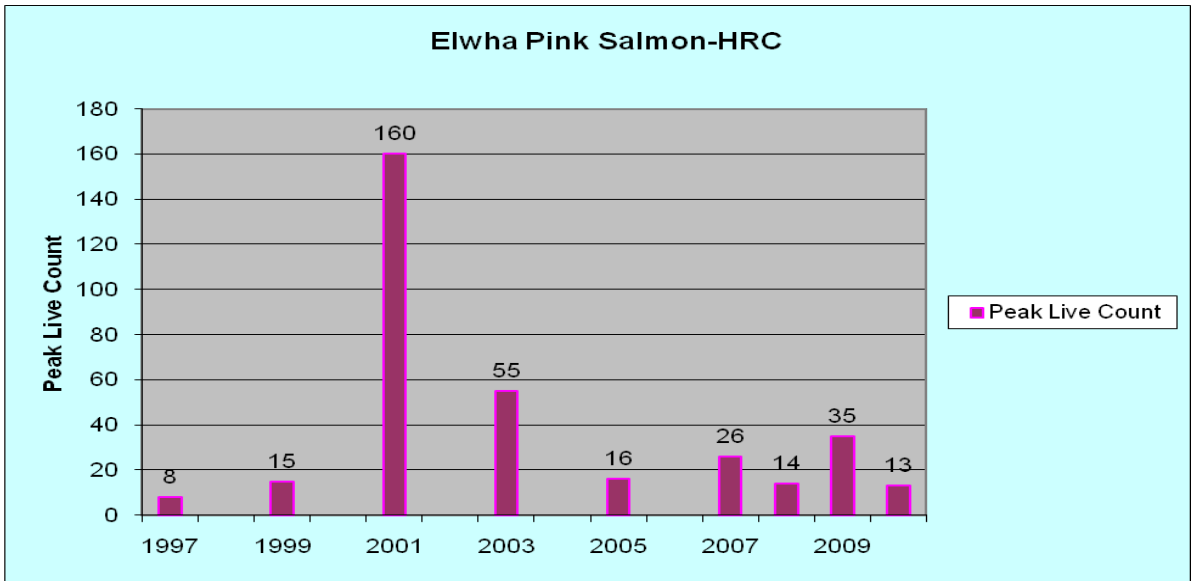
The program reduces the risk of extinction during the dam removal period, and enhances production after the dams are removed, as habitat recovers.

The populations fell to very low abundance after construction of the Elwha Dam due primarily to blockage and degradation of spawning and rearing habitat. Pink salmon were thought to once be the most abundant salmonid species in the watershed, and likely of great importance to the

Elwha River ecosystem. Recent abundance has been extremely low. Odd-year pink salmon escapement estimates have ranged from approximately 200 in 2001 to less than 40 in 2009; even- year pink salmon escapements have been under 20 (Figure 1). Although the quantity and quality of available habitat will be gradually increased and improved when the Elwha and Glines Canyon dams are removed (2011-13), both populations will be threatened with extirpation by inhospitable water quality and sedimentation conditions in the mainstem during, and for some period following, dam removal. Captive rearing of the odd- year stock and supplementation (release of fed fry) of odd- and even-year stocks, are needed in the short term to preserve the stocks during the dam removal phase, circumventing lower river migration, spawning and incubation conditions that will substantially prevent natural production. Captive rearing of broodstock for the odd-year stock will be phased out, and the program will transition to conventional supplementation for approximately three generations depending on population size, to increase juvenile and adult recruit abundances, and foster recovery of self-sustaining stocks at historic abundance.

Even-year and odd-year pink salmon will be handled differently, consistent with apparent differences in the longevity of the two races in the Elwha River. Odd-year pink salmon, which include both summer (early) and fall (late) adult return components (considered together in this document), are known to have been present in the Elwha River prior to dam construction. Native even-year pink salmon populations have not been observed historically in Washington State, with self-sustaining returns of the race confined to regions north of Vancouver Island. Even-year pink salmon have become more common throughout Puget Sound in recent years due to an apparent range expansion through natural colonization.

Figure 1. Annual magnitude of Elwha River adult pink salmon escapement based on peak live counts in side channel and mainstem river index areas.



Source: Mike McHenry, Lower Elwha Klallam Tribe, October, 2010.

It is unclear if a self-sustaining even-year pink salmon population was historically present in the Elwha River prior to construction of the Elwha dams, but adult fish returning in even numbered

years have been observed at least since 1996 and through the present (Tim Tynan, NMFS, personal observation; Mike McHenry, LEKT, personal communication; WDFW weir collections in 2010).

Abundance and productivity levels as well as spatial distribution and diversity characteristics marking the end points of the preservation and recolonization phases of recovery for odd-year pinks are under development by the Elwha fish recovery subgroup (MAMP) The Elwha Fish Restoration Plan (Ward et al 2008) set an interim escapement target of 10,000 fish after 10 years and total abundance of 96,000 fish after 25 years. In contrast, attempts will be made to simply preserve even-year pink salmon at their current, low abundance level, thereafter allowing the race the opportunity to colonize the Elwha River naturally. This Plan maintains the option for a short-term supplementation program for even-year pink following dam removal (i.e. into the recolonization phase of recovery).

1.9) Performance Standards for Hatchery Production

The following are objectives for supportive breeding programs for Elwha River odd- and even-year pink salmon populations, in the context of recovery benchmarks established for the preservation and recolonization phases:

1) Broodstock collection: Collect and spawn all available pink salmon returning to the river from 2011 through 2014. From resulting juveniles, rear adult broodstock in captivity and propagate three generations of juveniles to preserve the native odd-year (summer and fall component) pink salmon population during the Elwha dam removal and early river recovery phases. Collect up to 200 adult fish returning to the Elwha River in 2015 and 2016 for the same purposes.

2) Rear odd-year captive brood fish to maturity, and select and spawn fish based on predetermined mating protocols designed to retain genetic diversity. Incubate and rear all progeny of captive broodstock in-basin, and release juveniles that are surplus to captive rearing needs as fed fry into the mainstem Elwha River.

3) If adult returns to the Elwha River exceed 10,000, phase out the captive rearing of broodstock after three odd-year (2011, 2013, 2015) generations and transition to conventional supplementation only, with the goal of restoring abundant, naturally producing, self-sustaining pink salmon populations that maintain genetic characteristics of the native stocks.

4) Mark all hatchery-produced pink salmon by otolith thermal banding (i.e. by altering water temperature during egg incubation) to allow their differentiation from any natural-origin fish upon return as adults. Monitor and evaluate annual hatchery-origin fish contribution rates to the naturally spawning population and identify the effectiveness of the supplementation programs.

5) Phase out the supplementation program for even-year pink salmon after the 2014 return year, after which time dam deconstruction activities will have been completed and

the Elwha River upstream of river mile 5.0 will be accessible to migrating anadromous salmonids.

6) Phase out the supplementation program for odd-year pink salmon after the 2021 return year, commensurate with completion of three brood year releases of supplementation after termination of the captive brood stock program. Phase out of the supplementation program sooner if total odd-year adult return levels to the Elwha River in any given year after 2015 exceed 10,000 naturally spawning fish (a benchmark for the end of the recolonization phase of recovery), and the adult abundances reflect a productivity of greater than 1.0 for natural spawners contributing to the return (10 year interim restoration goal from Ward et al. 2008).

1.10) Objectives, Performance Standards, and Performance Indicators of Population Status

Performance standards and interim performance indicators are shown below in Tables 1.2 and 1.3 to assess recovery performance against objectives shown in Table 1.1 during the preservation and recolonization phases, and to inform the transition between phases.

Table 1.2. Objectives, performance standards, and performance indicators for the preservation phase of pink salmon recovery.

Objective	Performance standards	Performance indicators
Abundance: Prevent extinction	Hatchery supportive breeding	Capture 200 odd-year broodstock 2011 and 2013 Capture 20 even-year broodstock 2012 & 2014 Transfer 2500 odd-yr eyed eggs for captive rearing >> 200-300 mature adults Odd-year fed fry release 300,000 2012 & 2014 Odd- year fed fry release 350,000 2016 and 2018
	Adult return	Reaches critical threshold
	Natural origin smolt production	Natural spawning produces outmigrant smolts
Productivity:	NOR population growth /recruitment	NOR abundance 4.61
	Wild SAR	Smolts per spawner = 260
	Hatchery SAR	SAR >/= 0.5%
Spatial structure	Migration	No upstream or downstream barriers
Diversity:	Retain genetic diversity and identity	Broodstock represents entire run timing Implement mate selection and spawning protocols
	Spawner & broodstock composition	Mark all hatchery-origin releases to permit identification of fish origin (juveniles and adults)
		pNOB and pHOS unconstrained
		Develop genotype data base

Table 1.3 Objectives, performance standards, and performance indicators for the recolonization phase of pink salmon recovery.

Objective	Performance standards	Performance indicators
Abundance: Prevent extinction	Hatchery supplementation	Capture 200 - 500 odd-year broodstock 2015 and 2017 Capture 50 even-year broodstock Transfer eyed eggs for captive rearing >> 200 adults Fed fry release 400,000 SAR >/= 0.5%
	Adult return	Abundance > critical population or ➢ 10,000
	Natural origin smolt production	260 smolts per spawner
Productivity:	NOR population growth /recruitment	NOR abundance </= 1.0 [4.61)
	Wild SAR	Smolts per spawner = 260
Spatial structure:	Migration	No upstream or downstream barriers
	Spawning distribution	33% of Intrinsic Potential habitat occupied
Diversity:	Retain genetic diversity and identity	Broodstock represents entire run timing Implement mate selection and spawning protocols for captive reared adults
	pHOS/pNOB/PNI ratios	Mark all hatchery-origin releases to permit identification of fish origin (juveniles and adults)
		pNOS and pHOS unconstrained
		Develop genotype data base
Triggers for reverting to preservation phase • Migration barriers develop • NOR return does not increase across 3 generations • Spawer distribution or density falls • Smolt production falls, or below goal		

1.11) Expected size of program.

1.11.1) Number of adult broodstock collected.

The number of pink salmon adults collected for broodstock will vary, as determined by; the phase of recovery (preservation transitioning to recolonization), captive broodstock survival and egg production levels, and the abundance of adults returning to the river (Table 1.4). For the initial two years of operation (2011-2012), the objective is to collect as many returning adult fish to the river as feasible. We assume that total adult returns will remain at or below the recent year estimated abundance of 200 fish. For 2013, the odd-year adult broodstock collection goal of 200 may decrease dependent on the number of eggs available from captive broodstock. Adult fish collected from the river will be incorporated at appropriate (20%) levels into spawning with captive broodstock. For 2014, the even-year pink salmon broodstock collection goal is to collect as many returning adult fish to the river as feasible. No even-year pink salmon will be collected for use as hatchery broodstock after 2014, unless habitat conditions in the Elwha River mainstem

remain inhospitable to natural production. For 2015 and 2017, up to 500 odd-year adult fish will be collected each year as a means to augment captive broodstock production, reduce divergence between the captive and "wild" returning aggregations, and to meet supplementation program fry release objectives.

Table 1.4 Annual Elwha River Pink salmon broodstock collection levels.

Return Year	Number of Adult Fish	Broodstock Use
2011& 2012	200	Seed odd- year captive broodstock and odd/even supplementation programs
2013 & 2014	Up to 200	Seed odd- year captive broodstock and odd/even supplementation programs
2015 & 2017	500	Seed last brood year of odd- year captive broodstock program, and support odd- year supplementation program
2019 & 2021	3,000	Support odd- year supplementation program

As the odd- year program transitions to supplementation, after collection of brood year 2019 adults for captive rearing, the number of broodstock collected from adult returns will be sufficient to achieve annual release of 3,000,000 fed fry into the Elwha River. Production of this number of fed fry would necessitate collection of 3,000 adult fish, assuming 80% green egg to fed fry survival, a 1:1 sex ratio for the adult return and an average fecundity of 1,600 per female (range 1,000 to 2,100).

1.11.2) Annual release

For the first two years of operation, the annual fry release for each race will be determined by the number of broodstock collected, assumed to be at the recent year estimated abundance of 200 for odd-year returns and 20 fish for even-year returns. For brood year 2013, assuming average fecundity of 1,600 eggs per female, 1:1 sex ratio in adult returns, up to 160,000 green eggs may be collected, resulting in 128,000 fed fry (assuming 80% green egg to fry survival). Of this total, 1,000 to 2,000 fed fry representative of the diversity of the total spawned population will be retained for the captive broodstock program, with the goal of producing 350 to 500 captive brood pink salmon adults at an average adult size of 2 to 3 pounds. The remaining fed fry will be released from Lower Elwha Hatchery in 2012 during the natural pink salmon fry emigration period. Projected odd- year fry production levels and locations beyond the initial year of operations are shown in Table 1.5.

Table 1.5. Annual number of Elwha River odd- year pink salmon juveniles retained for the captive broodstock (CB) program at the Manchester Research Station and number released as fed fry from Lower Elwha Hatchery for supplementation (Supp) purposes.

Brood Year	Production Location	Annual Level
2011	Manchester Facility Lower Elwha Hatchery	1,000-2,000 (CB) 126,000 (Supp)
2013	Manchester Facility Lower Elwha Hatchery	1,000-2,000 (CB) 126,000 (Supp)
2015	Manchester Facility Lower Elwha Hatchery	1,000-2,000 (CB) 1/ 1,200,000 (Supp)
2017, 2019, 2021	Manchester Facility Lower Elwha Hatchery	0 (CB) 3,000,000 (Supp)

1/ Up to 2,000 pink salmon juveniles will be retained for captive broodstock rearing through the 2015 brood year, after which time, the program will transition to supplementation only.

If 20 even-year adults are collected in 2012, making the same assumptions (above) regarding average fecundity sex ratio and survival, 16,000 green eggs will be incubated, leading to release of 12,000 fed fry in 2013. Similar production would be anticipated for brood year 2014.

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

This is a new program, and the native pink salmon populations have not been artificially propagated in the Elwha River watershed in previous years.

For program planning purposes, a fed fry-to-adult return survival rate of 1.0% is assumed, based on survival rates (total fisheries contribution and escapement) observed for other hatchery pink salmon fed fry release programs in the Puget Sound region (Fuss and Ashbrook, 1995 - WDFW Hoodsport Hatchery data). Marine and freshwater area harvest rates for Elwha River pink salmon are expected to be unsubstantial over the 12 year term of the program, so a 1.0% rate is also assumed to reflect expected adult escapement levels as a proportion of total fed fry release numbers.

The fed fry to spawning adult survival rate for fish transferred to the Manchester Research Facility for captive brood rearing is assumed to be 50%. This survival rate is a best estimate, based on the performance of Chinook and sockeye salmon reared to adult size at the facility.

1.13) Expected duration of program.

Odd- Year Pink Salmon –
Supplementation – 2011 (first adult collection) through 2022 (last fry release). The supplementation portion of the program may be terminated sooner than 2021, pending evaluation of natural- and hatchery-origin adult contribution levels to total returns and natural spawning, and success in restoring self-sustaining natural production in historically used areas. If by 2021,

target adult return abundance has not been realized, the co-managers will determine whether to continue the program, change production strategies, as related to genetic issues.

Captive Brood Program - The duration of the captive broodstock portion of the program will be limited to 3 brood years (2011, 2013, and 2015). Supplementation releases from the captive brood program will commence in 2014 with the first brood year collected (2011 for odd- year), and end in 2018 from progeny of 2017 captive brood fish. The supplementation portion of the program may be terminated sooner than 2021, contingent on observed abundance, spawning distribution, and hatchery contribution levels to natural spawning.

Even-year Pink Salmon Supplementation - 2012 (first adult collection) through 2015 (last fry release).

1.14) Alternative actions for attaining program goals, and reasons why those actions are not being proposed.

Alternative actions considered and rejected in favor of the proposed hatchery plan:

1) Allowing pink salmon to spawn naturally in the Elwha River during the dam removal phase without any hatchery intervention. This action was rejected because extremely high sediment loads and turbidity levels in 2011-2013 resulting from removal of the dams are expected to make habitat inhospitable for fish species present in the lower river. All pink salmon are two–year old fish, and the extant odd-year and even-year populations will spawn in the river in 2011 (odd), 2012 (even), and 2013 (odd), respectively. The native Elwha River pink salmon populations are in danger of extirpation with dam removal, and supportive breeding is needed to reduce that risk; and,

2) Implementation of a supplementation program only. This alternative action was considered and rejected for the odd- year pink salmon race in the Elwha River, because the current genetically unique odd- year pink salmon population is currently at critically low abundance levels which threaten the prospects for re-establishing the populations to a viable status. Current brood year abundance levels (< 200 adult fish) are insufficient to provide enough gametes to seed a successful supplementation effort. A captive broodstock program is initially needed to preserve remaining genetic diversity and to expeditiously bolster the abundance of emigrating juvenile, and returning adult fish. This action was not adopted for the even-year pink salmon since it is unclear if they were present historically in the Elwha River or if they are naturally colonizing the Elwha River along with other Puget Sound system.

3) Use egg boxes placed in side-channels throughout the lower Elwha River. Although side channel habitats will likely not be impacted as much as the mainstem, this plan was rejected due to the critically low abundance of odd- and even-year pink salmon in the system, and the need to implement support breeding practices that have the highest likelihood for producing juvenile fish that will survive to adult return (see 2 above).

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

2.1) ESA authorization.

This HGMP has been revised to reflect development of the Elwha Fish Restoration Plan (Ward et al. 2008), and in response to reviews by the Hatchery Scientific Review Group in 2002 and 2012. This and other HGMPs for programs in the Elwha River will be evaluated by the NMFS NWR Salmon Management Division to determine whether they are compliant with conservation the criteria defined in the Salmon (4)d Rule (70 FR 37160, June 28, 2005) and the 4(d) Rule for the Puget Sound Steelhead DPS (73 FR 55451, September 25, 2008).

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

Elwha River Chinook salmon (*O. tshawytscha*): The Elwha River Chinook salmon population was delineated as one of 22 independent populations that compose the Puget Sound Chinook salmon ESU (Ruckelshaus et al. 2006). The ESU was listed as threatened under the ESA on March 24, 1999 (64 FR 14308). Chinook salmon originating from WDFW's Elwha Channel Hatchery program are included as part of the Puget Sound Chinook ESU, and are ESA listed with natural-origin Elwha River Chinook salmon (70 FR 37160, June 28, 2005). Elwha Chinook mature primarily at age 4 (57%), with age 3 and age 5 fish comprising 13% and 29%, of annual returns, respectively (WDF et al.1993, WDFW 1995, PNPTC 1995 cited in Myers et al.1998). The average annual sex ratio for returning fish is unknown, but assumed to be 1.5 males to females when estimating the number of wild spawners from redd counts. Data collected from gaffed adults, fish volunteering to Elwha Channel Hatchery, and spawning ground surveys (WDFW database, 1987-98) indicate that Elwha River Chinook range in size from 45 cm to126 cm in length. Migrating adult fish enter the river beginning in early June and extending through early October (WDF et al.1992). Spawning in the Elwha River begins in late August and peaks in late September to early October (WDF et al. 1992). The dominant juvenile life history trajectory involves short term rearing in freshwater (5 to 8 months) and seaward emigration as sub-yearling smolts. However, prior to construction of the two dams in the watershed which block the majority of anadromous habitat, multiple juvenile rearing and emigration strategies may have existed for this species. Roni (1992) reported that 45 to 83% of Elwha River smolts emigrated as yearlings, and 17 to 55 percent as subyearlings, but this study could not differentiate naturally produced smolts from hatchery releases of yearlings, because the hatchery fish were not marked to allow for their distinction from wild fish.

Elwha River Winter-Run Steelhead (*O. mykiss*). The native Elwha winter steelhead population is part of the Puget Sound steelhead Distinct Population Segment (DPS), listed as threatened under the ESA on July 11, 2007 (72 FR 26722). Hatchery production of native Elwha steelhead will be included in the listed DPS (73 FR 55451, September 25, 2008). Resident, native rainbow trout in the Elwha are not listed, but if they still maintain anadromous legacy, their anadromous progeny, resulting from resident or resident x anadromous parents, would be included in the listed DPS. There is historical evidence of native, summer steelhead in the Elwha, but their persistence is uncertain (PS Steelhead TRT 2011). Non-native steelhead have been produced by the LEKT hatchery , but plans are underway to eliminate this stock in the Elwha River over the

next 2-3 years. This program was initiated in 1976 with eggs from Chambers Creek (South Puget Sound), Cook Creek (Quinault National Hatchery), and Eagle Creek Hatchery (Columbia River). In addition, steelhead smolts from various other hatcheries in northwest Washington were released into the Elwha to enhance fishing opportunity. Non-native (McCloud River, California stock), resident rainbow also exist in the system. Despite potential for interbreeding, the native winter steelhead stock remains distinct, and shows no evidence of introgression (G. Winans, NMFS, pers comm – presentation to Elwha hatchery review January, 2012).

Native winter steelhead enter the Elwha River starting in February, and spawn from April to June (McMillan et al. 2010). Little is known about the freshwater life history of native steelhead in the basin. The typical life history for Puget Sound winter-run steelhead involves spending one to three years rearing in freshwater before smolting, followed by one to four years oceanic life before they return to spawn. The incidence of repeat spawning has not been estimated for Elwha steelhead (Wydoski and Whitney 2003), but repeat spawners typically comprise three to six percent of runs elsewhere in the region. (WDFW unpublished data).

The historical distribution and abundance of steelhead in the Elwha system (i.e. prior to construction of the dams) is not known, but suitable spawning and rearing habitat exists in the mid- and upper- mainstem up, and in several tributaries, such as Little River and Indian Creek.

Elwha River Bull Trout (*Salvelinus confluentus*)*:* Elwha River bull trout occupy a designated Core Area within the Coastal Recovery Unit of the co-terminous (Northwestern U.S.) DPS of bull trout, which is listed as threatened under the ESA. Bull trout in the Elwha River may exhibit fluvial, adfluvial, and anadromous life history strategies (Ward et al. 2008). Fish found in the basin below Elwha Dam are thought to be anadromous, while adfluvial and fluvial populations inhabit the basin above Elwha Dam. Researchers in the watershed report that few bull trout are observed in the river below the Elwha Dam and only one redd has been documented (Ward et al. 2008). Although Dolly Varden (*S. malma)* are present in other Olympic Peninsula watersheds, limited genetic and morphological analysis of a few specimens collected in the Elwha River indicates that only bull trout are present (Leary and Allendorf 1997). NMFS researchers identified three char fry and a handful of adults (10″–24″ in length) during snorkel surveys initiated in 2000. This population has likely been negatively impacted by loss of access to the upper river, habitat degradation in the lower river, nearshore, and estuary, and potentially to harvests in the lower river. Construction of the mainstem dams isolated populations of bull trout in both the middle and upper Elwha River basins. The creation of lakes Aldwell and Mills also modified habitat features, resulting in the establishment of adfluvial populations in these lakes. Population size in the upper basin is unknown; however, 215 bull trout were counted during a survey of the entire mainstem Elwha River in 2007. However, this estimate does not include some of the canyon reaches or the two reservoirs. Bull trout were observed throughout the basin during these surveys; however, o the fish observed during this survey, only 27 were observed below Elwha Dam, the furthest downstream dam in the system. Bull trout have been observed as high as RM 43.9 (ONP Fish Distribution Database). They are also found in at least seven of the mainstem tributaries.

2.2.1) Status of ESA-listed salmonid population(s) affected by the program. relative to critical and viable population thresholds.

Elwha River Chinook salmon: Annual spawner escapement since 2000 has ranged from 1,146 to 3,439. These estimates include natural- and hatchery-origin adults counted on the spawning grounds in the lower river, and those adults removed for use as hatchery broodstock. The nominal spawning escapement goal of 2,900 has been achieved only once since the 1980s, even though harvest in U.S. marine area fisheries have been reduced, and in-river fishery impacts have been near zero for over 10 years. The average number of spawners over the last five years (2006-2010) was 1538, which is lower than the average of 2,527 for the preceding five years (2001 - 2005).

The escapement abundance trend has been stable since the 1990's (0.99 – data from 1990-2009) (Ford et al 2010). The median growth rate of the population from 1990 through 2005 was 0.99 for the total adult return and 1.0 for escapement to the river. The recent ten year (2001 - 2010) geometric mean spawner escapement was 1,895. There are no estimates of the proportion or number of natural-origin adult returns, but it has been assumed that natural production is critically depressed, requiring hatchery supplementation to maintain the population. Recent productivity of the population has not been quantified.

Table 2.1 Chinook escapement to the Elwha River, 1999 - 2010

	Broodstock	Natural Spawners	Pre-spawn mortality	Total
1999	699	903	23	1625
2000	1136	715	62	1913
2001	1553	655	38	2246
2002	1505	863	40	2408
2003	1182	1045	78	2305
2004	1325	2075	39	3439
2005	1396	835	7	2238
2006	1229	693	11	1933
2007	757	380	9	1146
2008	667	470	16	1153
2009	1514	651	16	2181
2010	709	564	5	1278

Elwha River Steelhead: Escapement surveys of the lower river below the Elwha Dam in 2005 - 2011 indicate the number of native steelhead spawners has ranged from 45 to 246. These estimates are based on redd counts which are expanded by 1.62 adults/redd (Mike McHenry, LEKT pers comm November 13, 2011; WDFW standard expansion of SH redd counts). These estimates should be interpreted cautiously because replicated surveys throughout the spawning period are often prevented by high flow and turbidity. Further surveys to monitor spawner abundance and distribution in the main stem, Indian Creek, and Little River are planned for implementation subsequent to removal of the Elwha River dams (McHenry and Pess 2008). The current productivity of the population is unknown.

The Puget Sound Steelhead Technical Recovery Team is developing recovery guidance for the DPS, and have provided preliminary critical and viable abundance thresholds of 712 and 3,558, respectively, for the Elwha population. Natural-origin winter steelhead production has been confined since 1911 to the five mile reach below Elwha Dam, where poor habitat conditions constrain spawning success and rearing survival. Recovery of the population to a viable level is contingent on restoration of anadromous access to the upper river, and implementation of other aspects of the Elwha River Fish Restoration Plan (Ward et al. 2008). As abundance and productivity increase following dam removal, critical and viable population thresholds will change.

Table 2.2 Estimated native winter steelhead escapement to the Elwha River.

Year	*Escapement*
2005	*100*
2006	*123*
2007	*-*
2008	*-*
2009	*45*
2010	*193*
2011	*246*

Elwha River Bull Trout: The Recovery Plan for the DPS (USFWS 2004) identified the Elwha River as a core area with one identified local population and one potential local population in Little River (USFWS 2004). Based on professional judgment, knowledge of bull trout distribution in drainages, availability of suitable habitat, and extremely low numbers of char observed in this system in recent years, the USFWS rates the lower Elwha River subpopulation as "depressed." Productivity of the population is unknown. Migratory bull trout may persist in the Elwha core area (USFWS 2004), but until anadromous access to the upper watershed is re-established, and a viable level abundance and diversity recovered, the stocks will remain at elevated risk of extinction (Ward et al. 2008). Critical or viable population thresholds have not been developed for bull trout. USFWS (2011) set interim recovery goals of two viable populations in the Core Area, with at least 500 spawners

2.2.2) Recent estimates of annual proportions of hatchery- and natural-origin fish on natural spawning grounds.

Elwha River Chinook : No recent data exist, but hatchery-origin adults are presumed to comprise a large majority of natural spawners.

Elwha River Steelhead: Given their later migration and spawn timing, natural-origin adults are assumed to comprise the majority of natural spawners. The number of early-timed, hatchery-origin spawners has not been estimated.

Elwha River Bull Trout: All fish in the spawning population are of natural origin.

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

Broodstock Collection: Listed Chinook salmon, steelhead, and bull trout will be captured at the weir, and by other methods of procuring pink salmon broodstock. With near-continuous operation of the weir for this and other monitoring purposes, handling or mortality of listed species associated with pink salmon brood stock collection cannot be accurately estimated, but mortality is expected to be very low, not exceeding 1% of the number captured. As the program transitions to supplementation only, pink salmon used as broodstock will be predominately adult fish recruiting to Lower Elwha Hatchery, and incidental trapping and holding effects on listed salmonids will be unsubstantial.

Operation of Hatchery Facilities: Contingent on the Lower Elwha Hatchery operating within NPDES Permit limits, the effect of hatchery effluent on water quality is not expected to result in harm to listed species.

Ecological effects or interactions of pink salmon produced by the program on listed species: Ecological interactions associated with juvenile pink salmon releases causing take of listed Chinook salmon, steelhead, or bull trout are unlikely to be substantial. There is no evidence that outmigrant pink fry prey on juvenile salmonids. The expected rapid outmigration of fry released from the hatchery minimizes the potential for competitive interactions with juvenile Chinook, steelhead, or bull trout. Adult pink salmon produced by the program have the potential to spawn in the same areas at the same time as Chinook salmon. The small initial size of the pink salmon population and the marked expansion in 2014 of available natural spawning areas resulting from removal of the Elwha dams reduce the likelihood for substantial adverse effects on Chinook salmon through competition for spawning sites and redd superimposition. The implementation of fish health monitoring and treatment protocols, specified by the Fish Health Policy will minimize the potential for pathogen amplification and transmission from propagated pink salmon to natural fish populations.

Monitoring Activities: The Elwha River weir and other stock status monitoring activities directly associated with the proposed pink salmon program that lead to fish capture, handling, sampling, and release may adversely affect natural-origin listed salmon and steelhead. Sections 11 and 12 describe the specific monitoring, evaluation and research programs proposed for Elwha River pink salmon, and methods applied to minimize incidental effects on listed salmon and steelhead.

-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).

Based on species encounters at WDFW's Elwha River weir during operation throughout the summer, fall, and winter in 2010 and 2011, up to 1,000 adult Chinook salmon, 5 adult steelhead, and 25 bull trout may be captured, handled, and released incidental to the annual collection of pink salmon broodstock at the weir, and through other broodstock collection actions upstream and downstream of the weir (see Take Table). Incidental take of listed species associated with weir operations that capture pink salmon has not been quantified, but these activities are already authorized by NMFS through the Elwha River Restoration Biop (2006).

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

The number of non-target species, including listed Chinook salmon, steelhead, and bull trout, incidentally captured, handled and released during pink salmon broodstock collection will be closely monitored. Variances from expected take levels, or unexpected mortalities of listed fish during handling, will be reported to NMFS. Broodstock collection actions will be modified to further limit incidental capture of listed salmonids.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan or other regionally accepted policies.

Implementation of the hatchery program is consistent with native Elwha River salmonid population preservation and restoration approaches included in the Elwha Fish Restoration Plan (Ward et al. 2008). The Plan describes basin-wide fish conservation measures, including artificial propagation, research, monitoring, and evaluation actions, that have been agreed to by the tribal, federal, and Washington State partners for application during the pre-, during, and post-dam removal phases.

This hatchery plan differs from the general approach described for restoring pink salmon in the Elwha Fish Restoration Plan, refining objectives and methods based on new stock status information. This plan defers from the previously planned supplementation-only approach, specifies and expands on the focus populations, and adjusts annual pink salmon fry production objectives. Native Elwha pink salmon are the focus of recovery efforts, and potential use of exogenous pink salmon stocks as described in the Plan is no longer under consideration. In addition to the native odd-year pink salmon, even-year pink salmon in the Elwha River are now included as a target population for recovery actions under this hatchery plan. Finally, the critical status of the pink salmon populations led to the decision to initiate a captive broodstock program to preserve and restore the odd-year population. This change necessitates new programs not described in the Plan, and juvenile release levels commensurate with revised pink salmon preservation and restoration needs.

As affirmed in the co-managers' Puget Sound hatchery resource management plans (WDFW and PSTT 2004; PSTT and WDFW 2004), salmon and steelhead hatchery programs in Puget Sound must adhere to a number of guidelines, policies and permit requirements. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW hatchery operations:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon

(Hershberger and Iwamoto 1981).

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). State, tribal and federal managers will manage hatcheries so they do not impede recovery of listed species. Through this Hatchery Reform Project (HSRG), the managers have sought to go beyond merely complying with ESA directives. The new approach is to reform hatchery programs to provide benefits to wild salmon recovery and sustainable fisheries. Hatchery management decisions will be based on system-wide, scientific recommendations. ,

Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (2006). This policy designates and delineates Fish Health Management Zones and defines inter and intra-zone transfer policies and guidelines for eggs and fish. These are designed to limit the spread of fish pathogens between and within watersheds.

National Pollutant Discharge Elimination System Permit. This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

Captive Broodstock Guidelines. Pollard and Flagg (2004) detail decision circumstances for initiating and conducting captive broodstock gene rescue activities for stocks of fish. Maynard et al. (in press) provides operational and husbandry guidelines for rearing groups of salmon in captive broodstock gene rescue programs.

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 program operates under *U.S. v Washington*, 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 (1985). This co-management process requires that both the State of Washington and the relevant Puget Sound Tribe(s) develop program goals and objectives and agree on the function, purpose and release strategies of all hatchery programs. The Future Brood Document is a detailed listing of annual production goals. This is reviewed and updated each spring and finalized in July. The Current Brood Document reflects actual production relative to the annual production goals. It is developed in the spring after eggs are collected. Two additional processes that involve co-managers include the "Annual Management Framework Plans" and "Salmon Run Status" reports for the Strait of Juan de Fuca, and the "Annual Winter and Summer Steelhead Forecasts and Management Recommendations"; the PNPTC, WDFW and Makah Tribe author both.

Co-manager fish management policies are in effect for all Puget Sound hatchery programs including the programs operated by WDFW and/or the Lower Elwha Klallam Tribe in the Elwha

River watershed.

3.3) Relationship to harvest objectives.

Over the term of this project, pink salmon adults produced through the program will not be the target of terminal-area fisheries, nor will returning adult fish lead to elevated harvest levels for other salmonid species, including listed salmon and steelhead. Hatchery-produced pink salmon may be caught in preterminal marine fisheries in B.C. and Washington, but the effect on return abundance will be very small. Chinook and coho harvest in the Elwha River will be managed consistent with the respective co-manager harvest management plans for those species, and with NMFS ESA authorizations for those plans. A temporary moratorium on in-river fishing is proposed for the Elwha River during dam removal to protect returning adults during this period when survival and spawning success is expected to be low due to elevated suspended sediment concentrations. Some low level fishing may be implemented during the next two seasons, targeting returning hatchery steelhead during the months of December and January, but no impacts to pink salmon are expected.

3.4) Relationship to habitat protection and recovery strategies.

Removal of the Elwha and Glines Canyon dams began in September, 2011; when removal is complete, anadromous species will have access to over 60 miles of habitat. Recovery of naturally self-sustaining Elwha River pink will depend on the recolonization of suitable habitat throughout the system, and developing successful freshwater life history trajectories. Natural or assisted restoration of lower river habitat is also necessary to create properly functioning conditions needed to sustain native pink salmon production. Several restoration projects (i.e., engineered log jams, levee removals, and lateral channel protection/enhancement) have been completed in the lower river that will benefit production of pinks and other species.

This hatchery program will preserve the native population through the Preservation and Recolonization Phases and will be reduced as natural production from the accessible new river habitat will provide increased adult abundance.

The Lower Elwha Klallam Tribe and WDFW participate with the National Park Service, Clallam County, the City of Port Angeles, local landowners, U.S. Fish and Wildlife Service, Forest Service, National Marine Fisheries Service, and other local entities in basin-wide habitat preservation and restoration planning efforts.

The NWIFC and the Salmon Recovery Funding Board (SRFB) administer Pacific Coastal Salmon Recovery Fund (PCSRF) grants to the Lower Elwha Tribe and other local entities. Advised by Lead Entities that prioritize recovery and restoration actions in each watershed, the SRFB provides grant funds to protect or restore salmon habitat and assist related activities. It also supports related programs and activities that produce sustainable and measurable benefits for fish and their habitat.

The North Olympic Peninsula Lead Entity (NOPLE) oversees recovery and restoration projects in the Elwha and Dungeness River watersheds. NOPLE's geographic area encompasses 8,051

salmon river and coastal miles located within 90 independent watersheds and 2 unique coastal systems over 2,330 square miles with management under two counties (Clallam & Jefferson), three cities (Sequim, Port Angeles and Forks), five native tribes (Jamestown S'Klallam, Lower Elwha, Makah, Quileute and Hoh), 3.5 WRIA's (20, 19, 18 and part of 17), 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 with non-listed species.

(1) Salmonid and non-salmonid fishes or other species that could negatively impact the program.

Hatchery pink migrants are subject to predation in the nearshore, estuary, mainstem, and side channel areas of the Elwha River basin. These areas serve as migration corridors for juvenile and adult fish, and spawning and incubation areas for the species. In addition to other salmonids of large enough size to consume pink salmon fry where the species interact, cottids (*Cottus* spp) avian predators, including terns (*genus Sterna and several sub-species*), gulls (*genus Larus and several sub-species*), mergansers (*Mergus merganser*), double crested cormorants *(Phalacrocorax auritus),* belted kingfishers *(Ceryle alcyon),* great blue herons *(Ardea herodias)* and night herons *(Nycticorax violaceus)* can also prey on pink salmon. Mammals that may be predators of migrating smolts and returning adults include: mink (*Mustela vison),* river otters (*Lutra canadensis*), harbor seals (*Phoca vitulina*), Stellar sea lions (*Eumetopias jubatus*), California sea lions (*Zalophus californianus*) and Orcas *(Orcinas orca).*

2) Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.

Returning pink salmon adults may become an important source of marine-derived nutrients input to the Elwha River watershed, benefiting numerous fish, bird, mammal, invertebrate, and plant species. Specifically, as the abundance of returning pink salmon increases, decaying carcasses of spawned adult pink salmon may contribute nutrients that substantially increase productivity in the watershed, providing food resources for many species. Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) release of nutrients from decaying carcasses that directly stimulates primary productivity (Wipfli et al. 1998); 2) enrichment of the food base of aquatic invertebrates by decaying carcasses; and 3) direct feeding on carcasses by juvenile salmonids.

Pink salmon fry released by the hatchery program will enhance the prey base for other salmonids (Chinook salmon, coho salmon, steelhead, and bull trout) but measurable benefits to their growth or survival are uncertain. Avian predators, including gulls, mergansers, cormorants, belted kingfishers, and great blue herons may also benefit. With a life history similar to chum, emigrating pink salmon fingerlings may reduce predation levels on co-occurring chum salmon fry by diluting predator effects. Mammals that may benefit from migrating fingerlings and adult pink salmon include river otters and harbor seals.

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.

Manchester Research Station

Odd-year pink salmon will be captive reared at the NMFS Manchester Research Station. The high quality seawater environment, combined with a 250-m pier made available to the station by the EPA Region X Laboratory, make the Manchester Research Station an excellent site for the culture of anadromous salmonids during their marine life history phase. Clam Bay is a major tidal mixing zone between Sinclair and Dyes Inlets to the west and waters of central Puget Sound to the east. Annual seawater temperature at the site normally ranges between 7-15°C and salinity ranges between 28-30 ppt.

A constant source of processed seawater is supplied to captive rearing tanks. A 60 hp centrifugal pump supplies approximately 6,000 Lpm (1,500 gpm) of seawater through a 700 m long pipeline from the east end of the pier to the Station's land based facilities. The system is outfitted with a back-up 50-hp pump in case of primary pump failure. An alarm system monitors the pumps and electrical supply and is tied into an automatic dialer system linked to cellular telephones. Redundant emergency generators (330 KW each) are automatically serially activated in the event of a power failure.

The seawater supplied to the station is processed to prevent naturally occurring bacterial pathogens and parasites from entering the rearing tanks. Primary filtering consists of six 1.9 m^2 deep-bed fiberglass sand filters. The filters use either a number 20-grade sand or number 25 glass micro beads as filter media. The sand filters remove all materials greater than 20 microns in diameter, and a portion of smaller materials. Immediately after leaving the sand filters the seawater enters two filter systems, which contain a total of 148 cartridge filters ensuring a filtration rate of 5 microns. To control for pathogens the seawater next passes through stainless steel UV chambers where it is irradiated with a UV dosage of 55,000 to 90,000 micro-Watts per second per cm^2. After UV filtration, seawater goes directly to rearing tanks. Sensors monitor water flow and pressure through the seawater filtration system.

A secured rearing area containing 13.5 ft diameter circular tanks (with about 430 ft^3 of rearing space each) is available for use in the Elwha odd-year pink salmon project. Four tanks will be used. Pink salmon fry transferred to the research facility from Lower Elwha or Hurd Creek hatcheries will be acclimated with a mixture of fresh water and seawater. Fish will be reared at a density not to exceed 0.5 pounds/ft^3.

Lower Elwha Hatchery

The facility operates with a mix of surface and ground water. Water quality is similar to that found in the Elwha River. Water temperature profile will be cooler during the summer and warmer during the winter due to the influence of the ground water component.

Surface flow from the Elwha River is diverted to a water treatment plant located at RM 3.2 of the Elwha River. The diversion is in compliance with NOAA Fisheries screening criteria. Flow up to 29 CFS can be delivered from this facility to the hatchery. Water delivered from the diversion structure may receive treatment to strip sediment from the surface delivered to the hatchery. Goal of treatment for sediment removal is to maintain a maximum surface water turbidity of 20 NTUs.

Six wells on the facility can contribute a total of 4,000 GPM of groundwater to the facility. Water from these wells is delivered to the hatchery where it is de-gassed prior to delivery to rearing units at the hatchery.

National Pollutant Discharge Elimination System (NPDES) permits regulate the discharge of water effluent from Tribal Hatcheries and Other Upland Aquaculture Facilities in the State of Washington. Permit No. WAG-13-0023.

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.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Pink salmon broodstock will be collected at the WDFW resistance-board weir on the Elwha River mainstem (RM 4.0), or, if necessary by beach seining and/or gillnetting at suitable sites in the lower river.

5.2) Fish transportation equipment.

Broodstock collected from the river, and captive-reared broodstock from the Manchester facility will be transported to the Lower Elwha Hatchery by tanker truck. Pink salmon eggs (1,000 to 2,000 eyed eggs for use as captive brood) will be transported from the Lower Elwha Hatchery to the Hurd Creek Hatchery by pickup truck. The eggs will hatch and develop into fed fry and then will be transported from the Hurd Creek Hatchery to the Manchester facility by tanker truck. Vehicles owned by WDFW, LEKT, or NMFS, typically a truck of 300 – 1,500 gallon capacity, will be used for these purposes.

5.3) Broodstock holding and spawning facilities.

Pink salmon adults collected from the Elwha River, and those captive-reared adults transported from the Manchester Research Station will be held and spawned at the Lower Elwha Hatchery, Holding facilities for the program consist of a .75 acre concrete holding facility divided into sections that permit the segregation of fish based upon species, sex and ovulatory status. Spawning facilities for the program consist of a covered work area and an egg processing room

in the main hatchery building.

5.4) Incubation facilities.

The incubation facility at the Lower Elwha Hatchery consists of 84 half-stack vertical incubation units (Marisource, Inc.) with a maximum instantaneous incubational capacity of 1.0 million eggs. The facility is located on the hatchery grounds and is served by pathogen-free ground water.

The incubation facility at the Hurd Creek Hatchery consists of both vertical incubation units and isolation incubation buckets.

5.5) Rearing facilities.

Manchester Research Station

Rearing at the Manchester facility will extend from the fed fry stage to mature (2 year old) adult stage. Land-based seawater captive broodstock rearing will be conducted in a secured building with 400 m^2 of floor space for fish rearing tanks. The 400-m^2 seawater laboratory contains four 4.1-m diameter circular fiberglass tanks that can be made available for rearing of Elwha pink salmon captive broodstock. Water depth in the 4.1-m tanks is generally maintained near 0.9-m. Before entering fish rearing tanks, the processed seawater passes through packed column degassers which are filled with plastic bio-rings that break up the water boosting dissolved oxygen levels and allowing excess nitrogen to off-gas, which can be present in pumped water situations. Water leaving the packed columns goes directly to individual tanks within the captive broodstock rearing building. In addition, each tank is directly supplied with oxygen to maintain life support in the event of an interruption in water flow.

Lower Elwha Hatchery - The hatchery's rearing facility consists of 10 fiberglass early-rearing troughs, 16 concrete raceways, and 4 asphalt-lined rearing ponds.

Hurd Creek Hatchery - Raceways supplied with pathogen-free well water are available for grow-out.

5.6) Acclimation/release facilities.

Lower Elwha Hatchery - Pink salmon fry will be volitionally released into the mainstem Elwha River from the Lower Elwha Hatchery (RM 2.5).

5.7) Describe operational problems that may cause significant fish mortality and systems to avoid such loss.

Lower Elwha Hatchery

Flooding: Flooding has the potential to inundate the facility's fish ladder. In the event of flooding effluent water can be diverted from the facility fish ladder and pumped out of the facility.

Electrical power outages: Loss of electrical power resulted in pump failure and loss of groundwater production. Loss of electrical power generation is mitigated through an emergency stand-by generator that is capable of supplying facility electrical needs in the event of power outages.

Pump failure: Shaft bearing failure on turbine pumps in the past have caused pump shaft shear and loss of groundwater production. Facility well field consists of six groundwater wells. No more than five wells are operated at one time, permitting redundancy in groundwater production capabilities.
Loss of surface water: Flooding in the Elwha River has the potential to erode and damage the buried pipeline feeding the hatchery. In the event of loss of surface water recirculation pumps at the hatchery facility can be employed to maintain flows throughout the hatchery facility.
Mammalian predation: Predation by piscivorous mammals has resulted in the loss of an undocumented number of juvenile salmonids.
Avian predation: Predation by piscivorous birds has resulted in the loss of an undocumented number of juvenile salmonids.

Backup systems/risk aversion measures in place
Flooding: A flood reduction levee has been constructed by the US Army Corps of Engineers to address the issue of flooding. During flood events a gate on the hatchery fish ladder can be closed preventing the entry of flood waters into the hatchery facility.
Electrical power outages: Local PUD has upgraded the service entrance and transmissions lines leading to the facility.
Emergency standby generator: An emergency standby generator is on-line and ready to provide electrical power in the event of a power outage.
Pump failure: Pump production and operation is monitored regularly. Pumps receive regular servicing and inspections.
Fish theft: A video security system has been installed to deter theft and is monitored 24/7.
Predation: Netting systems have been upgraded to limit effects of avian predation. No risk aversion measures have been taken to limit mammalian predation.

Hurd Creek Hatchery – A backup water supply from Hurd Creek is available if pumps are rendered inoperable. A generator provides power in case of power loss. Staff live on-station, providing added security at the facility.

Manchester Research Station - The Manchester Research Station is staffed full-time. The facility complies with Washington State Department of Fish and Wildlife (WDFW) quarantine certification standards by depurating all effluent from the captive broodstock rearing areas by ozone treatment. The ozone treatment system consists of four parts, 1) a below ground three-chamber 25,000-gallon concrete depuration tank, 2) a recirculation pump system to move water from the depuration tank through the ozone building where the water is injected with ozone gas, 3) an air-cooled six-module ozone generator capable of producing 360g/hr of ozone, and 4) an ozone destruct system to control ozone off-gas.

Security measures to protect all fish and property on the station include water flow, fire, and intruder alarms. Alarms are monitored through a security system linked to home and cellular telephones. A back-up generator automatically activates during power failures. Backup pumps are in place to maintain life support should a primary pump fail.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

6.1 History.

Pink salmon have not previously been produced by hatcheries on the Elwha River. The odd-year pink salmon stock is the naturally produced native stock in the Elwha River, which likely consists of both a summer (early) and fall (late) run timing component, similar to the population in the nearby Dungeness River. The even-year adult pink salmon race returning to the Elwha River is considered a naturally spawning stock in the river, but its origin and genetic characters are as yet unknown. The even-year race appears to be a recent colonizer of the river. The broodstock are the most appropriate stocks for use in a supportive breeding program to preserve and restore pink salmon in the Elwha River.

6.2 Annual size.

The annual number of pink salmon adults collected for use as broodstock will range from an estimated 200 spawners at the beginning of the program, increasing up to 3,000 fish in later phases for the odd-year race, whereas the number of even-year adult fish will likely be in the range of 20 adult fish over the two brood year duration of the proposed program.

6.3 Past and proposed level of natural fish in broodstock.

Natural-origin adults comprised all of the brood year 2011 odd-year broodstock, and so fish used to initiate the captive broodstock and supplementation programs will be 100% natural origin fish. Beginning in 2013, hatchery origin fish recruiting to Lower Elwha Hatchery and the river will also be included in broodstock. Otolith marks on all juveniles released from the hatchery will enable their recognition among broodstock collected, but their contribution will only be quantified after spawning occurs, when their otoliths are read.

6.4 Genetic or ecological differences.

The intent is for broodstock and released juveniles to be identical to the native occurring population of pink salmon. Domestication selection will occur to some degree, particularly for captive reared adults, and to a lesser extent for juveniles which will have relatively short duration (~1.5 months) of rearing before their release.

SECTION 7. BROODSTOCK COLLECTION

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

7.2 Collection or sampling design.

Broodstock will be collected at the resistance board floating weir located at RM 4.0 on the mainstem Elwha River, or, if necessary by seining and/or gillnetting in the lower mainstem and side channels. If the weir does not capture a sufficient number, or large numbers of adult pink salmon are observed holding or spawning in downstream habitats, the other methods will be

applied to secure additional fish from those habitats. The goal will be to remove as many of these adult spawners from the compromised lower river habitats during dam removal in order to improve overall survival of Elwha pink salmon during dam removal.

We expect most adults will be transported to the Lower Elwha Hatchery and held there until they are spawned, but ripe fish collected from the river may be spawned on site with eggs and milt transported green to Lower Elwha Hatchery where they will be fertilized. Eggs will be transported in coolers containing ice to keep them cool. Milt containers will be supplemented with oxygen to enhance survival.

7.3 Proposed number of broodstock to be collected:

The following collection goals for the program assume a 50:50 sex ratio. Target broodstock collection levels after 2014 apply to the odd-year pink salmon race only.

Table 7.1. Annual number of adult pink salmon collected for use as broodstock.

Return Year	Number of Adult Fish	Broodstock Use
2011 and 2012	200	Seed captive broodstock and supplementation programs
2013 and 2014	Up to 200	Seed captive broodstock and supplementation programs
2015 and 2017	500	Seed last two years of captive broodstock program, and support supplementation program
2019 and 2021	3,000	Support supplementation program

7.4) Broodstock collection levels for the last twelve years (e.g. 1990-2011), or for most recent years available:

In 2011, a total of 112 adult pink salmon were collected at the Elwha River weir and transferred to Lower Elwha Hatchery for holding and eventual spawning (WDFW draft data, October 16, 2011). No collection of pink salmon broodstock occurred prior to 2011 in the Elwha River.

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

Captive Broodstock Program – Manchester Research Station
The capacity of the Manchester Research Station rearing is 800-900 pounds of fish per year. Adult capacity will depend on adult weight, but assuming average mature weight of 4 – 5.5 lbs (Wydoski and Whitney 2003; Heard 1991), capacity is approximately 200 fish per brood year. In previous experience with marine captive rearing programs involving Chinook and sockeye at Manchester, survival was initially low but increased as experience was gained (Maynard et al. in press). Experience gained with sockeye and Chinook will pave the way for greater than 60% smolt to pre-spawning adult survival for pink salmon. In the event this is not the case and

survival is low as in the early years of the other programs, the decision has been made to compensate for low survival by transferring more Elwha pink salmon smolts (1,500-2,000) to the Manchester Research Station than may be needed to produce 800-900 pounds of pre-spawning adults. If survival is high, an off ramp for the excess fish will need to be created to ensure total poundage of Elwha pink salmon at Manchester Research Station does not exceed 800-900 lbs per brood year.

If survival during captive rearing at Manchester is higher than expected, some adults would be transferred to the Lower Elwha Hatchery, or Elwha River estuary, or nearshore marine area when the mean individual fish size within the captive population reaches 6, 8, and 12 inches in length.

Tissue will be collected from all pink salmon surviving to age-1 at Manchester for genotyping, to distinguish early- and late-timed components, and to describe family structure for subsequent reference when implementing the mating protocol.

Supplementation Program – Lower Elwha Fish Hatchery
Adult pinks captured at the weir, or returning to the hatchery, in excess of program broodstock requirements will be released into the river to spawn naturally, contingent on turbidity and other habitat conditions.

7.6) Describe fish health maintenance and sanitation procedures applied.

Ovarian fluid, and kidney and spleen tissue will be collected from all trapped adults for use as broodstock at the Lower Elwha Hatchery. Samples will be screened for registered pathogenic viruses, *Renibacterium*, and *Aeromonas salmonicida*, consistent with protocols established by the co-managers' fish health policy. Health of fish in captive rearing will be monitored under protocols established by NMFS staff.

7.7) Disposition of carcasses - Carcasses of fish spawned at Lower Elwha Fish Hatchery will be returned to the river for nutrient enhancement purposes.

7.8) Risk aversion measures to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Adult fish used for broodstock will be collected across the breadth of the adult return period to reduce the risk of selection for run timing or sex ratio divergence from the extant natural-origin pink salmon population. Fish representative of each egg take at Lower Elwha Fish Hatchery will be incorporated at appropriate proportions of the total annual egg take in assembling the fry population transferred to Manchester each year.

Physical in-river activity will be minimized as much as possible to reduce the risk of negative impacts on ESA-listed spawning fish and redds. Live spawned fish or carcasses will be returned back to the river for nutrient enhancement. Incidental take of ESA-listed salmonid species in the watershed, including Chinook salmon, steelhead, and bull trout will be minimized to the extent feasible during pink salmon broodstock collection activities through implementation of appropriate capture, handling and release practices that reduce the risk of injury and mortality.

Any listed fish captured and not needed for use as broodstock for other Elwha Fish Restoration Plan hatchery programs will be returned immediately to the river with minimal handling.

SECTION 8. MATING

8.1) Selection method.

Supplementation Program: Lower Elwha Hatchery - The initial program intent is to spawn all adult fish collected at levels in accordance with the schedule specified in section 7.3. As the program evolves and the total abundance of returning adult fish to the hatchery release location increases, adult fish will be selected for spawning at representative levels over the span of the annual pink salmon return period. Selection of spawners in future years may be based on genetic identification data (DNA) and/or origin (hatchery or wild) as identified by otolith mark analyses.

Captive Broodstock Program: Manchester Research Station - All fish surviving to age-1 at Manchester will be genotyped and PIT-tagged to implement a mating protocol that maintains early- and late-timed components of the population, and avoids crossing full siblings, to maintain the genetic diversity of the population.

8.2) Mating scheme.

Males will be used for spawning at a 1:1 ratio with a 2 x 2 factorial mating scheme. This mating scheme may be expanded if sufficient adults are available to maximize genetic diversity. Additional males, including a repeat spawner, may be used to ensure fertilization (after 30 seconds of fertilizing with primary male) for each female spawned on a given day.

For at least the first brood year (2011), eggs from fish deemed to be part of either the early- or late-timed populations will be kept segregated, even as they are transferred to Hurd Creek, and then onto Manchester Station for captive rearing.

8.3) Fertilization.

Eggs from each female are divided into two one-gallon buckets. Sperm from each male is expressed into a paper cup. Sperm is added from each male to the egg aliquot of each female. After mixing, the buckets are combined, drained, weighed and placed in vertical incubation trays containing 100 ppm iodophor for water hardening. Biological samples are taken at this time to screen for fish health monitoring purposes.

8.4) Cryopreserved gametes.

None proposed.

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.

The factorial mating scheme, and implementing the pair selection protocol to avoid mating full siblings from captive-reared parents, will reduce the risk of loss of genetic diversity within the pink salmon populations. Based on pink salmon productivity, hatchery fish survival, and natural escapement trends, efforts to increase the number of natural-origin fish incorporated as hatchery broodstock may be used to reduce domestication and inbreeding depression risks (will be further developed in the MAMP).

SECTION 9. INCUBATION AND REARING

9.1 Incubation:

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

In 2011, the initial year of operation, approximately 60,000 green eggs were collected from odd-year pink salmon females collected from the Elwha River. Survival from the green to eyed-stage was 80.9%, from green egg to release 68.3%, and eyed egg to release 84.4% (L. Ward, Lower Elwha Klallam Tribe, pers comm March 24, 2012).

9.1.2 Cause for, and disposition of surplus egg takes.

No surplus anticipated.

9.1.3 Loading densities applied during incubation.

Green eggs are incubated to the eyed stage at the Lower Elwha Fish Hatchery. Incubation trays hold up to 3,000 eggs. Once eggs reach the “eyed”stage, transport of the captive brood component (1,000 to 2,000 eggs) will be transferred to the Hurd Creek Hatchery for additional rearing. Each Heath tray at the WDFW Hurd Creek Hatchery can hold six aliquots, which can hatch about 500 eggs. After receipt, eyed eggs are otolith marked. After otolith marks are applied, the water temperature is manipulated to adjust development (of eggs) such that all emergent fry are ponded on approximately the same date. This will produce a more uniform sized fry for eventual transfer to the Manchester facility.

9.1.4 Incubation conditions.

The Elwha Hatchery incubation facility is supplied by constant temperature ground water. Eggs are shocked, sorted to remove non-viable eggs, inventoried, and re-trayed prior to hatching. Embryo development is tracked on a weekly basis. Incubation flow rate through tray stacks is 3.0 gallons per minute. Water temperature, flow, and dissolved oxygen levels are continuously monitored. Eggs are incubated in discrete lots identified by the capture location. Eggs are retrayed with a triple-layer of Vexar screening to inhibit coagulated yolk condition. Groundwater supplied to the Elwha Fish Hatchery has a constant temperature of 47°F +/- 0.5°F. Water can be chilled to 38°F +/- 1.0°F for specified intervals to apply thermal marks to otoliths.

Hurd Creek Hatchery has the ability to regulate incubation water temperatures from 34°F to 74°F, but has a constant water temperature of 47°F +/- 0.5°F, except when otolith marks are

applied using chilled water at a temperature of 38°F +/- 1.0°F. Dissolved oxygen is 11.4 mg/l at the inlet.

9.1.5 Ponding.

Button-up fry are force-ponded from incubator trays when yolk is approximately 95-100% absorbed, as determined by visual inspection of a sample of fry. Temperature units at this time are approximately 1,600 temperature units (TU's).

9.1.6 Fish health maintenance and monitoring.

The health of incubating pink eggs is monitored according to protocols stated in the Co-Manager's Fish Health Policy procedures (NWIFC and WDFW 2006). Eggs are fertilized and water hardened in an iodophore solution. Fungal infection of incubating eggs is treated prophylactically by formalin drip treatments (166 PPM for 15 minutes, 3 days of treatment per 10 days rearing). The 3.0 GPM flow regime and use of incubational substrate prevents malformations. At the eyed stage dead eggs are removed mechanically and the remaining live eggs are re-trayed.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation. None identified.

9.2 Rearing:

For the odd- and even-year conventional supplementation programs, rearing to release of fed fry will occur exclusively at the Elwha Hatchery. Those odd-year fertilized eggs allocated for captive rearing will be transferred from Elwha hatchery to the WDFW Hurd Creek facility for rearing in cooler water, resulting in slower more even growth. As these slower growing pink fry begin smolting, it is thought that they will adapt more successfully to saltwater rearing at Manchester Station. The discrete families of fry produced from early- and late-timed parents will be kept separate when transferred to WDFW's Hurd Creek Hatchery,.

It is projected that Manchester will be able to grow a total maximum of about 800-900 lbs of fish weight to the adult stage per brood year in the five tanks combined. At an estimated 2 lb adult size and a projected 50% fry-to-adult survival, the Manchester component could yield a maximum of 250 females with an upper potential of approximately 300,000 eyed eggs at a 50:50 male: female ratio. At a projected 70% survival and a 3 lb adult size, numbers might be in the range of 150 females and 180,000 eggs. However, if the fish reach the documented 4-5.5 lb size of other Washington coast populations (Heard 1991, Wydoski and Whitney 2003), then numbers of females produced could be as low as less than 100 fish.

Projected survival, growth, and production scenarios at Manchester suggest a starting number of pink salmon smolting fry transferred to seawater should be in the 400-1,000 fish range. However, little is currently known regarding actual growth and survival targets for pink salmon in captive broodstock programs. Therefore, the project is planning to transfer more (1,500-2,000) smolting pink salmon fry than might be necessary, with the contingency that excess fish

will be returned to the Elwha hatchery at appropriate times to ensure that Manchester production does not exceed the total maximum of 800-900 lbs of total fish weight per brood year that can safely be reared at Manchester at a rearing density of 0.5 lbs/ft^3.

A proposed off-ramp schedule (see Section 7.5) would include returning pink salmon from Manchester to the Elwha Hatchery at a minimum of three size thresholds; e.g., when the population mean size reached 6, 8, and 12 inches in length. At each size threshold, appropriate numbers of fish would be transferred back to the Elwha Hatchery to maintain growth and survival targets to ensure a maximum end adult stage production that does not exceed the capacity of the facility.

9.2.1 Survival rates by hatchery life stage.

For brood year 2011 odd-year pinks were reared at the Elwha hatchery. Survival to the eyed-egg stage was 80.9%; 2,500 eyed-eggs were transferred to the Hurd Creek Hatchery for rearing prior to transfer to the Manchester Station. Survival from the green egg stage to release was 68.3%; survival from the eyed-egg stage to release was 84.4% (L. Ward, Elwha Hatchery Manger, pers comm March 29, 2012). Survival at Manchester is yet unknown.

9.2.2 Rearing Density.

At the Lower Elwha Fish Hatchery, NWIFC fish health staff have recommended that rearing indices based upon volume and flow not exceed 0.3 lbs fish/ft^3/inch fish length and 1.2 lbs fish/GPM/inch of fish length for volume and flow-based indices.

At Hurd Creek Hatchery, following WDFW Fish Health manual specifications, the pond rearing density index goal is < 0.4 lbs/ft^3 and the flow index is maintained at < 2.0. Actual density indices have not exceeded 0.25 and flow indices do not exceed 1.07.

At Manchester Research Station, rearing density will be maintained under 8 kg/m^3 (0.5 lbs/ft^3) during most of the juvenile-to-adult period. However, as the fish approach maturity, rearing densities may be allowed to increase to 15 kg/m^3 (1.**0** lbs/ft^3) as this is when maturing fish stop feeding. Based on practical experience and published literature, loading densities for pink salmon captive broodstocks maintained at Manchester Research Station will not exceed 0.84 kg/lpm (7 lbs/gpm), except for non-feeding maturing adults with oxygen supplementation. The most rapid turnover rate for the 4.1-m diameter circular tanks is calculated at 0.80 times/hour. When the tanks are lightly loaded the turnover rate can be as low as one third of this value.

9.2.3 Fish rearing conditions

At the Hurd Creek Hatchery, fry will be removed from incubators and ponded into 4’ fiberglass circular ponds (24 ponds available) until they actively feed. Once the fish attain an individual size of 1.0 to 1.5 grams, they will be transferred for rearing in 5’ x 40' fiberglass raceways. Raceway cleaning will be done at least weekly and any mortalities will be removed and recorded daily. WDFW Fish Health Specialists will routinely monitor fish health. Temperature regimes and dissolved oxygen levels have posed no problems during routine operation of the facility.

At Manchester Research Station, the fish will be reared in a 400-m^2 fish culture room containing six 4.1-m diameter circular fiberglass tanks. Water depth in the 4.1-m tanks is generally maintained near 0.9-m. During most of the juvenile-to-adult rearing period density will be maintained under 8 kg/m^3 (0.5 lbs/ft^3). Tanks will be completely covered with a taut 2.5 x 2.5 cm or smaller mesh nylon netting to prevent fish from escaping. The energy absorbing properties of the nylon mesh minimizes injuries that might occur to fish when they leap against it. In addition to the mesh covering, half of each tank will be covered with solid black fabric that provides a shaded area for fish to take refuge when disturbed.

At the Lower Elwha Hatchery, the remaining production fry will be transferred to and reared in 3' x 16' raceways. Maintenance and monitoring of fish will occur daily. Fish health staff from the NWIFC will monitor fish on a monthly basis or as needed.

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.

Not yet available from this past year's efforts.

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

At Manchester Station, fish will be reared on commercial feeds produced by BioOregon or Skretting[1]. Beginning with seawater entry, fish will be reared on a semi-moist starter diet fed by hand at least 8 times a day. When ready, the fish will be transitioned through standard pelleted semi-moist or dry grower feeds and progressed through "brood" ration sizes (6 mm, 9 mm). Fish will be transitioned to dry diets dispensed by automated feeders as they grow. The pellet size fed will follow the feed manufacturer's recommendations, based on current guidelines for commercial aquaculture and guidance provided in Fowler (1989). However, pellet size is adjusted from the recommendation to ensure that the smallest fish in the population are able to feed. Daily ration may range from 5.6% body weight per day for fry that are being transitioned to seawater down to 0.4% body weight per day for pre-spawning adults, all dependent upon fish size and water temperature (Iwama 1996). This feeding regime will attempt to emulate the growth trajectory reported by Heard (1991).

At the Lower Elwha and Hurd Creek hatcheries, supplementation program fish will be reared on a diet of Bio-Oregon' BioVita Starter . Feeding rates during the fed-fry stage range from 2.5% to 3.0% body weight per day.

9.2.6 Fish health monitoring, disease treatment, and sanitation procedures.

Fish health monitoring, fish disease treatment, and sanitation procedures will be in accordance with methods specified or referenced in the Disease Control Policy (2006). Monthly monitoring exams will be conducted to monitor and detect fish pathogens of concern. In the event of fish

disease epizootics or elevated mortality, fish pathologists are available to diagnose problems and provide treatment recommendations. Ponds are vacuumed weekly or as needed to maintain water quality and fish health. When emptied, all ponds are cleaned, air dried and sun-sanitized, if possible.

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

The migratory state of fry produced in the hatcheries will be consistent with size and time of natural pink salmon fry emigration. Based on WDFW's experience with pink salmon at the Hurd Creek Hatchery (increased mortality as fish approach 600/lb (0.76 g) (Dan Witczak, WDFW, personal communication), supplementation fish will be released from Lower Elwha Fish Hatchery at an individual size of 0.57 – 1.12 g (400 to 800 fpp). Fed fry produced through the captive broodstock program at Hurd Creek Hatchery will be transferred to Manchester Research Station within these same size ranges. Gill ATPase activity is not monitored.

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

N/A

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

The artificial production of pink salmon at the Hurd Creek Hatchery, Manchester Research Station, and Lower Elwha Fish Hatchery facilities is unlikely to pose substantial genetic or ecological risks to listed salmon or steelhead within the vicinity of the rearing locations. To protect fish under propagation with pink salmon at the facilities, operations are staffed full-time to allow for rapid response to catastrophic events including flooding or power failure. Low flow alarm systems and back-up generators allow for appropriate response to water or power failures to safeguard rearing fish.

SECTION 10. RELEASE

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size	Release Date	Location
Fry	3,000,000	400 -800 fpp (0.57-1.12 gm)	March-April	Lower Elwha River

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

Elwha River (WRIA 18.0274); Lower Elwha Fish Hatchery – Elwha River, RM 2.5. Fed fry may also be released into main channel flow to reduce predation, and far enough upstream of the river mouth to allow acclimation.

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

For the initial brood year (2011) produced at the Elwha Hatchery, 40,743 fry were released from the Elwha Hatchery to the river in March, 2012. The size of the fish released was approximately 600 per pound (1.3 g/fish). Eggs destined for eventual captive rearing at Manchester were transferred from Elwha Hatchery to Hurd Creek in January, 2012.

10.5) Fish transportation procedures, if applicable.

See Section 10.4 above.

10.6) Acclimation procedures

No off-station release or acclimation is currently planned for the program.

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

All eggs will be thermally treated to create an otolith mark to allow evaluation of the contribution of hatchery-origin fish to total annual returns and natural spawning contribution over the duration of the program.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels. No surpluses anticipated.

10.9) Fish health certification procedures applied pre-release.

All fish are examined for general condition and health as well as presence of "reportable pathogens" as defined in the disease control guidelines, within 1 to 3 weeks prior to release. A Fish Health Specialist checks fish prior to release, as per the Salmonid Disease Control Policy (2006).

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

In the event of flooding or drought conditions at Lower Elwha Hatchery, ponds may be drained and fish transported to and released directly into the lower Elwha River to prevent fish loss, if possible. Efforts will be made to transfer fry, fingerling, or sub-adult fish back to the Lower Elwha Hatchery or the Elwha River mouth in response to catastrophic conditions that prevent rearing at Hurd Creek Hatchery or Manchester Research Station.

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.

Artificial production and release of pink salmon from Lower Elwha Fish Hatchery is unlikely to pose substantial genetic or ecological risks to listed salmon or steelhead in the Elwha River watershed. Measures applied to reduce risks to the natural-origin pink salmon and other

populations include:

- Fed fry release time and size practices for the hatchery program are consistent with what is known about wild pink salmon emigration timing and size in the system (Mike McHenry, LEKT, personal communication).
- Fish may be released into mainstem and side channel habitats in the lower Elwha River to increase initial survival.
- Due to the small size (~ 1 gram) at release, pink salmon will not pose ecological risks to listed Chinook salmon and steelhead they may encounter in the lower Elwha River, and the duration and extent of any interactions will be limited as the fry quickly disperse in the lower river and estuary.

SECTION 11. MONITORING AND ADAPTIVE MANAGEMENT

The Monitoring and Adaptive Management Plan (MAMP) (2012 *in draft*) creates and implements monitoring and management strategies that incorporate the best available scientific methods and management responses to ensure the recovery of anadromous fish while minimizing risks to those species from dam removal and stock preservation efforts. The MAMP was developed by an interagency group through the review of technical memorandums, planning documents, the ERFRP (Ward et al 2008), recommendations from the HSRG (2012), Biological Opinions, and relevant scientific literature.

The MAMP will be subjected to peer review by independent scientists and has received policy review and concurrence by the co-managers and relevant federal agencies.

The adaptive management process includes:

- Definition of the decision making process and timeframe
- Definition of decision rules
- A Monitoring and Evaluation Plan focused on the process for establishing and modifying goals and objectives, and making decisions based on biological triggers
- Performance indicators (metrics) that drive the decision-making process
- Identification of biologically-oriented phases of recovery

The MAMP prioritizes recovery strategies for each species during each phase of recovery The Objectives of the MAMP are to evaluate restoration strategies and their associated assumptions, and to design a monitoring plan that identifies objectives and provides performance indicator values of adequate quality to evaluate management assumptions and the success of restoration strategies. Adaptive management will modify restoration strategies in response to assessment of their efficacy.

The endpoint of each phase of recovery is identified by the population achieving benchmark levels ('triggers') of abundance, productivity, spatial distribution, and diversity. These characteristics refer to recovery standards developed by the NMFS (McElhany et al 2000). Research and monitoring will focus on measuring progress toward these benchmarks, with results informing adaptive management. The MAMP will specify data standards for adaptive management decisions, tools and analytical methods, and data management and record keeping standards.

11.1 Monitor abundance and trend in adult returns .

Returning pink salmon will be counted at the weir, located at RM 4.0, and as they enter the Elwha Hatchery. Those fish passed above the weir (i.e., some may be retained for hatchery broodstock) will be Floy tagged. Surveys of the lower river below the weir will provide supplementary data on pink return abundance. Return abundance, specifically the HOR component (see 11.2) will inform decisions to continue hatchery supplementation for brood years 2015 and beyond.

11.2 Estimate the contribution of hatchery-origin recruits to total annual pink returns.

Thermal marking of otoliths for all pink fry released from Elwha Hatchery is intended to enable estimation of the HOR contribution to annual returns. Otoliths collected from pink carcasses on the spawning grounds and from hatchery broodstock, will be read to determine the HOR proportion. A carcass sampling scheme will be developed to obtain representative sampling of odd-year spawners.

11.3 Smolt production

Natural pink smolt production and outmigration timing will be estimated from capture at the screw trap in the lower river. Trap efficiency will be estimated used pink or chum fry from Elwha Hatchery. Smolt production provides an estimate of productivity (smolts per spawner) to track recovery. These data will be equally useful in assessing status of odd- and even-year populations. The smolt trap will also generate estimates of short-term survival of fry released from the hatchery. A sub-sample of pink salmon fry captured at the screw trap will be sacrificed so their otoliths can be examined for thermal marks. This will allow the contribution of naturally produced fry and hatchery fry to be determined.

11.4 Monitor length and run timing of returning adults, and genetic diversity.

Pink salmon caught at the weir and any carcasses retrieved from the spawning grounds will be measured to monitor size at maturity.

Adult return timing, spawn timing, and distribution of adult pink salmon will be evaluated from weir counts and spawner surveys. The weir will be used to monitor general return timing, while spawner surveys will be used to assess spawn timing and distribution.

Juvenile outmigration timing will be evaluated using a screw trap near the mouth of the Elwha River. This data will be compared to historic data on pink salmon outmigration timing collected using these same methods. Outmigration timing will also be compared to that of any naturally produced pink salmon fry.

Fin clips for later genetic analysis will be collected from a subsample of adults handled at the weir and during carcass sampling. These samples will be archived and analyzed as funds become available to assess the genetic diversity of the population.

11.5) Monitor hatchery protocols and survival

* Monitor egg and post-emergence survival to determine if the hatchery program can achieve production objectives.

* Compare broodstock collection with run timing characterized at the weir to determine if broodstock represent the entire run timing.

* If estimates from the screw trap suggest poor post-release survival, assess alternative release strategies to improve survival.

11.6) Adequacy of funding to support hatchery operations and monitoring and evaluation.

Partial funding is available to implement the monitoring and evaluation program. Operation of the weir is funded through 2012. Securing funds to continue weir operations is of the highest priority. In addition, existing spawner surveys will be continued as part of the normal escapement monitoring conducted by the co-managers. However, long-term funding is not available for weir operation and upstream spawner surveys. It is likely that the upstream spawner surveys can be partially completed with existing Federal, State, and Tribal staff. However, the consistency of these surveys will likely be inadequate without additional funding.

SECTION 12. RESEARCH

No additional research on odd- or even-year pink populations is anticipated as necessary for management of the hatchery supplementation program, contingent of conclusions of the 2012 Adaptive Management and Monitoring Plan.

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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: Larry Ward, Fisheries Biologist

Certified by_____ Date: 08.01.12