HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	George Adams Fall Chinook Hatchery Program (Integrated)
Species or Hatchery Stock:	George Adams Hatchery and Skokomish River Fall Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Hood Canal / Puget Sound
Date Submitted:	
Date Last Updated:	October 13, 2014

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Executive Summary

ESA Permit Status:
In 2004, the Washington Department of Fish and Wildlife (WDFW) and the Puget Sound Treaty Tribes (PSTT) submitted a Hatchery Genetic Management Plan (HGMP) for the George Adams Hatchery Chinook sub-yearling program under Limit 6 of the 4(d) rule. In a letter from NOAA Fisheries dated August 4, 2004, the Co-managers were informed that NOAA Fisheries anticipated completing a draft Environmental Impact Statement (EIS) by the summer of 2005. NOAA noted that "A final EIS may then be completed by winter 2005-2006, after which time NOAA Fisheries will release ESA 4(d) Rule determinations for the hatchery plans." The letter concluded by stating that "Your work on these hatchery plans is important, and will substantially contribute to on-going salmon recovery efforts within the region." The WDFW provided updated HGMPs to NOAA Fisheries in August 2005.

The Co-managers are now re-submitting an HGMP for the George Adams Hatchery Chinook sub-yearling program to further update the description of the program -- consistent with the *Hood Canal Salmon Management Plan*, the *Recovery Plan Recovery Plan Skokomish Chinook*, and the co-managers' *Management Plan for Fall Chinook in the Skokomish River* -- and incorporates new information and analyses.

The Puget Sound Chinook ESU is listed as "Threatened" under the ESA. In the Hood Canal region, the Technical Recovery Team (TRT) has identified two demographically-independent Chinook populations (DIPs): the Skokomish and the Mid-Hood Canal rivers (Dosewalips, Duckabush and Hamma Hamma) (Ruckelshaus et al. 2006).

George Adams Hatchery Chinook Program:
The purpose of the program is to produce fall Chinook for sustainable recreational and tribal fisheries. Juvenile fish will be produced at the George Adams Hatchery (located on Purdy Creek, tributary to the lower Skokomish River). The program will release 3.8-million sub-yearling smolts into Hood Canal annually.

The program will be operated as an "integrated" program, with the intent to minimize the genetic and reproductive fitness differences between the hatchery broodstock and the naturally spawning population from which they are derived. Hatchery-origin Chinook returning to the Purdy Creek trap are can be differentiated from natural-origin Chinook by the adipose fin-clip and/or (in the case of the double-index tag (DIT) group) the presence of a coded-wire tag (CWT).

Starting with the 2014 brood, the program will begin the development of a "late-timed" component of the extant George Adams Hatchery stock. The objective is to cultivate a stock that exhibits peak maturity in late-October (five to six weeks later than the current peak), better-adapted to the hydrology of the Skokomish River. This component will be undertaken with the expectation that the earlier-timed fall Chinook production at George Adams Hatchery will continue its primary function of supporting harvest.

Risk control measures are also in place to address other potential hazards including ecological interactions with ESA-listed species, disease transmission, and facility effects.

Harvest:
The program produces salmon for harvest in regional recreational fisheries that are of high value to the State of Washington. Adult fish produced also help meet tribal fishery harvest allocations that are guaranteed through treaties, as affirmed in *U.S. v Washington* (1974). Program-origin salmon also help meet Pacific Salmon Treaty harvest sharing agreements with Canada. These harvest objectives are met in a manner that minimizes diverse effects on listed fish. Returning fall Chinook adults provide for Tribal commercial and subsistence use, and provide a localized recreational sport fishery, mostly from July through October each year.

Monitoring, Evaluation, and Adaptive Management:
WDFW and the Co-managers conduct annual spawning ground surveys throughout the Hood Canal Watershed. CWTs recovered from hatchery releases on natural spawning grounds in adjacent basins are used to evaluate stray risks of this program to the listed Skokomish and Mid Hood Canal Chinook ESUs.

1 SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1 Name of hatchery or program.

George Adams Hatchery Fall Chinook Program.

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

Puget Sound fall Chinook (*Oncorhynchus tshawytscha*) – George Adams Hatchery stock integrated with Skokomish River natural stock

Status: Reaffirmed "*Threatened*" by five-year status review, completed August 15, 2011 (76FR50448).

1.3 Responsible organization and individuals.

Hatchery Operations Staff Lead Contact

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Fish Management Staff Lead Contact

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The Skokomish Tribe (SIT)

The Lower Elwha Klallam Tribe

Port Gamble S'Klallam Tribe and Jamestown S'Klallam Tribe (Represented by the Point No Point Treaty Council).

The Hood Canal Salmon Enhancement Group (*HCSEG*) and *Long Live the Kings* (*LLTK*) operates a RFEG cooperative project (RFEG 6 Hood Canal) at the John Creek Conservancy Site, which produces fall Chinook sub-yearlings for release; a portion of the George Adams production is used to supplement the Hamma Hamma Fall Chinook program releases (see Hamma Hamma Fall Chinook HGMP).

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

Funding Sources	Operational Information (FY 2013)
Wildlife Fund - State	Full time equivalent staff – 4.36
Local (Tacoma City Light)	Annual operating cost (dollars) - $396,811
Other (ALEA)	

The above information for annual operating cost applies cumulatively to all species produced from this facility.

1.5 Location(s) of hatchery and associated facilities.

Broodstock Source: George Adams Hatchery (Skokomish River) Fall Chinook

Table 1.5.1: Location of culturing phases, by facility.

Facility	Culturing Phase	Location
George Adams Hatchery	Broodstock collection, Adult holding/spawning, Incubation, Rearing	Located on Purdy Creek (WRIA 16.0005) at RM 1.0, tributary to the lower Skokomish River (WRIA 16.0001) draining into Hood Canal in southwestern Puget Sound near Union, Washington. Hood Canal Basin

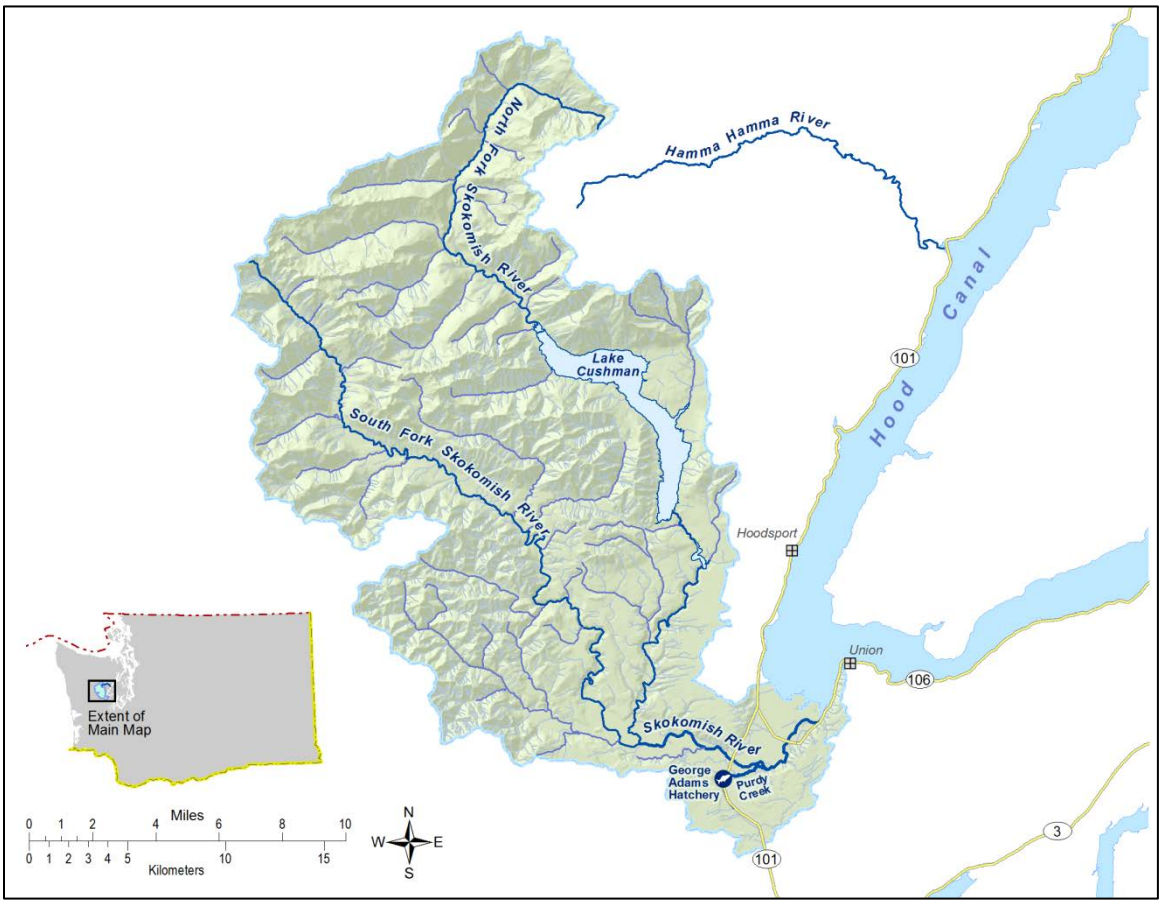

Figure 1.5.1: Map of George Adams Hatchery and the Skokomish basin. Source: WDFW GIS Unit.

1.6 Type of program.

Integrated harvest.

1.7 Purpose (Goal) of program.

Harvest Augmentation/Mitigation.

This program provides also fry to the Hood Canal Salmon Enhancement Group fall Chinook program (see Hamma Hamma Fall Chinook HGMP).

1.8 Justification for the program.

The program produces hatchery fish that maintain important and meaningful Treaty and Non-Treaty fishing opportunities. Fall Chinook production at the George Adams Hatchery augments harvest opportunities by providing partial mitigation for the loss of natural production due to construction and operation of the Cushman hydroelectric project (SIT and WDFW 2010). In terms of fishery benefits, hatchery-produced fish from this program contribute significant benefits and value to numerous directed and incidental Chinook Treaty and Non-Treaty fisheries from

Alaska, British Columbia, the Washington coast, Puget Sound pre-terminal and terminal area fisheries.

Program-origin salmon also help meet Pacific Salmon Treaty harvest sharing agreements with Canada. These harvest objectives are met in a manner that minimizes diverse effects on listed fish. Interactions with listed salmon populations in Puget Sound are reduced by relying on localized broodstock, by fully imprinting juveniles through rearing at the release site (to minimize straying) and by releasing fish as smolts (to minimize marine area ecological interactions), as programmed in the Future Brood Document (FBD).

Table 1.8.1: Summary of risk aversion measures for the George Adams fall Chinook program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Usage of spring, well and surface water rights are formalized through trust water right permit #s S2-20811 and G2-26481. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	There are no wild Chinook or chum above the Purdy Creek intake. The surface water intakes at George Adams Hatchery are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not currently meet (NMFS 2011a) screening passage requirements.
Effluent Discharge	4.2	George Adams operates under the conditions of NPDES Permit # WAG13-1019. A two-cell pollution abatement system was installed in June 2009 for settling and removal of pond vacuuming waste.
Broodstock management & Adult Passage	2.2.3, 5.1, 7.9	There is no in-river rack on the Skokomish River. Fish voluntarily enter Purdy Creek where an in-stream rack and pond collect and holds adults. No Chinook are passed upstream of the rack in Purdy Creek.
Disease Transmission	9.2.7	The *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006) details hatchery practices and operations designed to stop the introduction and/or spread of any diseases.
Competition & Predation	2.2.3, 10.11	Fish are released at times, size, life-history stage (smolts), and locations to foster rapid downstream migration to marine waters.

1.9 List of program "Performance Standards".

See HGMP section 1.10. Standards and indicators are referenced from Northwest Power Planning Council (NPPC) Artificial Production Review (APR) (NPPC 2001).

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

1.10.1 "Performance Indicators" addressing benefits.

Table 1.10.1.1: "Performance Indicators" addressing benefits.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.1 Program contributes to all fisheries including fulfilling	Contributes to harvest.	Participate in annual coordination between co-

tribal trust responsibility mandate and treaty rights as described in *U.S. v WA*.		managers to identify and report on issues of interest, coordinate management, and review programs (FBD process, North of Falcon, HAIPs).
3.1.2 Program contributes to mitigation requirements.	Number of fish released by program returning, or caught, as applicable to given mitigation requirements.	This program provides mitigation for lost fish production due to development within the Skokomish system contributing to sport, tribal and commercial fisheries. Estimation of survival rates and contribution to fisheries for each brood year released.
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA listed fish "take" authorizations for harvest and hatchery actions.	HGMP updated and re-submitted to NOAA with significant changes or under permit agreement.
3.2.1 Fish produced for harvest are propagated and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	Annual number of fish produced by this program caught in all fisheries, including estimates of fish released and associated incidental mortalities, by fishery. Annual escapements of natural populations that are affected by fisheries targeting program fish.	Annually mass-mark hatchery releases and record estimates of mark rate. Agencies monitor harvests and hatchery returns to provide up-to-date information.
3.3.1. Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas	Annual number of spawners on the spawning ground, by age. Spawner recruit ratios.	Number and proportion of hatchery origin fish among natural spawners. Spawning ground surveys conducted weekly in the NF, SF, mainstem, and tributary index areas. Spawning ground carcass sampling rate at least 5% to estimate pHOS.
3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production, and to evaluate effects of the program on the local natural population.	Marking rates and mark type.	Annually record, monitor and assess size, number, date of release and mass mark quality (adipose fin-clip (AD), AD+CWT, CWT-only, otoliths) of all hatchery releases. Approximately 92% of release ad-clipped. Double Index Tag (DIT) groups of at least 200,000 adipose-clipped and/or CWTs. Examine returning fish are sampled in fisheries and at the hatchery for CWT recovery. Annually record numbers of estimated hatchery (marked) and natural (unmarked). CWTs decoded; data compiled and reported annually to RMIS.
3.4.1 Broodstock for the main program are taken throughout the	Broodstock collection is conducted representatively and	Collect and evaluate annual run timing, age and sex composition

return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	systematically, in proportion to timing, age and sex composition of return.	and spawning escapement data. Collect and evaluate run timing, age and sex composition, and escapement data from the late-timed component, as a comparison to the current program releases. It is the intent of this portion of the program to develop a late mode that exhibits peak sexual maturity in late-- October (i.e., five to six weeks later than the current peak). Broodstock for this purpose will be collected from the latest arrivals at George Adams Hatchery. Adhere to WDFW spawning guidelines. (Seidel 1983).
3.5.1. Maintain genetic diversity of broodstock.	Timing of collection compared to overall run timing. Total number of natural spawners reaching the collection facility.	Collect and evaluate annual run timing, age and sex composition and spawning escapement data. Broodstock for the main program are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.
3.5.5 Juveniles are released at fully-smolted stage to benefit juvenile to adult survival rates, and reduce the likelihood for residualism and negative ecological interactions with natural-origin fish.	Higher survival benefit and reduced residualism -- smoltification (size fpp/mass CV and condition factor) and behavior monitored in the hatchery.	Monitor fish condition in the hatchery throughout all rearing stages. Annually monitor and record size, number, and date of release in WDFW Hatcheries Headquarters Database.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is properly sized to meet harvest objectives; program fish are fully utilized in target fisheries.	Harvests and hatchery returns are monitored throughout the run.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Adhere to HSRG (2004) and WDFW spawning guidelines (Seidel 1983). Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, age and sex composition data upon adult return. Annually record growth rates, mark rate and size at release and release dates.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Recreational fishery angler days, length of season, number of licenses purchased. Meet tribal subsistence and ceremonial requirements.	Estimate annual harvest of hatchery fish based on CWT recovery analysis and from sampling tribal fisheries and recreational creel surveys. WDFW and Co-managers annually review harvest.

1.10.2 "Performance Indicators" addressing risks.

Table 1.10.2.1: "Performance Indicators" addressing risks.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	Program complies with Federal ESA-listed fish take authorizations for harvest and hatchery actions.	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Program risks have been addressed in this HGMP through best available science hatchery management actions.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while adequately minimizing by-catch of non-target species.	.Annual number of fish produced by this program caught in all fisheries, including estimates of fish released and associated incidental mortalities, by fishery. Annual escapements of natural populations that are affected by fisheries targeting program fish.	Harvest directed at hatchery production does not impede recovery of the Skokomish fall population. Agencies monitor harvests and hatchery escapements to provide up-to-date information for in-season fishery and hatchery adjustments. Post-season FRAM validation ER estimates. Consistent with Total Exploitation Rate ceiling (currently 50% or 15% SUS if projected escapement below the Low Abundance Threshold.
3.2.2 Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Percentage of total hatchery releases are identifiable as hatchery-origin fish (adipose-fin clip, CWT, otolith-mark, etc., depending on species) to allow for their differentiation from naturally produced fish for selective fisheries and escapement estimates.	As of December 2005, the Co-managers agreed to mass-mark the remaining production with full implementation beginning with brood year 2007 production (*Skokomish Mass-Marking MOU* 2005). Assess annual harvest of mass-marked hatchery fish based on CWT recovery estimates and creel surveys. DIT groups (CWT-only) can provide data on catch contributions, run timing, total survival, migration patterns, straying, in-stream evaluations of adult behaviors, NOR/HOR ratio on the spawning grounds.
3.3.1 Hatchery program contributes to an increasing number of spawners returning to natural spawning areas.	Total number of spawners, categorized by origin, are monitored (pHOS, spawner-recruit ratios).	Consistent with the Skokomish River fall Chinook management plan (Skokomish Tribe and WDFW 2014), will evaluate population characteristics including abundance (pHOS), productivity, life history diversity, run-timing, and spatial distribution of natural spawners.

3.3.2 Releases are sufficiently marked to allow statistically significant evaluation of program contribution to natural production and to evaluate effects of the program on the local natural population.	Mass-mark rates and mark type (adipose-fin clip, CWT, otolith-mark, DIT, other, etc., depending on species) production fish to identify hatchery releases from naturally-produced fish.	Annually monitor and record size, number, date of release and mass-mark quality (adipose fin-clip rate) of all hatchery releases. Annually sample returning fish in fisheries and at the hatchery for CWT recovery; record numbers of estimated hatchery (marked) and natural-origin (unmarked).
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of population from which broodstock is taken.	Temporal and age distribution of broodstock collected, compared to that of naturally-produced population at collection point.	Collect and evaluate annual run timing, age and sex composition and return timing data. Adhere to WDFW spawning guidelines. (Seidel 1983, HSRG 2004).
3.4.2 Broodstock collection does not significantly reduce potential number of natural-origin spawners.	Number of spawners of natural-origin removed for broodstock. Number and origin of spawners migrating to natural spawning areas.	Hatchery contribution to natural escapement maintains abundance Hatchery rack monitoring, spawning escapement surveys, with sampling to estimate NOS and HOS. pNOB < 5% of NOS. 1,200 Natural Escapement. Escapement surveys and carcass sampling to estimate number and origin of spawners in the NF, SF, mainstem, and tributaries.
3.4.3 Life history characteristics of the natural population do not change as a result of this hatchery program.	Specific life history characteristics of the natural and artificially-produced population are measured include: Adult return age and sex composition; Adult run timing; Adult size (fork length, weight) at return; Spawn timing and distribution.	Hatchery spawning protocols maximize effective population size. Operation of program prevents loss of genetic diversity among extant population. Determine age composition of broodstock. Weekly selection from pool. Random selection of mates. Determine mark status of broodstock. pNOB at least 10%.
3.5.1 Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	Within and between populations, genetic structure is not affected by artificial production.	Currently not monitored.
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Timing of collection compared to overall run timing.	Collect annual run timing, age and sex composition data. Examine returning fish for the fin-mark at the hatchery. Annually record numbers of estimated hatchery (marked) and

		natural (unmarked). DIT groups allow evaluation of straying, in-stream evaluations of adult behaviors, NOR/HOR ratio on the spawning grounds.
3.5.3 Hatchery-origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.	The ratio of observed and/or estimated total numbers of artificially-produced fish on natural spawning grounds, to total number of naturally-produced fish (pHOS).	Harvest of early-timed adult returns and development of a late-timed adult component of the population consistent with the fall Chinook management plan (SIT and WDFW 2014).
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Location of release (on-station, acclimation pond, direct plant). Release type (forced, volitional or direct stream release).	Annually monitor size, age class, number, date of release, location and release type, and record in the WDFW Hatcheries Headquarters Database. Fully-smolted sub-yearling release to minimize interactions in the river and estuary. Rearing and release protocols minimize potential for competition and predation on naturally produced juvenile Chinook, steelhead, coho, and chum.
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release and release type.	Monitor size, number, date of release.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is sized appropriately for harvest goals. Numbers of surplus hatchery returns are calculated annually.	Annually record numbers of adults returning to the hatchery, broodstock collected, and surplus returns
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Apply minimal monitoring standards in the hatchery: food conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Collect annual run timing, origin, age and sex composition and return timing data. Annually record growth rates, mark rate and size at release and release dates. Adhere to HSRG (2004) and WDFW spawning guidelines (Seidel 1983).
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, WDFW Fish Health Policy, INAD, MDFWP).	Annual reports indicating levels of compliance with applicable standards and criteria. Periodic audits indicating level of compliance with applicable standards and criteria.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed. The program is operated consistent with *the Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards by NPDES permit. WDOE water right permit compliance.	Hatchery facility operated to minimize effects of water diversion and effluent on extant fish populations in the Skokomish River. Flow and discharge reported in monthly NPDES reports. Effluent water quality consistent with NPDES permit. Intake screens in compliance with WDFW standards
3.7.3 Water withdrawals and in-stream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Water withdrawals compared to NMFS, USFWS and WDFW applicable passage and screening criteria for juveniles and adults.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens. Follow the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).	Necropsies of fish to assess health, nutritional status, and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary. A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites.	Examine fish 1 to 6 weeks prior to transfer or release, in accordance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).
	Inspection of adult broodstock for pathogens and parasites.	At spawning, lots of 60 adult broodstock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites.	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006).

3.7.5 Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal and federal carcass distribution guidelines.	All applicable fish disease policies are followed. See HGMP sections 7.5 and 7.8.	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Disposition of carcasses are recorded in the WDFW Hatchery Adult Data.
3.7.6 Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally-produced population.	Spatial and temporal spawning distribution of natural populations above and below weir/trap currently compared to historic distribution.	Collect annual run timing, age, and sex composition data. Primary historic spawning habitat exists in NF, SF, and mainstem Skokomish. Currently no upstream escapement goals for Purdy Creek.
3.7.7 Weir/trap operations do not result in significant stress, injury or mortality in natural populations.	All observations of natural-origin fish at hatchery facilities are recorded and reported annually.	Trap checked daily. Natural- and hatchery-origin fish abundances recorded and reported annually. Minimize pre-spawn mortality of broodstock trapped and held at the facility. Monitor condition of adults in the trap, enumerate mortality in the holding pond. (Injury and mortality associated with Purdy Creek trap < 5%)
3.7.8 Predation by artificially produced fish on naturally – produced fish does not significantly reduce numbers of natural fish.	Hatchery juveniles are raised to smolt-size and released from the hatchery at a time that fosters rapid migration downstream.	Not available due to funding constraints.
3.8.1 Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	Total cost of operation.	Annual operational cost of program compared to calculated fishery contribution value (Wegge 2009). 5-year review of production costs.
3.8.2 Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	Artificial production was chosen as the preferred alternative for attaining hatchery production objective.	Annual operational cost of program compared to calculated fishery contribution value (Wegge 2009). 5-year review of production costs.

1.11 Expected size of program.

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

Up to 2,500 adults collected annually.

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

Table 1.11.2.1: Proposed annual release levels.

Life Stage	Release Location	Annual Release Level
Sub-yearling	Purdy Creek (WRIA 16.0005)	3,600,000*
Sub-yearling	Purdy Creek (WRIA 16.0005)	200,000**

WDFW, Future Brood Document 2013.

* Releases do not include the 43,000 sub-yearlings (125 fpp) provided to RFEG 6-Hood Canal's Hamma Hamma fall Chinook program at the Long Live the Kings' John Creek Conservancy Site (see Hamma Hamma Fall Chinook HGMP), or the 200,000 sub-yearlings released from Hoodsport Hatchery starting in 2015 (SIT and WDFW 2014).

** Late-timed spawners.

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

Based on the average smolt-to-adult survival rate of 0.49% for 2000-2007 brood years, and a programmed release goal at George Adams Hatchery of 3,800,000 sub-yearlings, the estimated adult production (goal) level would be 23,560 (see also HGMP section 3.3.1).

For escapement levels, see HGMP section 2.2.

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

George Adams Hatchery began producing Hood Canal sub-yearling fall Chinook in 1961.

1.14 Expected duration of program.

Ongoing.

1.15 Watersheds targeted by program.

Purdy Creek (WRIA 16.0005) – Skokomish Basin.

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

The *Puget Sound Salmon Management Plan* (PSSMP 1985) and the *Hood Canal Salmon Management Plan* (HCSMP 1985) are federal court orders that currently guide both the harvest management rules and production schedules for salmon in Hood Canal under the *U.S. v Washington* (1974) management framework between the Co-managers (WDFW, the Skokomish, Jamestown S'Klallam, Port Gamble S'Klallam, and Lower Elwha Klallam tribes.). The co-management process requires that both the State of Washington and the relevant Puget Sound tribes agree on the function and purpose of each hatchery program and on production levels. Guidelines for production at Hood Canal facilities are set out in the *Hood Canal Salmon and Steelhead Production MOU* (PNPTC et al. 1996) and the Future/Equilibrium Brood Documents. The PSSMP explicitly states that, "no change may be made to the Equilibrium Brood Document (production goals) without prior agreement of the affected parties."

Management of Fall Chinook in the Skokomish River. The Puget Sound Hatchery Action Advisory Committee (PSHAAC) final report (2013) recommended that fall Chinook in the Skokomish River be designated as a "primary" constituent population, and concurred with the Puget Sound Chinook recovery plan designation of the Skokomish River Chinook for high viability in recovery (NMFS 2006). PSHAAC acknowledged and understood that the current survival and productivity of the natural Chinook population in the Skokomish River is limited by the degraded condition of the current habitat. This HGMP is developed following an alternative approach.

The Skokomish Indian Tribe (SIT) and WDFW considered this recommendation when developing a plan for the *Management of Fall Chinook in the Skokomish River* (SIT and WDFW 2014). This plan specifies objectives and measures to benefit the extant population and potential recovery. It will function as an amendment to the *Skokomish Chinook Recovery Plan* (SIT and WDFW 2010) by advancing implementation of a sequence of measures that could ultimately increase natural production of fall-timed Chinook. The plan is consistent with the primary assumption of the recovery plan that significantly improved natural production is contingent on restoration of habitat function. The plan describes measures intended to improve the status of Skokomish River fall-timed Chinook salmon, and preserve their genetic diversity.

Although the current Green River-lineage Chinook stock is different in entry timing and genetic characteristics from the extirpated indigenous population, the extant, non-native stock is a potential resource for meeting management objectives. The extant summer/fall stock will continue to be the primary source of future harvest opportunities and current or altered characteristics of the stock can provide a source for natural production. HGMP section 6.3 addresses the intent of the plan to enhance the diversity of the fall Chinook population through the development of a component of the population which will exhibit later river entry and spawn timing, consistent with the hydrological regime of the Skokomish River. This action, combined with fisheries management actions to increase exploitation of the early entry/spawning population, as well as reduction in exploitation on the late-timed component of the population, is intended to allow for the development of local adaptation to the hydrology of the Skokomish River. Due to factors indicating low potential for effecting recovery of the current timed fall Chinook population by relying solely on the extant George Adams Hatchery stock to supplement natural production, the development of a late-timed component of the extant George Adams Hatchery stock will commence with the 2014 brood. Development of this component will be undertaken with the expectation that the earlier-timed fall Chinook production at George Adams Hatchery will continue its primary function of supporting harvest.

2 SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

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

This HGMP is submitted to NOAA Fisheries for ESA consultation and determination regarding compliance of the plan with ESA Section 4(d) rule criteria for joint state/tribal hatchery resource management plans affecting listed salmon and steelhead.

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

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

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

Puget Sound Chinook (*Oncorhynchus tshawytscha*): Listed as *Threatened* on March 24, 1999 (64FR14308); *Threatened* status reaffirmed on June 28, 2005 (70FR37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The Puget Sound Chinook salmon ESU is composed of 31 historically quasi-independent populations, of which 22 are believed to be extant currently. The ESU includes all naturally-spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Strait of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington (Ford 2011), as well as

twenty-seven artificial propagation programs (NMFS 2013 78FR38270). In the Skokomish River, the Technical Recovery Team (TRT) has identified one demographically independent population (DIP) the Skokomish (Ruckelshaus et al. 2006).

Genetic data indicate that Green River lineage Chinook salmon, considered a summer/fall stock, replaced the indigenous late-returning population (Myers et al. 1998, Ruckelshaus et al. 2006). Although different in entry timing and genetic characteristics from the indigenous population, the extant, non-native stock is a potential resource for meeting management objectives. The extant summer/fall stock will continue to be the primary source of future harvest opportunities and current or altered characteristics of the stock can provide a source for natural production (SIT and WDFW 2014).

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

Hood Canal summer chum (*Oncorhynchus keta*): Listed as *Threatened* on Mar. 25, 1999 (64FR14507); *Threatened* status reaffirmed on June 28, 2005 (70FR37160); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). Final designation for Critical Habitat was published Sept. 2, 2005 (70FR52630), with effective date of Jan. 2, 2006. The ESU includes all naturally spawned populations of summer-run chum in Hood Canal and its tributaries, populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington (Ford 2011). Also includes summer chum from four artificial propagation programs: Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, Tahuya River, and the Jimmycomelately Creek Fish Hatchery summer-run chum programs (Draft Proposed Language - NMFS 2013 78FR38270).

Puget Sound steelhead *(Oncorhynchus mykiss*): Were listed as *Threatened* under the ESA on May 11, 2007 (72FR26722); reaffirmed *Threatened* by five-year status review, completed August 15, 2011 (76FR50448). The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, below natural migration barriers in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington. This DPS is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive) (Ford 2011). Also includes steelhead from six artificial propagation programs: Green River Natural; White River Winter Steelhead Supplementation; Hood Canal Steelhead Supplementation Off-station Projects in the Dewatto, Skokomish, and Duckabush Rivers; and the Lower Elwha Fish Hatchery Wild Steelhead Recovery (Draft Proposed Language - NMFS 2013 78FR38270). In the Skokomish River region, the TRT has preliminarily delineated one demographically independent population (DIP) of winter steelhead; (Skokomish). No summer run populations were identified in this region (PSSTRT 2013) and there is no current evidence of self-sustaining summer steelhead populations in the Hood Canal basin (PNPTT and WDFW 2013).

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

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds *(see definitions in "Attachment 1")*.

George Adams Hatchery Fall Chinook in the Puget Sound ESU: NMFS (1999) considered this stock to be part of the ESU but not essential for recovery. The hatchery population was listed with natural-origin Chinook salmon that are part of the Skokomish population (70 FR 37160. June 28, 2005; NMFS SHIEER 2004). This stock is a category 2b or 3c. Broodstock sources are from within the ESU, but because of the frequent exchange between George Adams Hatchery and Finch Creek (Green River origin) fall Chinook salmon broodstocks, the George Adams stock is unlikely to be closely related to any native Hood Canal fall Chinook salmon populations. This categorization could be revised as more information on the genetic and demographic relationship between the hatchery and natural populations becomes available (SSHAG 2003).

Skokomish Fall Chinook in the Puget Sound Chinook ESU. Escapement to the Skokomish River increased from 1998 to 2004 during a period of rising SUS exploitation rates. Escapement has rebounded again since 2008, during a period of stable SUS exploitation rates. Escapement exceeded the nominal escapement goal (1,200) in eight years since 2001, so the fundamental objective of harvest management has been achieved (PSIT and WDFW 2013).

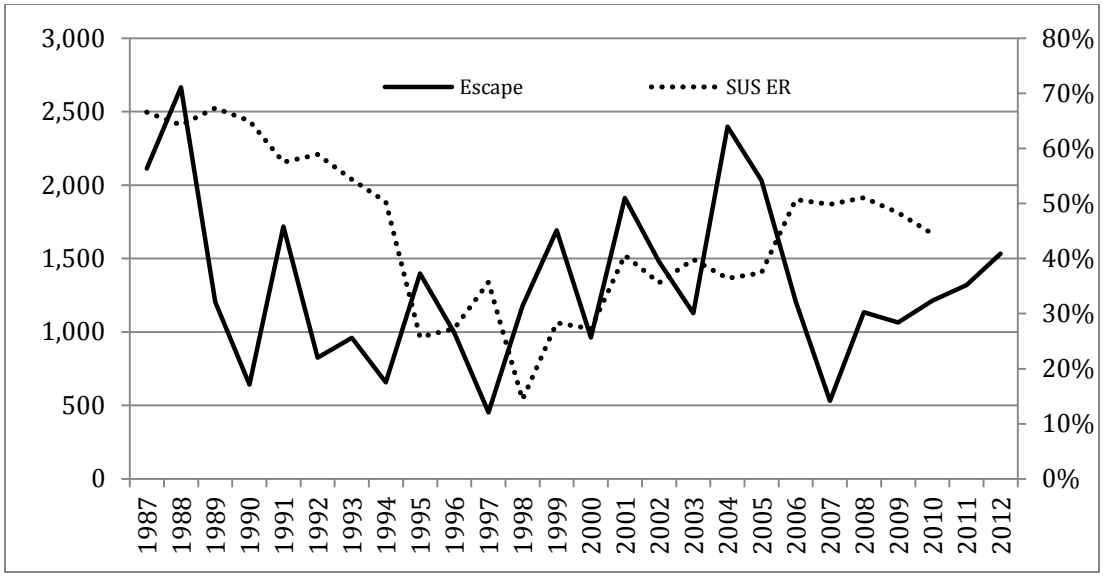

Figure 2.2.2.1. Chinook escapement to the Skokomish River and SUS exploitation rates (source: PSIT and WDFW 2013).

Estimates of natural escapement for 1988-2011 are derived from surveys of the mainstem (RM 2.2 to 9.0), North Fork (RM 0.0 to 15.6), South Fork (up to RM 2.2), Vance, and Hunter creeks. Survey design has been relatively consistent since 1988, with some deviation in survey frequency in each area. Additional area in the South Fork up to RM 5.5 have been surveyed since 2008, and are included in the estimate. There has been increased frequency of surveys of some reaches since 2008. Regression abundance trend not significant: 1988 – 2011 (X_1 = 0.003 (-0.024 – 0.031) Trends (Geiger and Zhang 2002) for total and NOR escapement not significant.

The majority (mean 65%) of redds have been counted in the mainstem reach since 2005, with a mean of 28% in the North Fork and 7% in the Lower South Fork. The South Fork has been inaccessible for much of the migration and spawning season in several recent years, when surface flow is near zero due to aggradation. Surveys of Hunter Creek, which has very limited suitable spawning habitat, have observed 7% to 20% of total redds.

Table 2.2.2.1: Distribution of Chinook spawning in the Skokomish River.

Year	Total	Mainstem	%	North Fork	%	South Fork	%
2005	2032	1445	71%	529	26%	58	3%
2006	1209	934	77%	275	23%	0	0%
2007	429	303	71%	123	29%	3	1%
2008	1134	671	59%	295	26%	168	15%
2009	1067	666	62%	368	34%	33	3%
2010	1214	701	58%	325	27%	188	15%
2011	1321	758	57%	405	31%	158	12%

Source: Mark Downen, WDFW District Biologist 2014.

In 2008 (372 adults + 26 jacks) and 2009 (400), surplus adults and jacks held at George Adams Hatchery were transported into the upper South Fork (released at confluence with Brown's Creek. This program was terminated when the revised *Chinook Recovery Plan* (2010) was completed.

Current habitat conditions cannot support an independently sustainable population. Hatchery returns, however, provide a stabilizing influence on natural escapement. The NOR component of natural spawners is estimated from carcass sampling for mark status and presence of CWTs. Hatchery marking rates were less than 100% until brood year 2006, so until 2011 the NOR proportion was derived by adjusting the unmarked carcass proportion by the marking rate for each of the three contributing hatchery broods. Carcass sampling rates are very low for several years. These factors increase uncertainty in those estimates.

Regression and Geiger trends for Skokomish natural escapement and NOR escapement are non-significant. Qualitatively, a decline in NOR escapement is apparent since 2002.

Table 2.2.2.2: Trends in Chinook escapement to the Skokomish River.

	Regression			Geiger 15 y		Geiger 21 y	
	X_1	95% C.I.		Slope	Slope/y_0	Slope	Slope/y_0
Skokomish	0.0034	-0.0244	0.0313	-4.3	0.003	17.79	-0.017
NORs	-0.0346	-0.0736	0.0043	8.37	-0.023	-0.285	0.001

Source: Mark Downen, WDFW District Biologist 2014.

Puget Sound Chinook salmon: Updated Risk Summary. All Puget Sound Chinook populations are well below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Several of the risk factors identified by Good et al. (2005) are also still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat. Many of the habitat and hatchery actions identified in the Puget Sound Chinook Recovery Plan (NMFS 2006) are expected to take years or decades to be implemented and to produce significant improvements in natural population attributes, and these trends are consistent with these expectations. Overall, the new information on abundance, productivity, spatial structure and diversity since the 2005 review does not indicate a change in the biological risk category since the time of the last BRT status review (Ford 2011).

Table 2.2.2.3: Hood Canal Chinook, minimum viability spawning abundance and abundance at equilibrium or replacement, and spawning A/P at MSY for a recovered state as determined by EDT analyses of properly functioning conditions and expressed as a Beverton-Holt function. The TRT minimum viability abundance was the equilibrium abundance or 17,000, whichever was less.

Region and population	TRT minimum viability abundance	Under properly functioning conditions (PFC)			NMFS Escapement Thresholds	
		Equilibrium abundance	Spawners at MSY	Productivity at MSY	Critical[a]	Rebuilding[b]
Skokomish	12,800	12,800	2,900	3.2	452	1,160
ESU	**261,300**	**307,500**	**70,948**	**3.2**	**3,875**	**2,785**

Source: Ford 2011; NMFS 2011b.

[a] Critical natural-origin escapement thresholds under current habitat and environmental conditions (McElhaney et al. 2000; NMFS 2000a).

[b] Rebuilding natural-origin escapement thresholds under current habitat and environmental conditions (McElhaney et al.

Hood Canal summer chum in the Hood Canal summer chum ESU. A viable population of summer chum in the Hood Canal population has 24,700 spawners, assuming a 1:1 replacement rate and density-independent dynamics at low population sizes. Spawner escapement numbers for a viable Hood Canal population could be as low as 18,300 adults if we can assume that the population is driven by density-dependent dynamics and the corresponding intrinsic α and β parameters of the population's viable spawner-recruit curve can be estimated and achieved (i.e., for escapement = 18,300, then $\alpha = 5$ and $\beta = 13{,}500$) (Sands et al. 2009).

Hood Canal summer chum salmon - Updated Risk Summary: The spawning abundance of this ESU has clearly increased since the time of listing, although the recent abundance is down from the previous five years due to the termination of supplementation programs. While spawning abundances have remained relatively high compared to the low levels in the early 1990s, productivity has decreased significantly for the last five brood years, being lower for brood years 2002-2006 than any previous 5-year average since 1971. This is a concern for future production. Since abundance is increasing and productivity is decreasing, this suggests that improvements in habitat and ecosystem function are needed. Diversity is increasing from the low values seen in the 1990s due both to the reintroduction of spawning aggregates and the more uniform relative abundance between populations; this is a good sign for viability in terms of spatial structure and diversity. Spawning survey data shows that the spawning distribution within most streams has been extended further upstream as abundance has increased (WDFW and PNPTT 2007). Overall, the new information considered does not indicate a change in the biological risk category since the time of the last BRT status review (Ford 2011).

Skokomish winter-run steelhead in the Puget Sound steelhead DPS. Population trends for Skokomish River winter-run steelhead. The counts have been especially low since the late 1990s. The estimated probability that this steelhead population would decline to 10% of its current estimated abundance (i.e., to 35 fish) is high—about 80% within 80 years. With an estimated mean population growth rate of −0.037 (λ = 0.964) and process variance of 0.019, we can be highly confident ($P < 0.05$) that a 90% decline in this population will not occur within the next 20 years and that a 99% decline will not occur within the next 40 years. However, beyond the next 30−40 years we are uncertain about the precise level of risk (Ford 2011). Based on a preliminary intrinsic potential (IP) estimate by the PSSTRT (2013), the capacity for winter steelhead in this DIP is 1,003 to 20,060 adults.

*Puget Sound steelhead: Updated Risk Summary***.** The status of the listed Puget Sound steelhead DPS has not changed substantially since the 2007 listing. Most populations within the DPS are showing continued downward trends in estimated abundance, a few sharply so (Ford 2011). For all but a few putative demographically independent populations of steelhead in Puget Sound, estimates of mean population growth rates obtained from observed spawner or redd counts are declining—typically 3 to 10% annually—and extinction risk within 100 years for most populations in the DPS is estimated to be moderate to high, especially for *draft* populations in the *putative* South Sound and Olympic MPGs. Collectively, these analyses indicate that steelhead in the Puget Sound DPS remain at risk of extinction throughout all or a significant portion of their range in the foreseeable future, but are not currently in danger of imminent extinction.

Table 2.2.2.4: Interim DIP abundance goals for steelhead in Puget Sound, based on a four-year average. Abundance goals for summer-run fish (italics) are still under review. QET, quasi extinction threshold; SAS, smolt to adult survival. Minimum abundance = 100 (Low Abundance), 250 (Viable).

Population Basin				Quasi Extinction Threshold	Low Abundance	Viable	Capacity
Population Name	Area km^2	Mean Elevation (m)	Total Stream Length (m)		1% SAS	5% SAS	20% SAS
Skokomish River	634	570	411,699	50	1,003	5,015	20,060
Puget DPS Total				**1,462**	**30,449**	**153,194**	**613,662**

Source: Hard et al. 2014.

Table 2.2.2.5: Average escapement of the Skokomish winter steelhead DIP.

Population	Run timing	2000-2005 escapement	2006-2010 escapement	2011-2013 escapement	Percent Change 2006-10 vs. 2011-13	Escapement Goal[a]	Status
Skokomish	Winter	260	392	734	88%	1,400	Depressed

Source: PNPTT and WDFW 2013.

[a] Escapement Goal is for index areas and was derived WDFW methodology (Gibbons et al. 1985). However the state and Treaty Tribes have not agreed to the goal or the method used to derive it.

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

See also **Table 2.2.3.1** below.

Table 2.2.2.6: Puget Sound Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S). Trend over the intervals is also given. Recent data are unavailable.

Brood Years	1982-1986		1987-1991		1992-1996		1997-2001		2002-2006		Trend	
Populations	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**	**R/S**	**S/S**
Skokomish	*12.84*	*1.84*	*2.7*	*0.45*	*0.84*	*0.51*	*1.86*	*0.57*	*0.93*	*0.33*	*-2.47*	*-0.29*
ESU	*9.57*	*2.19*	*5.05*	*0.96*	*3.01*	*1.24*	*2.70*	*1.19*	*1.67*	*0.67*	*-1.81*	*-0.28*

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Skokomish, Lower Elwha Klallam, Port Gamble S'Klallam and Jamestown S'Klallam Tribes.

Table 2.2.2.7: Short and long term population trend and growth rate estimates for the Puget Sound Chinook ESU populations in the Skokomish River. Recent data is unavailable.

Populations	Years	Trend Natural Spawners w/Cl	Hatchery Fish Success = 0 Lambda w/Cl	p>1	Hatchery Fish Success = 1 Lambda w/Cl	p>1
Skokomish River Fall Run	1995-2009	1.019 (0.936 - 1.108)	0.995 (0.408 - 2.424)	0.48	0.76 (0.345 - 1.674)	0.07
	1968-2009	0.994 (0.976 - 1.013)	0.982 (0.861 - 1.12)	0.37	0.784 (0.692 - 0.888)	0.00

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Skokomish, Lower Elwha Klallam, Port Gamble S'Klallam and Jamestown S'Klallam Tribes.

Table 2.2.2.8: Short and long term population trend and growth rate estimates for the Hood Canal Summer Chum ESU populations.

Regions and Populations	Years	Trend Natural Spawners w/CI	Hatchery Fish Success = 0 Lambda w/CI	p>1	Hatchery Fish Success = 1 Lambda w/CI	p>1
Hood Canal	1995-2009	1.075 (0.964 - 1.198)	1.041 (0.108 - 10.016)	0.57	0.958 (0.114 - 8.026)	0.42
	1968-2009	0.989 (0.956 - 1.022)	0.989 (0.786 - 1.244)	0.46	0.962 (0.775 - 1.195)	0.34

Source: Ford 2011. These are based on analyses reported by Ford (2011) that are not necessarily agreed to by WDFW and the Skokomish, Lower Elwha Klallam, Port Gamble S'Klallam and Jamestown S'Klallam Tribes.

Table 2.2.2.9: South Fork Skokomish Steelhead Parr and Smolt Counts, 2008-2014.

Population	2008	2009	2010	2011	2012	2013	2014
SF Skokomish	432	511	127	134	549	78	~2,000

Source: Personal communication, Matt Kowalski, Skokomish Tribe 2014.

Table 2.2.2.10: Exp. Steelhead Population Trend ln (nat. spawners) (95% CI)

Population	1985-2009	1995-2009
Skokomish River winter-run	0.956 (0.932 - 0.979)	1.006 (0.958 - 1.057)

Source: Ford 2011.

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

Table 2.2.2.11: Fall Chinook escapement to George Adams Hatchery 2002-2013.

Year	Escapement		
	Adults	Jacks	Total
2002	9,375	567	9,942
2003	10,034	431	10,465
2004	12,278	1,255	13,533
2005	16,018	398	16,416
2006	12,356	1,050	13, 406
2007	13,270	1,944	15,214
2008[a]	13,695	1,741	15,436
2009	13,220	2,119	15,339
2010	12,891	1,736	14,627
2011[b]	24,581	3,441	28,022
2012	22,874	2,675	25,549
2013	21,444	2,990	24,434
Average	**16,256**	**1,762**	**17,842**

Source: Mark Downen (WDFW District Biologist) and Hatchery Headquarters Database 2014.
[a] Includes South Fork adult releases
[b] Adjusted for jack definition discrepancy encountered in 2011

Table 2.2.2.12: Spawner abundance data, for fall Chinook, summer chum and wild winter steelhead, Skokomish River 2000-2013.

Year	Fall Chinook	Summer Chum	Steelhead
2000	962	NA	261
2001	1,913	3	286
2002	1,479	0	156
2003	1,126	0	132
2004	2,398	24	233
2005	2,032	5	Data Unavailable
2006	1,209	8	231
2007	531	22	405
2008	1,134	23	285
2009	1,066	36	567
2010	1,214	61	361
2011	1,321	107	478
2012	1,533	524	564
2013	1,722	977	1,161
Average	**1,403**	**128**	**366**

Sources: SaSI 2014 and Mark Downen (WDFW District Biologist) 2014. Note that the origin of natural-origin summer chum in the Skokomish River is unknown. As verification of a self-sustaining population has not occurred, these fish may or may not be strays from nearby populations.

Table 2.2.2.13: Spawner abundance data, summer chum, Hood Canal region 2000-2013.

Year	Summer Chum[a,b]
2000	8,649
2001	12,044
2002	11,454

2003	35,696
2004	69,995
2005	16,378
2006	26,753
2007	10,781
2008	15,403
2009	7,423
2010	12,741
2011	6,968
2012	30,058
2013	22,806
Average	**20,511**

Sources: Summer chum data are from WDFW and PNPTT (2013) and co-manager run reconstruction.
[a]Includes wild broodstock used in supplementation program.
[b]Based on WDFW SCoRE data 2014.

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

Table 2.2.2.14: Natural- and hatchery-origin Chinook spawning escapement in the Skokomish watershed (CWT-based through 2008), 2002-2013.

Year	*Natural-Origin Spawners	Hatchery-Origin Spawners	Total Spawning Escapement
2002	1,370	109	1,479
2003	860	266	1,126
2004	748	1,650	2,398
2005	433	1,599	2,032
2006	492	717	1,209
2007	419	112	531
2008	257	877	1,134
2009	304	762	1,066
2010	312	902	1,214
2011	157	1,164	1,321
2012	246	1,287	1,533
2013	389	1,333	1,722
Average	**499**	**898**	**1,397**

Sources: *NORs uncertain before initiation of mass-marking in 2007.
Skokomish RER Technical Work Group provided estimates for 1987-2007; Mark Downen (WDFW) and Cindy Gray (Skokomish Tribe) provided estimates for 2008-2013; Co-manager-agreed Terminal Run Reconstruction files 2014.

Hood Canal summer chum (*Oncorhynchus keta*): The level of summer run chum spawners in the Skokomish River is incompletely known. However overall the level of hatchery and natural returns is monitored in other streams throughout the Hood Canal watershed (See **Tables 2.2.2.12** and **2.2.2.13**).

Skokomish winter steelhead (*Oncorhynchus mykiss):* Plants of Chambers stock winter steelhead were terminated in 2004 in the Skokomish basin. Prior to the start of the supplementation program, the number of hatchery-reared steelhead on the spawning grounds was unknown, but the proportion is believed to be low based on the very poor marine survival of hatchery-origin fish (indicated by low catch numbers), temporal divisions in spawn timing, and genetic analyses. Current pHOS levels in the Skokomish is unknown.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take (see "Attachment 1" for definition of "take").

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

Broodstock Collection for Fall Chinook: Program broodstock volitionally enter the George Adams Hatchery trap. Natural-origin Chinook that recruit to the trap are also used in the broodstock. (See HGMP section7.2 and Take Tables at the end of this document for direct take).

Operation of Hatchery Facilities: Potential facility operation impacts on listed fish include; water withdrawal, hatchery effluent, and intake compliance. Monitoring and maintenance are conducted along with staff observations. Effluent at outfall areas is rapidly diluted with stream flows, and operation is within permitted guidelines (see HGMP sections 4.1 and 4.2). All permit requirements are followed in order to minimize the potential indirect 'Take" associated with the operations of these facilities.

Disease Transmission: Interactions between hatchery-reared and naturally-produced populations may be a source of pathogen and disease transmission although there is little evidence showing that diseases are transmitted from hatchery fish to natural-origin fish (Steward and Bjornn 1990, Tynan 1999). WDFW conducts fish disease examinations to ensure minimal disease transmission and to prevent the introduction and/or spread of any fish diseases. Fish health monitoring efforts include fish health examinations and virus sampling, abnormal fish loss investigations, virus sampling, and pre-transfer and pre-liberation inspections. All activities are done in accordance with guidelines developed under the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State (*WDFW and WWTIT 1998, updated 2006).

Hatchery Production/Density-Dependent Effects: Hatcheries can release numbers of fish that can exceed the density of the natural productivity in a limited area for a short period of time and can compete with listed fish. Fish are released as active smolts that will emigrate in order to minimize the effect of the release. Indirect take from density-dependent effects is unknown.

Predation/Competition: George Adams Hatchery smolts are expected to migrate quickly to Puget Sound, however, their actual stream residence time and freshwater competition between George Adams Chinook and wild Skokomish-basin Chinook have not been examined. These smolts are released at around 80 to 100 mm in May when wild Skokomish smolts are expected to be about 60 to 80 mm long (personal communication D. Seiler, WDFW, February 2000). The USFWS (1994) has suggested that juvenile salmonids can consume fish which are one-third or less their own body length; given this rule of thumb, there is little or no potential for predation by hatchery Chinook.

The Species Interaction Working Group (SIWG 1984) categorized various risks to wild salmon species and steelhead from hatchery-origin salmon species and steelhead (**Table 2.2.3.2**).

Table 2.2.3.1: Risks posed by hatchery-origin Chinook to wild Chinook (data from SIWG (1984).

Type of Risk	Level of Risk
Freshwater predation	Unknown
Freshwater competition	High potential
Early marine predation	Unknown
Early marine competition	High potential

There is no available information regarding hatchery/wild overlaps in the Skokomish Basin or in the waters of Hood Canal.

Residualism: To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, volitional release strategies, size, and time guidelines for sub-yearling release groups.

- Condition factors, standard deviation and co-efficient of variation (CV) are measured throughout the rearing cycle and at release.
- Feeding rates and regimes throughout the rearing cycle are programmed to satiation feeding to minimize out-of-size fish and programmed to produce smolt size fish at date of release.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.
- Releases from these ponds are volitional with large proportions of the populations moving out initially with the remainder of the population vacating within days or a few weeks.

Run timing effects of George Adams Hatchery on Chinook adult returns: Based on the timing of gillnet catch and hatchery rack returns in recent years the extant fall population enters the river from early July through September; peak in-river catch usually occur from mid-August through early September. Field surveys to estimate escapement indicate that spawning occurs from early September until mid-October, peaking in late September. Freshwater entry and spawning now occur earlier than when the hatchery program was initiated. Harvest patterns in the early-1950s further suggest the timing of the native fall run was even later (Smoker et al. 1952). Freshwater entry and upstream migration currently occurs five to seven weeks earlier than the indigenous fall stock, and spawning occurs at least six weeks earlier.

Chinook returning to George Adams Hatchery and natural spawners in the river exhibit similar run timing, suggesting these natural spawners are first generation hatchery fish. Similar run timing shifts for adults returning to the Soos Creek and Issaquah Creek hatcheries and their associated natural spawners have occurred despite increase in water temperature in those systems which would be expected to select against earlier run timing (Quinn et al. 2002), and are primarily attributed to hatchery broodstock selection.

Potential effects of George Adams Hatchery Chinook releases on Summer Chum: Hatchery practices will follow the recommended actions of the *Summer Chum Salmon Conservation Initiative* (SCSCI). Summer chum fry are expected to migrate to salt water from February through April and swim seaward quickly (Tynan 1997) thus they are expected to clear the area well before the release of George Adams sub-yearling Chinook in May. The SCSCI requires that no hatchery fish releases are to occur prior to April 1 as a protection measure during out-migration of listed Hood Canal summer chum. Both juveniles and returning adults from the on-station program pose low risk for competition or predation to summer chum (Tynan 1999).

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

As of December 15, 2005, the Co-managers have agreed to mass-mark the remaining production with full implementation beginning with the brood year 2007 production (*Skokomish Mass-Marking MOU* 2005). Most of the George Adams Hatchery production (92%) are released with an adipose fin-clip (AD); this allows WDFW to monitor and evaluate hatchery production, and provides NOR/HOR ratios on the spawning grounds. AD-marked fish may also include internal marks (thermal otolith marks or coded-wire tags) as part of a program to conduct and evaluate alternative production strategies. The double-index tag (DIT) group, which includes CWT-only releases, serves as an index for natural-origin sub-yearling fall Chinook, and provides data on

catch contributions, run timing, total survival, migration patterns and straying into other watersheds.

See also "Take" tables at the end of this document.

- 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).

In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect take from hatchery releases such as predation and competition is highly uncertain and dependent on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. (See Take Tables at the end of this document for identified levels).

- 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.

Any projected take that will exceed the estimates given in this HGMP from this operation on a yearly basis would be communicated to WDFW Fish Program and NOAA staff for additional guidance.

3 SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

It is understood that this HGMP alone, in the absence of habitat protection, assessment, and restoration, will not by itself lead to recovery. This HGMP is a part of the Co-managers' overall recovery plan under development, which itself is also a three-part plan integrating hatchery, harvest, and habitat components. Through close coordination with the habitat and harvest components of the overall Skokomish watershed salmonid recovery plans, this HGMP will address the monitoring of hatchery activities and their potential interaction with limiting factors that will promote recovery through the generation and assurance of self-sustaining populations.

Washington Department of Fish and Wildlife Commission Policy C-3619. WDFW adopted the *Hatchery and Fishery Reform Policy C-3619* in 2009. Its purpose is to advance the conservation and recovery of wild salmon and steelhead by promoting and guiding the implementation of hatchery reform. The intent of hatchery reform is to improve hatchery effectiveness, ensure compatibility between hatchery production and salmon recovery plans and rebuilding programs, and support sustainable fisheries. WDFW Policy C-3619 works to promote the conservation and recovery of wild salmon and steelhead and provide fishery-related benefits by establishing clear goals for each state hatchery, conducting scientifically defensible-operations, and using informed decision making to improve management. It is recognized that many state operated hatcheries are subject to provisions under *U.S. v Washington* (1974) and *U.S. v Oregon* and that hatchery reform actions must be done in close coordination with tribal Co-managers (available at: http://wdfw.wa.gov/commission/policies/c3619.html).

Hatchery Reform - Principles and Recommendations of the Hatchery Scientific Review Group (*HSRG*). WDFW programs have incorporated suggestions this report provided, in 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) (see also HGMP section 6.2.3).

Draft Resource Management Plan: Puget Sound Chinook Salmon Hatcheries, a component within the *Comprehensive Chinook Salmon Management Plan*. This plan describes the operating procedures for Chinook salmon hatcheries in Puget Sound, their role in achieving the co-managers' resource management goals, and their consistency with the protection given to Puget Sound Chinook salmon by the Endangered Species Act (ESA). The plan describes both Tribal and WDFW hatcheries, as tightly linked: they often operate in the same watersheds, exchange eggs, and share rearing space to maximize the effectiveness of the programs (WDFW and PSTT 2004).

Recovery Plan for Skokomish River Chinook Salmon (2010). The recent Cushman Settlement Agreement (FERC Project No. 460, January 12, 2009) reached by the Skokomish Tribe, Washington State, and the Federal government with the City of Tacoma over the Cushman Dam Project provides significant resources and impetus for initiating recovery actions aimed at early-timed Chinook. Skokomish Tribe and WDFW developed the *Recovery Plan for Skokomish River Chinook Salmon*.

The highest recovery priority is given to the early-timed population. Because of its extirpation, recovery necessitates a re-introduction of a suitable early-timed stock to the watershed. Once this has been accomplished, the plan has been developed to treat the reintroduced stock as the listed Chinook in the watershed. As the plan goes forward, and as progress is made in restoring key habitats in the lower valleys, the potential for expanding recovery efforts to include the late-timed population will be re-evaluated. Failure to make significant progress toward recovering the early-timed group over the next 10 to 12 years, however, would be cause to re-examine plan direction and possibly reset the priority to the late-timed life history group.

Management Plan for Fall Chinook in the Skokomish River. A management plan was developed as specified in the 2010 Management Unit Profile (M. Grayum and P. Anderson letter to R. Turner, February 28, 2014). The plan includes strategies for managing harvest and hatchery production, and provides updates of ongoing habitat protection and restoration programs. The Co-managers agreed to implement an experimental strategy to improve the potential for recovery of the fall Chinook population. A portion of production at George Adams Hatchery will utilize the latest-returning adults as broodstock, under the hypothesis that recruits from the later component are better suited to the local flow regime, and will spawn naturally with improved productivity. The objective for the late-timed component of the hatchery stock is to develop a late mode that exhibits peak maturity in late October, which is five to six weeks later than the current peak.

Summer Chum Salmon Conservation Initiative (*SCSCI*). Summer chum supplementation, habitat restoration and harvest management measures are integrated as presented in the *Summer Chum Salmon Conservation Initiative* (WDFW and PNPTT 2000). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed. The goal of the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages.

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

This hatchery program, and all other WDFW anadromous salmon hatchery programs within the Puget Sound Chinook ESU, operates under *U.S v Washington* (1974) and the *Puget Sound Salmon Management Plan* (PSSMP 1985) and the *Hood Canal Salmon Management Plan*

(HCSMP 1985), which provides the legal framework for coordinating these programs, defining artificial production objectives, and maintaining treaty-fishing.

Hatchery salmon and steelhead production levels are detailed in the annual Future Brood Document (FBD). The FBD is a pre-season planning document for fish hatchery production in Washington State for the upcoming brood stock collection and fish rearing season (July 1 – June 30). The FBD is coordinated between WDFW, the Northwest Indian Fisheries Commission (NWIFC) representing Puget Sound and coastal treaty tribes, eastern Washington treaty tribes, and Federal fish hatcheries. Hatchery production by volunteers, schools, and Regional Fisheries Enhancement Groups are represented by WDFW.

As of December 15, 2005, the co-managers agreed to mass-mark the remaining production with full implementation beginning with the 2007 brood year production (*Skokomish Mass-Marking MOU* 2005). The adipose fin-clipped fish may also include fish with other marks (thermal otolith marks or coded-wire tags) as part of a program to conduct and evaluate alternative production strategies. Marking of the George Adams Hatchery production will allow monitoring and evaluation of the hatchery program production and provide NOR/HOR ratios on the spawning grounds.

See also HGMP section 3.1.

3.3 Relationship to harvest objectives.

Tribal and non-tribal commercial and recreational fisheries directed at salmon and other species produced through WDFW hatchery releases will be managed to minimize incidental effects to listed salmon and steelhead. Compliance with the fisheries management strategy defined in the *Puget Sound Chinook Harvest Management Plan* (WDFW and PSTT 2004, revised 2014) and *Summer Chum Salmon Conservation Initiative* (2000) will lead to fisheries on WDFW hatchery-origin stocks that are not likely to adversely affect listed Chinook or listed summer chum.

The Co-managers have set general harvest goals to provide fishing opportunities consistent with the mandate of the agency for restoration and recovery of wild indigenous salmonid runs, the *Pacific Salmon Treaty*, the *Puget Sound Salmon Management Plan* (1985), *U.S. v Washington* (*1974*), and other state, federal, and international legal obligations.

The annual pre-season planning process for Northwest recreational and commercial salmon fisheries, known "North of Falcon", involves a series of public meetings between federal, state, tribal and industry representatives and other concerned citizens. The North of Falcon process coincides with meetings of the Pacific Fishery Management Council, which sets the ocean salmon seasons at these meetings.

The Skokomish Tribe and WDFW developed a plan for the *Management of Fall Chinook in the Skokomish River* (2014). The plan outlines changes in harvest management to address the surplus of returning adults at George Adams Hatchery and to begin the development of a late-timed component of the population better-adapted to the hydrology of the Skokomish River. Managers will implement changes in river fisheries intended to harvest a greater proportion of the large hatchery surplus of fall Chinook at the George Adams Hatchery. An earlier start for the summer-fall Chinook fisheries (in July) may be implemented if data supports the assumption that earlier returning fall Chinook are comprised of a higher proportion of hatchery-origin fish. Conducting fisheries in Purdy Creek also have potential to reduce the hatchery surplus, contingent on their not reducing natural escapement. There is also potential for expansion of hatchery selective fisheries including the existing sport fisheries and tribal selective fisheries that would operate in the lower mainstem, below the SR 106 highway bridge during the Summer Chum Base Conservation Regime restriction from August 1-September 30. These, and possibly other fishing strategies, will be implemented and evaluated for their effectiveness in reducing the hatchery surplus beginning in 2014. Managers anticipate several years of data collection, analysis, and refinement of these strategies may be required before reaching a conclusion on their effectiveness. The data collected,

estimates of catch and mortality, and any preliminary analysis associated with any new fishing strategies implemented by co-manager agreement will be reported in the Chinook fisheries annual report.

3.3.1 Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available. *Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish.*

Table 3.3.1.1: George Adams Hatchery Sub-yearling Fall Chinook Fishery Contributions.

Brood Years: 2000-2009[g] Fishery Years:2004-2013		
	Average SAR%[a]	**0.66**
Agency	***Non-WA Fishery***	***% of total Survival***
ADFG	All	*0.28*
CDFO	All	*16.89*
NMFS	All	*0.66*
ODFW	All	*0.79*
Agency	***WA Fishery***	***% of total Survival***
WDFW	10- Ocean Troll	*1.30*
MAKA	15- Treaty Troll	*1.46*
WDFW	15- Treaty Troll	*1.48*
WDFW	22-Coastal Gillnet	*0.04*
MAKA	23- PS Net	*0.01*
SUQ	23- PS Net	*0.09*
TULA	23- PS Net	*0.01*
WDFW	23- PS Net	*16.27*
WDFW	41- Ocean Sport- Charter	*0.19*
WDFW	42- Ocean Sport- Private	*0.58*
WDFW	45- PS Sport - May to September	*8.12*
WDFW	45- PS Sport - Winter Blackmouth[b]	*2.27*
WDFW	46- Freshwater Sport[c]	*9.00*
NIFC	50- Hatchery Escapement (Strays)[d]	*0.04*
PUYA	50- Hatchery Escapement (Strays)[d]	*0.01*
SUQ	50- Hatchery Escapement (Strays)[d]	*0.01*
WDFW	50- Hatchery Escapement	*39.75*
WDFW	50- Hatchery Escapement (Strays)[d]	*0.14*
SUQ	54- Spawning Grounds (Strays)[e]	*0.02*
WDFW	54- Spawning Grounds (Strays)[f]	*0.58*
	Total	*100.00*

Source: RMIS 2014 and WDFW CRC 2014.

[a] Average SAR% = (tags recovered/tags released).

[b] Winter Blackmouth fishery occurs between October and April.

[c] Freshwater Sport based on WDFW Catch Record Card (CRC) data.

[d] Strays to Clarks Creek, Clear Creek, Garrison Springs, Grovers Creek, Hoodsport, Kalama Creek, Minter Creek, Soos Creek, Tokul Creek and Tumwater Falls hatcheries.

[e] Strays to WRIA 09, 14 and 16.

[f] Strays to WRIA 15.

[g] 2009 Data not fully reported and represents a minimum estimate of survival and contribution.

3.4 Relationship to habitat protection and recovery strategies.

Salmon and Steelhead Habitat Limiting Factor Analyses: Limiting factors analyses have been completed for streams and nearshore areas in WRIA 14 and 15 (Dewatto and Tahuya rivers), WRIA 16 (Skokomish, Dosewallips, Duckabush and Hamma Hamma rivers) and WRIA 17 (Quilcene river) by the Washington State Conservation Commission (Correa 2002 and 2003, Kuttel 2003); these reports will provide information useful for identifying factors limiting populations in Hood Canal. Gradients of west Hood Canal Rivers rapidly become steep with impassable waterfalls, so most of these rivers are not fully accessible to steelhead. All of these rivers have suffered damage from human activities (dam, roads, logging, diking, agriculture and development) that have exacerbated natural summer low flows, winter flooding and streambed scouring, and sediment deposition due to unstable soils and slopes. Large woody debris is lacking in most areas used as a result of forest practices. In the Skokomish, the Cushman hydropower project on the North Fork has reduced stream flows in the Skokomish by about 40% and has altered the normal pattern of sediment delivery to the estuary with the result that eelgrass has been lost (WDFW and WWTIT 1994). Gravel aggradation and removal have been problems in the lower Big Quilcene.

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

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

Recovery Plan for Skokomish River Chinook Salmon (*2010*). The Skokomish Chinook recovery plan describes a multi-faceted strategy for habitat restoration. The primary approach is to restore and protect physical and biological processes that form and sustain Chinook habitats. Hatchery management is integrated with the habitat recovery strategy by providing the adult recruits that will test the function of restored habitats.

Re-introduction and restoration of an early-timed Chinook population is the primary focus of the recovery plan, but if this is not successful, options for recovering a late-timed Chinook population will be considered. This HGMP describes the initial phase of developing a later-timed hatchery production that may subsequently result in a component of natural spawners with life history characteristics better-suited to production under the local hydrologic regime. If successful, habitat restoration is expected to further improve the production potential of the late-timed component.

It will be decades before the extent of habitat restoration is realized. In the interim, the George Adams Hatchery program will continue to play its primary role of enhancing fishing opportunity, thereby mitigating lost natural Chinook production. This mitigation function will continue to be essential until habitats are restored to the extent they will support self-sustaining natural populations. The program also provides important benefits in maintaining the abundance,

diversity, and distribution of naturally spawning fall Chinook, and maintaining the option to utilize this stock in recovery. Changes in hatchery management (i.e. production goals, broodstock selection, and rearing and release strategies) will be largely motivated by detecting improvement in habitat function, evidenced by increased natural productivity.

Summer Chum Salmon Conservation Initiative (*SCSCI*)*:* Summer chum supplementation, habitat restoration and harvest management measures are integrated as presented in the Summer Chum Salmon Conservation Initiative (WDFW and PNPTT 2000). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed. The goal of the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages.

Lead Entities: The Lead Entity for the Hood Canal basin is the Hood Canal Coordinating Council. It oversees an area that is 62 miles long (Hood Canal) and covering about 358 miles of shoreline. Land ownership in the watershed is 48% federal and includes portions of Olympic National Park and Olympic National Forest, 39% private, 12% state and local, and 1% Tribal trust lands. Major projects are underway to restore critical estuarine habitat. These include removal of levees; ditches and tide gates to allow disconnected and degraded salt marshes to recover in the Skokomish, Union and Dosewallips estuaries. Natural functions and processes are being restored in the Chimacum Creek estuary through removal of fill and riprap.

RFEGs: Several citizen based groups in conjunction with local governments work on habitat actions to benefit both listed and non-listed stock in the system including the Hood Canal Salmon Enhancement Group (HCSEG).*Shared Strategy Plan:* An ESU-wide recovery planning effort was undertaken by Shared Salmon Strategy for Puget Sound, a collaborative group dedicated to restoring salmon throughout Puget Sound (online at http://www.sharedsalmonstrategy.org).

Puget Sound Partnership Action Plan: An ESU-wide recovery planning effort is being undertaken by the Puget Sound Partnership, a collaborative group dedicated to restoring salmon and steelhead throughout Puget Sound (online at http://www.pugetsoundpartnership.org).

3.5 Ecological interactions.

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

- Avian predators, including mergansers, cormorants, belted kingfishers, great blue herons, and night herons
- Mammalian predators, including mink, river otters, harbor seals, and sea lions
- Cutthroat trout

Rearing and migrating juvenile and adult Chinook originating through the program may also serve as prey for large, mammalian predators in nearshore marine areas, the estuary and in freshwater areas downstream of the hatchery in the watershed to the detriment of population abundance and the program's success in augmenting harvest. Species that may negatively impact program fish through predation may include:

- Southern Resident Killer Whales
- Sea lions
- Harbor seals

- River otters

(2) *Salmonid and non-salmonid fishes or other species that could be negatively impacted by the program).*
  – Puget Sound Chinook
  – Puget Sound steelhead
  – Puget Sound bull trout

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

(4) *Salmonid and non-salmonid fishes or other species that could be positively impacted by the program.* The Chinook program could positively impact freshwater and marine fish species that prey on adult and juvenile fish. Nutrients provided by decaying carcasses may also benefit fish in freshwater. These species include:
  –Southern Resident Killer Whale
  - Bull trout
  - Northern pikeminnow
  - Cutthroat trout
  - Puget Sound Steelhead
  - Pacific staghorn sculpin
  - Numerous marine pelagic fish species

4 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.

Table 4.1.1: Water sources available at George Adams Hatchery.

Water Source	Water Right		Available Water Flow	Water Temp. (F°)	Usage	Limitations
	Record/Cert. No.	Permit No.				
Wells (3) (north)	G2-26481C WRIS	-----	1500 gpm	48	Incubation	None
Well (south)	G2-24645C WRIS	-----	1400 gpm		Drought relief well	None
Purdy Creek (surface)	S2-*05575C WRIS/ 08321	03749	9.75 cfs	42-52	Broodstock holding, rearing, acclimation	Lower water flows, possible risk of contamination
	S2-*20811C WRIS/ 10615	20811	10 cfs			

	S2-23232C WRIS	-----	1.5 cfs			from spills on the highway
Unnamed stream (Ellis Spring)	S2-24688C WRIS	-----	6.0 cfs	42-52	Former rearing, no longer used	None
	S2-25769	-----	2.5 cfs		Rearing	None

Source: Phinney 2006, WDOE Water Resources Explorer 2014, WDFW hatchery data.

Surface and well water is used in the production of Chinook at George Adams Hatchery. Well water usage is limited to incubation, but can be used for rearing when pathogen-free water is required. Otherwise, it is not used, in order to allow the aquifer to recharge. Due to high nitrogen and low dissolved oxygen content, well water is passed through an aeration and de-gassing tower before distribution to the hatchery.

The water right for Purdy Creek is 21.3 cfs. Surface water from Purdy Creek is used for broodstock holding, rearing and acclimation. Lower flows have been observed in recent years due to dryer conditions and progressing development in the watershed. The proximity to Highway 101 poses risk of contamination from spills on the highway. One such spill (barrels of powdered zinc) occurred in 1976.

The water right for Ellis Spring is 2.5 cfs. Spring water is used for rearing. Flow is variable from a low of 1.0 cfs to 2.5 cfs.

Surface water rights at George Adams Hatchery are formalized through the Washington Department of Ecology (WDOE), and were obtained in 1941, 1968, 1974, 1977, and 1980 for the purpose of fish propagation.

NPDES permit:
This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (WDOE) (**Table 4.1.2**). Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from WDOE.

Discharges from the cleaning treatment system are monitored as follows:

- *Total Suspended Solids (TSS)* 1 to 2 times per month on composite effluent, maximum effluent and influent samples.
- *Settleable Solids (SS)* 1 to 2 times per week on effluent and influent samples.
- *In-hatchery Water Temperature* - daily maximum and minimum readings.

Table 4.1.2. Record of NPDES permit compliance at George Adams Hatchery.

Facility/ Permit #	Reports Submitted Y/N			Last Inspection Date	Violations Last 5 yrs (see list)	Corrective Actions Y/N	Meets Compliance Y/N
	Monthly	Qtrly	Annual				
George Adams WAG13-1019	Y	Y	Y	5/1/2008	2	N	Y

Source: WDFW Hatcheries Headquarters Database 2014.

Table 4.1.3. List of NPDES violations at George Adams Hatchery, over the last five years (2009-2013).

Monitoring Month	Parameter	Sample Type	Result/ Violation	Permit Limit	Comment	Action
April 2009	SS	Drawdown Max Grab	1.4 ml/L	1.0 ml/L	Unknown reason for drawdown violation. Could have been error.	NA
April 2013	TSS	Drawdown Grab	113 ml/L	100 ml/L	DD out of creek pond, hard to avoid going over. Talked to headquarters about taking dam boards out slower.	NA

Source: WDFW Hatcheries Headquarters Database 2014.
Note: These violations did not result in non-compliance with NPDES permit.

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

The surface water intakes at George Adams Hatchery are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not currently meet (NMFS 2011a) screening passage requirements.

A two-cell pollution abatement system was installed in June 2009 for settling and removal of pond vacuuming waste.

5 SECTION 5. FACILITIES

5.1 Broodstock collection facilities (or methods).

Broodstock is collected from adult fish returning to the George Adams Hatchery trap on Purdy Creek. The trap operates from 2nd week of July through early-December, starting with Chinook collection, and remains open through the end of the chum run.

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

A 400-gallon tanker truck equipped with aerators and oxygen tanks, is available at the facility for transportation needs. This truck will be used to transport the 200K sub-yearlings to Hoodsport in April as fry. See Section 10.5.

5.3 Broodstock holding and spawning facilities.

Returning adults are held in the 71’ x 157’ x 27” holding pond until ready to spawn. Pond is supplied with surface water.

5.4 Incubation facilities.

Table 5.4.1: Incubation vessels available George Adams Hatchery.

Type	Number	Size
Vertical stack incubators	996 trays	24' x 25' x 3”
Simms “deep troughs”	12	60’ x 20' x 60”
Magnum “deep boxes”	12	45' x 40' x 38”

The Magnum deep box has a capacity for 350,000 eggs.

Chinook eggs are incubated to eyed-egg stage in Simms deep troughs. After eyeing, eggs are transferred to vertical stack incubators for hatching.

5.5 Rearing facilities.

Table 5.5.1: Rearing vessels at George Adams Hatchery.

Type	Number	Size
Standard concrete raceways (Pond 1-6)	6	20' x 77' x 31"
Concrete ponds (Pond 11-12)	2	109' x 10' x 41"
Gravel bottom pond (Pond 7)	1	48' x 240' x 31"
Gravel bottom rearing/adult pond (Pond8)	1	71' x 157' x 27"
Asphalt bottom pond (Pond 9)	1	61' x 167' x 55"

After hatching, Chinook eggs are moved from the incubators into three raceways for initial rearing, then the gravel-bottomed ponds for final rearing and release.

5.6 Acclimation/release facilities.

Final rearing takes place in gravel- and asphalt-bottom ponds supplied with Purdy Creek water. The fish are released directly from the ponds into Purdy Creek.

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

Severe flooding at George Adams Hatchery in 1997 led to the early release of 1,949,600 Chinook fry. Mortalities occurred, but the total number is unknown.

New bridge construction on Purdy Creek in 2009 may have alleviated the flooding problem. The longer and higher bridge allows flood waters to pass beneath the spans instead of backing up and flooding the bridge, highway and surrounding area.

In 2014, low water at the facility led to the need to use the ditch, aka "Pond 10." Flood waters caused an early volitional release of 586,295 GA Fall Chinook out of the pond. This also alleviated the low water conditions at the facility.

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

A hatchery employee is on stand-by at the hatchery at all times to monitor hatchery operations and respond to any unexpected events. The facility is equipped with low water alarms, back-up generator in case of power loss and gas powered pumps in case of pump failure.

Fish rearing is conducted in compliance with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Adherence to artificial propagation, sanitation and disease control practices defined in the policy reduce the risk of fish disease pathogen transfers.

6 SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1 Source.

Existing Fall Chinook Program: Up to 2,500 natural and hatchery-origin adult Chinook salmon returning to George Adams Hatchery trap, representing the extant locally-adapted population delineated by the Puget Sound TRT (Ruckelshaus et al. 2006).

Late-Timed Component: Broodstock for this purpose will be collected from the latest natural- and hatchery-origin arrivals at George Adams Hatchery. Up to 150 sexually-mature adults returning in late-October (i.e., five to six weeks later than the current peak) will be collected for this brood. Egg-take will occur towards the historic end of the run, allowing enough time to collect the 230,000 needed to meet program. Egg-take will continue through the latest possible pairs of fish, as they return. Eggs in excess of the program needs will be culled from the earliest egg-takes.

Hoodsport Transfer Group: Only hatchery-origin fish will be selected for the brood to provide the 200,000 release group transferred to Hoodsport Hatchery beginning in brood year 2014 (released in 2015) (SIT and WDFW 2014).

6.2 Supporting information.

6.2.1 History.

George Adams fall Chinook originated in 1961 from the Hoodsport Hatchery stock. The Hoodsport stock originated in 1952, with an introduction of Dungeness spring/summer Chinook. The introduction at Hoodsport was not successful and was followed by several years of Soos

Creek Hatchery (Green River) releases until the stock became (largely) self-sustaining (SSHAG 2003).

The Green River fall Chinook hatchery stock originated from adults collected in the Green River and propagated at the Soos Creek Hatchery. This stock was disseminated widely throughout Puget Sound Hatcheries.

6.2.2 Annual size.

Up to 2,500 adults collected annually for the total program, up to 150 for the late timed component.

6.2.3 Past and proposed level of natural fish in broodstock.

Past levels of natural-origin fish incorporated into the hatchery broodstock are unknown. Fish released from the hatchery program were not 100% mass-marked prior to the 2007 brood (2008 release); positive identification by origin at hatchery return was not possible until fall 2012.

The *Skokomish Chinook Management Plan* (SIT and WDFW 2012) states that measures will be taken to ensure that the current status of the extant fall population remains stable until the decision is made to implement more aggressive recovery measures. Specifically, this means maintaining the current abundance, productivity, diversity and spatial distribution of the fall stock. Maintaining current status is consistent with categorizing the fall population's conservation priority as "stabilizing."

6.2.4 Genetic or ecological differences.

George Adams Hatchery fall Chinook salmon originated in 1961 from a transfer of Hoodsport Hatchery stock and Soos Creek Hatchery (Green River) stock (see HGMP section 6.2.1). Genetic analyses of naturally-spawning Chinook salmon in the Skokomish River indicate that those populations are similar to George Adams Hatchery fish. Hood Canal-area populations appear to be somewhat differentiated from South Puget Sound populations, although not strongly (Marshall 1999, Marshall 2000). Chinook salmon in the Skokomish were identified by the Puget Sound TRT as an independent population (Ruckelshaus et al. 2006).

The genetic diversity of the introduced stock has been affected by selection in the hatchery environment, prior to and since the introductions in the 1960s. The extent to which resulting changes in fitness have reduced the survival of hatchery releases is uncertain. The hatchery stock has replaced the native fall stock, and a recent average of at least 80% of natural spawners are first generation hatchery recruits, so hatchery broodstock and natural spawners are genetically indistinguishable. There is risk that interbreeding among naturally-spawning first generation hatchery- and natural-origin recruits is affecting the natural recruitment, but the current effect on survival (i.e. fitness) has not been quantified. Given the relatively high effective population size of broodstock, the risks of inbreeding depression (of fitness) and genetic drift are low.

Natural production is primarily limited by historical and current habitat conditions in the basin. Recruitment has been very low in many recent years, even below replacement in some years when all fishing mortality is accounted. Under these circumstances, the hatchery program provides essential benefit to the abundance of natural spawners, which otherwise would be at high risk of extinction. If it is possible to improve the recovery potential of the extant summer/fall stock, altering run timing, and extensive habitat restoration in the river and delta would address the fitness risks.

6.2.5 Reasons for choosing.

The program uses both natural-origin Skokomish River fall Chinook and the locally-adapted hatchery stock established in Purdy Creek, and returning to the Purdy Creek trap.

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

Existing Fall Chinook Program: Broodstock for the existing program is selected randomly from all adults returning to Purdy Creek. By selecting adults randomly from all returns, unmarked, natural-origin adults are also included in the broodstock, keeping the hatchery- and naturally-produced fish genetically similar and reducing the risk of divergence of the populations. The annual collection and use of a sufficient number of broodstock (up to 2,500 adults annually) minimizes adverse genetic impacts. Broodstock will continue to be collected across the entire run-timing spectrum in order to maintain genetic variability. Continued use of factorial mating protocols will maximize family size (avoids duplicate use of males). The intent is to maintain effective population size of the hatchery stock above 500 to protect against loss of genetic diversity; current effective population size was estimated at 800 (*Recovery Plan for Skokomish River Chinook Salmon* 2010).

Late-Timed Component: Consistent with the *Skokomish River Fall Chinook Management Plan* (SIT and WDFW 2014), production of a later-timed component of the extant George Adams stock will begin with the 2014 brood. Returns targeted for the late-timed broodstock component will be selected by return date. Returning adults that are sexually mature in late-October (i.e., five to six weeks later than the current peak) will be collected to develop a component stock with a later peak sexual maturity. Broodstock will be collected from the latest natural- and hatchery-origin arrivals at George Adams Hatchery.

Hoodsport Transfer Group: Broodstock selected for the 200,000 sub-yearling group shipped to and released at Hoodsport Hatchery will exclude any natural-origin spawners that return to George Adams Hatchery and the Purdy Creek trap. These transfers are scheduled to start with the 2014 brood (release 2015) (SIT and WDFW 2014).

7 SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2 Collection or sampling design.

Returning fall Chinook are collected for the existing on-station program through the entire run. A permanent weir placed in the Purdy Creek blocks upstream passage and directs returning fish into the holding pond through a ladder and a “V”-trap. The trap operates from mid-July through early-December. Fall Chinook currently return to the hatchery from early-July through mid-October, with a peak in mid-September. Fish returning after the second week in October will be selected for the late-timed component brood.

7.3 Identity.

Chinook releases at George Adams Hatchery have been 100% adipose fin-clipped (AD) and/or coded-wire tagged (CWT’d), including the DIT component, since the 2007 brood (released in 2008). Out of a total 3,800,000 sub-yearling release goal: 225,000 are AD+CWT, 225,000 are CWT-only, and the remaining 3.35-million are AD-only. Since adults return predominately at age 3 and age 4, this has been reflected in the hatchery Chinook returns beginning fall 2011 and 2012.

7.4 Proposed number to be collected:

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

Up to 2,500 adults collected annually.

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

Table 7.4.2: Sex composition and origin of fall Chinook broodstock spawned at George Adams Hatchery, 2002-2013.

Brood Year	Marked			Unmarked		
	Females	Males	Jacks	Females	Males	Jacks
2002	95	90	---	856	774	6
2003	88	119	---	881	854	6
2004	119	128	1	861	856	15
2005	137	114	9	1,032	949	102
2006	117	122	19	940	873	52
2007	114	207	29	817	704	13
2008[a]	652	747	72	843	653	23
2009	526	599	91	457	291	2
2010	1,069	1,093	123	224	76	1
2011	1,350	1,214	129	16	14	9
2012[b]	942	1,001	40	9	12	1
2013[c]	938	846	89	2	5	0
Average	**512**	**523**	**60**	**578**	**505**	**19**

Source: WDFW Hatchery Headquarters Database 2014.
[a] First year of 100% mass marked component releases.
[b] First year of expected 100% mass marked component returning adults, including both age 3 and 4 returns.
[c] 2013 preliminary data.

The 2007 brood (released in 2008) was the first to be 100% mass-marked at release; a significant portion of this brood returned in fall 2012. In previous years, fish returning to the hatchery were checked for hatchery marks and tags (**Table 7.4.2**), however, the number of unmarked adults recovered represents a mixture of natural-origin and unmarked hatchery-origin fish.

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

Surplus adults are sold to the contracted fish buyer.

7.6 Fish transportation and holding methods.

Broodstock is not transported.

7.7 Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols are adhered to, as defined in the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). No antibiotics or formalin treatment is applied.

7.8 Disposition of carcasses.

Carcasses are sold to contracted fish buyer.

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

The program has incorporated natural-origin fish for use as broodstock at an unknown level over the years (integrated program) from volunteers entering the hatchery trap. As of the 2007 brood (released in 2008), all hatchery-origin Chinook produced at George Adams Hatchery are mass-marked (*Skokomish Mass-Marking MOU* 2005).

8 SECTION 8. MATING

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

8.1 Selection method.

Existing Fall Chinook Program: Broodstock is selected randomly from natural- and hatchery-origin fish across the entire maturation time frame. Spawning takes place one or two times a week.

Late-Timed Component: Broodstock will be collected from sexually-mature fish returning in October (five to six weeks later than the current peak), currently targeted at up to 150 spawners.

8.2 Males.

All males collected, including jacks at up to 2% per spawning guidelines (draft WDFW 2010), are considered for spawning and are selected randomly on spawn days.

8.3 Fertilization.

Eggs and milt are collected separately; eggs from one female are mixed with milt from one male (pairwise spawning). Eggs mixed with milt are allowed 60 seconds for fertilization. Fertilized eggs from five females are combined into a 5-gallon bucket and taken to the incubation room, where the eggs are moved to bags, placed in deep troughs, and water hardened for 1-hour in an iodophor solution (100 ppm).

8.4 Cryopreserved gametes.

Cryopreserved gametes are not currently used.

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.

Existing Fall Chinook Program: Adults to be spawned are chosen randomly from the available gene pool. Every attempt is made to ensure that the egg-take is representative of the entire Chinook run.

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

The annual collection and use of a sufficient number of broodstock (up to 2,500 adults annually) minimizes adverse genetic impacts.

Late-Timed Component: Broodstock will be collected across the entire later run-timing spectrum beginning in October in order to maintain genetic variability. Continued use of factorial mating protocols will maximize family size (avoids duplicate use of males).

9 SECTION 9. INCUBATION AND REARING -

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

9.1 Incubation:

Egg collection, incubation, rearing and release takes place at George Adams Hatchery. The current egg-take goal for the George Adams Hatchery fall Chinook program is 4,450,000 (FBD 2014). The total egg-take includes the portion of George Adams stock Chinook (43,000 juveniles)

reared and shipped as sub-yearlings (125 fpp) to supplement the RFEG 6-Hood Canal Hamma Hamma fall Chinook program at the John Creek Conservancy Site (see Hamma Hamma Fall Chinook HGMP). In the event returns to Hamma Hamma Hatchery meet egg-take goals, the extra 45,000 eggs from George Adams Hatchery will not be needed.

Total egg-take also includes 200,000 fry to be shipped to Hoodsport Hatchery in April, beginning in brood year 2014 (released in 2015) (SIT and WDFW 2014).

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

Table 9.1.1.1: Survival rates of George Adams fall Chinook eggs, from collection to ponding, 2002-2013.

Brood Year	Eggs Collected	Survival Rates (%)	
		Green-to-Eyed Up	Eyed-Up-to-Ponding
2002	4,629,000	92.3	98.7
2003	4,583,800	93.5	96.5
2004	4,651,420	94.2	99.2
2005	4,581,700	92.7	97.3
2006	4,671,400	93.9	99.4
2007	4,538,800	95.7	98.1
2008	6,954,446	95.8	96.1
2009	4,909,092	94.2	97.7
2010	6,386,651	95.5	92.7
2011	6,824,470	93.8	97.0
2012	4,497,717	95.2	98.0
2013	4,511,036	97.5	98.0
Average	**5,144,961**	**94.5**	**97.4**

Source: WDFW Hatchery Headquarters Database, 2014.

Note: Includes eggs provided to the RFEG 6-Hood Canal Hamma Hamma fall Chinook program at the John Creek Conservancy Site. George Adams stock may be used as backfill of up to 85,000 fall Chinook for this program (see Hamma Hamma Fall Chinook HGMP), and the 200,000 sub-yearlings to be released at Hoodsport Hatchery beginning in 2015 (SIT and WDFW 2014).

9.1.2 Cause for, and disposition of surplus egg takes.

No excess eggs are collected beyond the needs of the program. If hatchery losses exceed the expected levels, then program goals for release are not met.

9.1.3 Loading densities applied during incubation.

Eggs are placed in nylon mesh bags at 45 pounds each and placed in deep troughs. Once eyed, eggs are loaded into vertical trays at 5 lbs/tray.

9.1.4 Incubation conditions.

All eggs are incubated on well water at constant 48°F and water flow of 12 gpm in the deep troughs, and 4 gpm in the vertical incubators. Vexar® layers are placed in trays as a substrate substitute.

9.1.5 Ponding.

When 95%+ buttoned up (mid-December/January), fish are moved from trays to three 20'x77'x31" raceways for initial rearing (surface water).

9.1.6 Fish health maintenance and monitoring.

All fertilized eggs are water-hardened in an iodophor solution. Fungus is controlled by formalin drip, (15-minute injection per day at a target dose of 1,667-ppm formalin), throughout incubation

to just prior to hatch. Once eyed, eggs are shocked and loss removed. Fry loss is picked at the time of ponding and then daily.

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

Eggs are incubated on high quality, pathogen-free well water. Survival from green eggs to release has been improved in recent years. Some cultural practices have been changed with recent personnel changes; overall success is reflected in survival rates (**Tables 9.1.1.1 and 9.2.1.1**).

All water systems are connected to 24-hr/day low water alarms and an emergency backup generator.

9.2 Rearing:

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

Table 9.2.1.1: Survival rates of George Adams fall Chinook fry-to-release, 2002-2013.

Brood Year	Fry-to-Sub-yearling Survival Rates (%)
2002	93.3
2003	93.2
2004	98.2
2005	97.7
2006	99.3
2007	97.2
2008	97.5
2009	98.4
2010	86.0
2011	96.0
2012	99.6
2013	99.3
Average	**96.3**

Source: WDFW hatchery records 2014.

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

Loading and density levels at WDFW hatcheries conform to standards and guidelines set forth in Fish Hatchery Management (Piper et al. 1982) and *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). Fish rearing densities are maintained at maximum less than 3 lbs; Chinook are generally split at 3 lbs/gpm and released at 5 lbs/gpm.

9.2.3 Fish rearing conditions

Chinook are initially reared in three 20'x77'x31" raceways. To accommodate fish growth and density requirements, 2.4-million fry are transferred to the 61'x167'x55" asphalt bottom pond and 1.4-million fry to the 48'x240'x33" gravel-bottom pond. Fry are marked when they reach ~250 fpp (March), and are spread between these ponds and third 71'x157'x27" gravel-bottom pond, where they remain until release. Ponds and raceways are filled with surface water.

Table 9.2.3.1: Monthly average surface water temperature (°F) at Purdy Creek.

Month	Average Water Temperature (ºF) Purdy Creek
October	48
November	46
December	45
January	45
February	46
March	47
April	48
May	48
June	50
July	52
August	52
September	51

Source: WDFW hatchery records 2012.

9.2.4 Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Table 9.2.4.1: Average size (fpp), by month, George Adams Hatchery juvenile fall Chinook.

Month	Average Size (fpp)
January	800
February	400
March	350
April	100
May	70

Source: WDFW hatchery records.

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

Not available.

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

Fish are fed a variety of diet formulations including starters, crumbles and pellets; feed brand used may vary, depending on cost and vendor contacts. Feeding regimes varies depending on the fish size, water temperature and other environmental factors, from eight feedings/7 days a week to 1-2 feedings/5days a week.

Feed rates varies from 1.7% to 2.5% B.W./day. An overall season food conversion rate is approximately1.2:1.

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

Fish health is monitored on a daily basis by hatchery staff and at least monthly by a WDFW Fish Health Specialist. Hatchery personnel carry out treatments prescribed by the Fish Health Specialist. Procedures are consistent with the *Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State* (WDFW and WWTIT 1998, updated 2006). See also HGMP section 10.9 for WDFW Standard Fish Health Procedures.

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

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

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

No "NATURES" type rearing methods are applied through the program.

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

All reasonable and prudent measures are employed to minimize rearing and incubation losses. These include the use of high quality spring or well water for incubation, use of high quality feeds for rearing, rearing densities and loadings that conform to best management practices, frequent fish health inspections, and the presence of professionally-trained personnel to operate the facilities. Hatcheries are designed to provide safe and secure rearing environment through the use of alarm systems, backup generators, and water re-use pumping systems to prevent catastrophic fish losses.

10 SECTION 10. RELEASE

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

10.1 Proposed fish release levels.

Table 10.1.1: Proposed release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Sub-yearling	3,600,000*	70	May	Skokomish River
Sub-yearling Late-timed component	200,000	70	May	Skokomish River

Source: WDFW, Future Brood Document 2014.

Notes: 60 fpp ~ 97 mm fork length (fl); 70 fpp ~ 92 mm fl; 80 fpp~88 mm fl; 90 fpp ~85 mm fl.

* Does not include the 43,000 sub-yearlings (125 fpp) transferred to the RFEG 6-Hood Canal's Hamma Hamma fall Chinook program at the John Creek Conservancy Site (see Hamma Hamma Fall Chinook HGMP), or the 200,000 sub-yearlings to be released at Hoodsport Hatchery beginning in 2015 (SIT and WDFW 2014).

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

Stream, river, or watercourse: Purdy Creek (WRIA 16.0005)

Release point: R.M. 1.8

Major watershed: Skokomish

Basin or Region: Hood Canal/ Puget Sound

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

Table 10.3.1: Numbers, sizes, CV, dates of release and release type, 2002-2013.

Release Year	Sub-yearling	Avg. size (fpp)	CV	Release Date(s)	Release Type
2003	3,806,706	86.5	5.62	5/15	Volitional/Forced
2004	3,824,193	68.7	5.07	5/14	Volitional/Forced
2005	3,835,482	69.6	5.00	5/18	Volitional/Forced
2006	3,817,449	71.4	5.13	5/16	Volitional/Forced
2007	3,848,340	71.0	7.87	5/15-16	Volitional/Forced

2008	3,684,518	65.9	5.33	5/15-16	Volitional/Forced
2009	3,899,993	73.0	4.97	5/15-19	Forced
2010	3,803,335	68.7	5.10	5/14	Forced
2011	3,771,245	71.0	5.86	5/17-18	Forced
2012	3,939,071	68.7	5.86	5/15-16	Forced
2013	4,154,153	72.0	7.06	5/20-23	Volitional/Forced
2014*	4,278,904	103.3	7.00	5/17-5/26	Volitional
Average	**3,888,616**	**74.2**	**5.82**		

Source: WDFW Hatcheries Headquarters Database 2014.

Notes: 65 fpp ~94 mm fork length (fl); 70 fpp ~92 mm fl; 80 fpp ~88 mm fl; 90 fpp ~85 mm fl.

* Average release number in 2014 reflects the 16% that escaped in early-March at 220 fpp (~63 mm fl); the remaining 84% was released at an average of 71 fpp.

10.4 Actual dates of release and description of release protocols.

George Adams Hatchery fall Chinook are generally released in mid-May, when they exhibit strong migratory behavior (screen and intake crowding, schooling and swimming around ponds) and appearance (silver body coloration). Screens are pulled to start a volitional release while the remainder is forced to leave after 24 hours.

10.5 Fish transportation procedures, if applicable.

A group of approximately 200,000 fall Chinook fry (250 fpp) will be shipped to Hoodsport Hatchery in April for acclimation and release as sub-yearlings, beginning with brood year 2014 (released in 2015). See HGMP section 5.2 for transportation vehicles available.

10.6 Acclimation procedures (methods applied and length of time).

All Chinook at George Adams Hatchery are acclimated on Purdy Creek water prior to release.

See Hoodsport Fall Chinook HGMP for acclimation procedures for George Adams Chinook transferred for release at Hoodsport Hatchery.

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

Table 10.7.1: Numbers released, by age and mark type.

Brood Year	Release	Marking[a]
2014	3,150,000	AD-only
	225,000	AD+CWT
	225,000	CWT-only
Late-timed component[b]	200,000	AD+CWT

Source: WDFW Future Brood Document 2014 (adjusted for late-time component).

[a] Does not include the otolith-marked 43,000 sub-yearlings (125 fpp) transferred to the RFEG 6-Hood Canal Hamma Hamma fall Chinook program at the John Creek Conservancy Site (see Hamma Hamma Fall Chinook HGMP), or the 200,000 fry transferred to Hoodsport Hatchery.

[b] Proposed marking regime for the late-timed component TBD with Co-manager agreement.

Sub-yearlings reared from the late-timed component of the broodstock will be differentially marked and coded-wire tagged to enable monitoring of freshwater entry and migration. The initial production objective will be 200,000 sub-yearling smolts reared from gametes collected from 75 adult pairs. A distinct later mode is expected to emerge by the time five brood years of production are recruited, at about the same time as an initial determination on the success of the spring re-introduction program (SIT and WDFW 2014).

George Adams Hatchery releases a Double-Index Tag (DIT) group of 225,000 sub-yearlings. The DIT group can serve as an index group for wild sub-yearling fall Chinook as well as providing

data on catch contributions, run timing, total survival, migration patterns and straying into other watersheds.

Only 166,000 Chinook were mass-marked (AD-only) in 2005 (2004 brood). Only 50% of the total releases in 2006 (2005 brood) were mass marked. The Co-managers agreed to mass-mark entire production with full implementation beginning with the 2007 brood (SIT and WDFW MOU 2005). As of the 2007 brood (2008 release), George Adams Hatchery fish are released ~92% AD-marked and ~8% CWT'd as a DIT group (**Table 10.7.1**).

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

Beginning with the 1999 brood, any excess of fry, resulting from higher than expected survival is released into landlocked lakes in the Hood Canal area following consultation with the tribes.

10.9 Fish health certification procedures applied pre-release.

Standard Fish Health Procedures performed at the facility:

- *All fish health monitoring is conducted by a qualified WDFW Fish Health Specialist.*
- *Juvenile fish examinations are conducted at least monthly and more often if necessary*. A representative sample (at the discretion of the fish health specialist) of healthy and moribund fish from each lot is examined.
- *Abnormal levels of fish loss are investigated if they occur*.
- *Fish health status is determined prior to release or transfer to another facility*. The exam may occur during the regular monthly monitoring visit, i.e. within one month of release or transfer.
- *Appropriate actions, including drug or chemical treatments are recommended as necessary*. If a bacterial pathogen requires treatment with antibiotics a drug sensitivity profile is be generated when possible.
- *Findings and results of fish health monitoring are recorded on a standard fish health reporting form and maintained in a fish health database.*
- *Fish culture practices are reviewed as necessary with facility personnel*. Where pertinent; nutrition, water flow and chemistry, loading and density indices, handling, disinfecting procedures and treatments are discussed.

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

In the event of a water system failure, screens would be pulled to allow fish to exit the pond. In some cases they can be transferred into other rearing vessels to prevent an emergency release.

The screens are not pulled during periods of severe flooding. Past experience has shown that the fish tend to home down to the bottom of the pond, and only those that are inadvertently swept out leave the pond.

During severe drought conditions, fish may be released early and directly into Purdy Creek.

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.

WDFW fish culture protocols generally use volitional releases to foster rapid seaward migration with minimal delay in the rivers, limiting interactions with listed Chinook. To minimize the risk of residualization and impact upon natural fish, hatchery sub-yearlings from George Adams Hatchery are released as smolts in mid-May at 70 fpp.

Fish are closely visually-monitored for smolting activities to ensure that they are released fully-smolted in order to actively migrate downstream. In addition, coefficient of variation (CV) for length at release at 10.0% or less is desirable in order to increase the likelihood that most of the

fish are ready to migrate (Fuss and Ashbrook 1995). The average CV for release years 2009-2012 was 5.56%.

Releasing hatchery Chinook as sub-yearlings only should reduce the likelihood of hatchery fish preying on wild Chinook since wild Chinook are expected to be nearly as large as the hatchery fish at the time of release. Hatchery Chinook would probably be smaller than any fluvial or anadromous bull trout that they might encounter in the lower Skokomish. Wild summer chum are considered extirpated in the Skokomish River so adverse effects in fresh water are not expected.

11 SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1 Monitoring and evaluation of "Performance Indicators" presented in HGMP section 1.10.

Elements of the annual monitoring and evaluation plan for this program are identified in HGMP section 1.10. The purpose of a monitoring program is to identify and evaluate the benefits and risks that may derive from the hatchery program. The monitoring program is designed to answer questions of whether the hatchery is providing the benefits intended, while also minimizing or eliminating the risks inherent in the program. A key tool in any monitoring program is having a mechanism to identify each hatchery production group.

Each production group shall be identified with distinct otolith marks, adipose fin-clips (AD), coded-wire tags (CWTs), blank wire tags (BWTs) or other identification methods as they become available, to allow for evaluation of each particular rearing and/or release strategy. This will allow for selective harvest on hatchery stocks when appropriate, monitoring of interactions of hatchery and wild fish wherever they co-mingle in riverine, estuarine and marine habitats and assessment of the status of the target population.

WDFW shall monitor the Chinook salmon escapement into the target and non-target Chinook populations to estimate the number of tagged, un-tagged and marked fish escaping into the river each year and the stray rates of hatchery Chinook into the rivers.

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

These fish are 100% mass-marked: 92% are released adipose-fin clipped, which will allow selective fisheries (harvest opportunity) in mixed stock areas, while minimizing impacts on weak or protected stocks, as well as enabling identification of the hatchery production and NOR/HOR spawning ground ratios.

WDFW and Co-manager staffs (Skokomish, Lower Elwha, Jamestown, and Port Gamble tribes) will communicate any proposed production changes. Production changes involving the Regional Fish Enhancement Group (RFEG) or volunteer co-op groups are communicated through the WDFW's Region 6 office. The changes in goals and production levels that result from these discussions are reflected in WDFW's Future Brood Document.

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

Monitoring, evaluation and research follow scientific protocols with adaptive management process, by the Co-managers, if needed. WDFW will take risk aversion measures to eliminate or reduce ecological effects, injury, or mortality as a result of hatchery monitoring activities. Most hatchery trap mortalities are either the result of extreme environmental conditions that flood traps, or equipment failure. WDFW hatchery staff will take precautions to make sure the equipment is properly functioning during the season. If environmental conditions are forecast that will cause

high mortality then hatchery traps will be removed or opened up to allow unobstructed passage without mortality. Any take associated with monitoring activities is unknown but will follow scientific protocols designed to minimize impact.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Risk aversion measures will be developed in conjunction with the monitoring and evaluation plans.

12 SECTION 12. RESEARCH

12.1 Objective or purpose.

Not applicable

12.2 Cooperating and funding agencies.

Not applicable

12.3 Principle investigator or project supervisor and staff.

Not applicable

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

Not applicable

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

Not applicable

12.6 Dates or time period in which research activity occurs.

Not applicable

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.

Not applicable

12.8 Expected type and effects of take and potential for injury or mortality.

Not applicable

12.9 Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Not applicable

12.10 Alternative methods to achieve project objectives.

Not applicable

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

Not applicable

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Not applicable

13 SECTION 13. ATTACHMENTS AND CITATIONS

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14 SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date: _____

Philip Anderson
Director, Washington Department of Fish and Wildlife

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

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

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

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

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

Skokomish Bull Trout *(Salvelinus confluentus):* Bull trout were listed as a threatened species in the Coastal-Puget Sound Distinct Population Segment on November 1, 1999 (64 FR 58910), five year review completed April 29, 2008 (69 FR 19449) (USFWS 2008). Two local populations have been identified in the Skokomish Core Area, based the distribution of suitable spawning and rearing habitat: North Fork Skokomish and South Fork Skokomish Rivers; Brown Creek has also been identified as a potential local population. The Skokomish Core Area is thought to support adfluvial, fluvial, anadromous and resident life history forms but conclusive data is lacking (USFWS 2004). Emigrating smolts have been detected in the South Fork Skokomish population (WDFW 2004). The USFWS (2004) considers this Core population to be depressed and at risk of extinction due to low numbers and habitat fragmentation. Bull trout are known to spawn in the South Fork Skokomish from RM 19 to an anadromous barrier at RM 23.5 and in Church Creek from RM 0 to RM 0.5. Spawning also occurs in the North Fork Skokomish, Elk and Slate Creeks above Lake Cushman Dam. The recovered abundance level for bull trout in the Skokomish Core Area has been set at 700 adult spawners, based on current habitat capacity (USFWS 2004).

Table 15.2.1: Summary table of core area rankings for population abundance, distribution, trend, threat, and final rank.

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Skokomish River	50-250	125-620	Rapidly declining	Substantial, imminent	High Risk

Source: USFWS 2008.

Table 15.2.2: Adult bull trout counts in the North Fork Skokomish River above Lake Cushman and bull trout redd counts in the South Fork Skokomish River.

Year	North Fork Skokomish Bull Trout	South Fork Skokomish Bull Trout Redds
1999	90	NA
2000	93	20
2001	87	22
2002	93	13
2003	89	8
2004	109	16
2005	150	18
2006	71	8

2007	243	14
2008	202	26
2009	74	3
2010	NA	3
Average	**118**	**14**

Source: SCoRE (WDFW 2014).

Habitat. The Skokomish Core Area population has been impacted due to hydropower, timber production and agriculture. Rural development has accompanied or followed conversion of agricultural lands and has also impacted aquatic habitat. Alterations to aquatic habitat in the mainstem and South Fork Skokomish River from forestry, roads, agriculture, and rural development include increased sediment, channel aggradation, altered flows, loss of woody debris, and elevated stream temperatures. The South Fork Skokomish River watershed has some of the highest road densities found west of the Cascade Mountains in Washington (USFWS 2004).

Cushman Dams 1 and 2 on the North Fork Skokomish River were constructed without fish passage and have eliminated connectivity of fish upstream from the dams with habitat and fish in the lower North Fork Skokomish River, the mainstem Skokomish River, the South Fork Skokomish River, and Hood Canal. Lack of, or greatly reduced, flows in the North Fork Skokomish River resulting from diversion of water to a power canal have reduced sediment transport capabilities, resulting in further aggradation of the river. Channelizing and diking for agriculture and residential development have further contributed to sediment accumulation (USFWS 2004).

Several listed and candidate species are found in Mason County; however the hatchery operations and facilities for this program do not fall within the critical habitat for any of these species. As such there are no effects anticipated for these species.

Listed or candidate species:
"No effect" for the following species:

Marbled murrelet (*Brachyramphus marmoratus*) –Threatened [critical habitat designated]
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened [critical habitat designated]

Candidate Species
Fisher *(Martes pennanti)* – West Coast DPS
(Shelton) Mazama pocket gopher (*Thomomys mazama* ssp. *couchi*)
Streaked horned lark (*Eremophila alpestris strigata*)

15.3 Analyze effects.

There are no activities associated with this hatchery program that would directly impact bull trout other than encountering them in other hatchery programs during broodstock collection activities. There may be some mortality from hook and release of bull trout in fisheries targeting other species. Any unintended take, observed or unobserved encounters of bull trout are reported by WDFW to USFWS.

15.4 Actions taken to minimize potential effects.

There are no activities associated with this hatchery program other than encountering them in other hatchery programs during broodstock collection activities (steelhead or coho) that would directly impact or create potential effects on bull trout in this system based on the current understanding of the status of these fish.

15.5 References

USFWS (U.S. Fish and Wildlife Service). 2004. Draft recovery plan for the coastal-Puget Sound distinct population segment of bull trout (*Salvelinus confluentus*). Volume II (of II): Coastal management unit. Portland, Oregon. 389 + xvii pp.

USFWS (U.S. Fish and Wildlife Service). 2008. Bull trout (*Salvelinus confluentus*) 5-year review: Summary and evaluation. Portland, Oregon. U.S. Fish and Wildlife Service. 55 pp.

WDFW (Washington State Department of Fish and Wildlife). 2004. Washington State salmonid stock inventory bull trout/ Dolly Varden. Washington State Department of Fish and Wildlife. Olympia, Washington.

"Take" Tables

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

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound Chinook		**Activity:** George Adams Fall Chinook Program	
Location of hatchery activity: George Adams Hatchery, RM- 1.0 on Purdy Creek (WRIA 16.0005)	**Dates of activity:** August-July 31		**Hatchery program operator:** WDFW	
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)	-	-	-	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c)	-	-		
Capture, handle, tag/mark/tissue sample, and release d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	Up to 2,795	-
Intentional lethal take f)	-	-	Up to 2,500	-
Unintentional lethal take g)	450,000	75,000	Up to 295	-
Other Take (specify) h)	-		-	-

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

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

Table 2. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Puget Sound Steelhead		**Activity:** George Adams Fall Chinook Program	
Location of hatchery activity: George Adams Hatchery, RM- 1.0 on Purdy Creek (WRIA 16.0005)	**Dates of activity:** August-July 31		**Hatchery program operator:** WDFW	
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	**Juvenile/Smolt**	**Adult**	**Carcass**
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			0	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.