HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Wallace River Summer Chinook Hatchery Program (Integrated)
Species or Hatchery Stock:	Skykomish River Summer Chinook (*Oncorhynchus tshawytscha*)
Agency/Operator:	Washington Department of Fish & Wildlife
Watershed and Region:	Skykomish River Snohomish Basin / Puget Sound
Date Submitted:	February 11, 2013
Date Last Updated:	February 7, 2013

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Wallace River Summer Chinook Program

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

Skykomish River Summer Chinook (*Oncorhynchus tshawytscha*) - Re-affirmed 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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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

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Co-manager policies are in effect for all Puget Sound hatchery programs. The legal basis for Co-management of salmon in Puget Sound is based on the Puget Sound Salmon Management Plan (PSSMP), which was developed by the Co-managers and adopted as an order of the Federal court in 1985 (United States v. Washington, No. 9213 Phase 1 (sub no. 85-2) 1985).

Summer Chinook eggs collected at Wallace River Hatchery are for both on-station program needs and for transfer to the Bernie Kai Kai Gobin Salmon Hatchery (a Tulalip Tribal hatchery) for incubation, rearing and release each year (WDFW and Tulalip Tribes Hatchery MOU Agreements; MOU 1997, 2003, 2005, 2012).

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

Funding Sources	Operational Information (for FY 2011)*
General Fund – State	Full time equivalent staff – 3.29
DJ – Federal	Annual operating cost (dollars) - $440,272
Puget Sound Recreational Fisheries Enhancement	

*The above information for annual operating cost applies cumulatively and cannot be broken out specifically by program.

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

Sunset Falls Fishway: Upper SF Skykomish River (WRIA 07.0012), RM 51.5 (see HGMP sections 6.2.3 and 6.3 for more details on the use of Sunset Falls).

Wallace River Hatchery: Wallace River (WRIA 07.0940), RM 4 at the confluence with May Creek (WRIA 07.0943); enters the Skykomish River (WRIA 07.0012) at RM 36.

1.6) Type of program.

Integrated harvest

1.7) Purpose (Goal) of program.

Harvest augmentation.

1.8) Justification for the program.

The program mitigates for lost natural-origin fish production in the watershed by producing Skykomish population summer-run Chinook salmon for harvest in regional recreational fisheries, and Tulalip Tribal commercial and ceremonial and subsistence fisheries. The program helps 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.

To minimize impacts on listed fish by WDFW facilities operation and the Wallace River Hatchery Chinook program, the following Risk Aversions are included in this HGMP:

Table 1.8.1: Summary of risk aversion measures for the Wallace River summer Chinook program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	Surface water rights for Wallace River and May Creek hatchery intakes are formalized through trust water right # S1-00109 and S1-05617, respectively. Monitoring and measurement of water usage is reported in monthly NPDES reports.
Intake Screening	4.2	The intake screens on the Wallace River and May Creek are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NMFS 2011). Currently scheduled for rebuild in 2015 -2017 biennium.
Effluent Discharge	4.2	This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System permit administered by the Washington Department of Ecology (DOE) - WAG 13 - 3006.
Adult Passage & Broodstock Collection	2.2.3, 7.2	The hatchery, located at the confluence of May Creek and the Wallace River, operates two adult weirs on both systems. Due to limited habitat, *Cryptobia* (parasite) problems and water quality problems, Chinook are not allowed above the May Creek weir. Management of Wallace River naturally-spawning Chinook includes a protocol for passage of fish above the Wallace River weir into approximately 3.1 miles of spawning

		habitat. Broodstock integration and controlling the number of hatchery-origin spawners (HOS) in the Wallace River are being done with the intent to increase local adaptation to the natural environment and boost productivity and diversity, while managing for other viability parameters (abundance, spatial distribution and genetic diversity). To manage abundance while implementing HOS control, the Co-managers established a Minimum Natural Spawner Guideline (MSG) for the Wallace River (see HGMP section 7.9).
Disease Transmission	9.2.7	The Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (1998, Revised July 2006) details hatchery practices and operations designed to stop the introduction and/or spread of infectious fish pathogens.
Competition & Predation	2.2.3, 10.11	Fish are released at a time, size, and life-history stage (smolts) to foster rapid migration to marine waters.

1.9) List of program "Performance Standards".

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

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

1.10.1: "<u>Performance Indicators" addressing benefits</u>.

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.1 Program contributes to fulfilling tribal trust responsibility mandate and treaty rights as described in US v WA.	Contributes to co-manager harvest (PS).	Participate in annual coordination between Co-managers to identify and report on data and issues of interest, coordinate management, databases and review programs (FBD and EBD processes, North of Falcon).
3.1.2 Program contributes to mitigation requirements.	This program provides mitigation for lost fish production due to development and habitat degradation within the Snohomish basin and contributes to sport, tribal and commercial fisheries.	Survival and contribution to fisheries will be estimated 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 is updated and revised to manage risks to listed fish in compliance with the Terms and Conditions of permits.
3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management	All Snohomish region hatchery production is marked and/or tagged enabling identification of all hatchery fish. Externally-mark hatchery fish to	Conduct 100% marking and tagging. Harvests and hatchery returns are monitored by agencies to provide up-to-date information on hatchery fish

plans, while avoiding overharvest of non-target species.	differentiate them from natural-origin fish and enable mark-selective fisheries, which can reduce directed harvest mortality on wild fish. Time-area fishery management strategies in terminal areas target hatchery production while limiting harvest rate on natural stocks.	contribution rates to fisheries.
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.	All Snohomish region hatchery production is marked and/or tagged enabling identification of all hatchery-origin fish. 100% mass-mark (adipose-fin clip, otolith) and representatively CWT production fish to distinguish them from naturally-produced fish.	Monitor and record fish size, number released, release date, numbers and proportions marked and tagged and marking and tagging efficiency rates. Annually record the final adjusted numbers and proportions of Ad & CWT, AD-Only, CWT-Only, and Unmarked per the 2012 Tulalip-WDFW Hatchery MOU Agreement (2012) for all regional hatchery releases. Returning fish are sampled in fisheries, hatcheries and on spawning grounds for adipose fin clip status and otolith and CWT recoveries. Estimate the contribution rate of hatchery-origin Chinook to Snohomish natural spawning populations such that the width of the 90% confidence interval is ± 8% of the estimate. Numbers of estimated hatchery (marked) and natural (unmarked) are recorded annually. The double index tag (DIT) group (CWT-only) provides data to evaluate the effects of mark-selective fisheries (MSF), natural-origin summer Chinook catch contributions, run timing, total survival, migration patterns and straying into other watersheds.
3.4.1 Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Collection of broodstock is done representatively and systematically throughout the summer Chinook return period. Use spawning guidelines for Washington Department of Fish and Wildlife hatcheries (Seidel 1983).	Numbers of all fish escaping to the hatchery are recorded annually by their mark/tag, sex and disposition and compiled annually. Annual return and spawn timing is recorded. Broodstock are collected by month of return and return timing is represented in the broodstock spawned.

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.	Smoltification status (size fpp/mass CV and condition factor) and behavior are monitored in the hatchery (70 fpp Chinook sub-yearling release size goal). Observations of behavior, coloration, scale loss and other signs of full smoltification. Forced release.	Condition of fish is monitored in the hatchery throughout rearing stages and at release. Monitor and record mean fork length, weight, condition factor, number released, date of release. behavior, coloration, scale loss and other signs of full smoltification.
3.5.6 The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Program is properly sized to balance broodstock and egg-take goals with harvest objectives, spawning objectives and goals for genetic and ecological interactions; program fish are fully utilized for hatchery production and in target fisheries.	Harvests and hatchery returns are monitored throughout the run. Egg-take, escapement and genetic and ecological interactions are monitored and potential interactions modeled with annual production and escapement data and adaptive management applied. Numbers of surplus and shipped hatchery fish along with numbers of mortalities, numbers passed upstream and numbers spawned are recorded annually by mark-tag-sex disposition.
3.6.1 The hatchery program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Follow HGMP spawning, rearing and post-release monitoring guidelines. Apply basic monitoring during hatchery rearing: Record feed conversion rates, growth trajectories, mark/tag rate error, weight distribution (CV).	Annual hatchery escapement data is recorded by mark/tag disposition, run timing, age and sex composition. Survival rates, marking and tagging rates, number and size of fish released and release dates are recorded annually.
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Contributes to cultural, ceremonial, subsistence, religious and recreational benefits for Northwest Native Americans and both cultural and recreational benefits to the general community. Recreational fishery angler days, length of season, number of licenses purchased.	Annual harvest of hatchery fish based on mark/tag recovery estimates and creel surveys. Annual numbers of surplus fish provided to the Tribes for cultural, ceremonial, subsistence and religious uses.

1.10.2: "<u>Performance Indicators" addressing risks</u>.

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
3.1.3 Program addresses ESA responsibilities.	This HGMP has been submitted for program authorization under auspices of the ESA. Potential risks have been addressed using the best available science applied to hatchery actions and an aggressive, proven and	HGMP is updated to reflect any major changes in program and resubmitted to NOAA fisheries. Monitor juvenile hatchery fish size, number of marked/tagged fish released and date of

	tested monitoring and adaptive management program has been in effect successfully for years.	release. Monitor potential genetic and ecological interactions between post-released program fish and natural-origin populations. Monitor the contribution rates of adult hatchery fish to fisheries, hatcheries, and natural escapement.
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 bycatch of non-target species.	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to differentiate hatchery- from natural-origin fish and enable state agencies to implement selective fisheries.	Harvests and escapements are monitored by agencies to provide up-to-date information.
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.	All hatchery releases are identifiable as hatchery-origin fish. Mass-mark (adipose-fin clip, CWT, otolith-mark, etc., depending on species) production fish to allow for their differentiation from naturally produced fish for selective fisheries.	100% mass-marking as of release year 2001. Annual harvest of mass-marked hatchery fish assessed based on CWT recovery estimates and creel surveys. DIT groups (CWT-only) provide data on MSF, catch contributions, run timing, total survival, migration patterns, straying, in-stream evaluations of juvenile and adult behaviors, NOR/HOR ratios 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 by sub-watershed (pNOS, pHOS, spawner-recruit ratios) using both demographic- and genetic-based methods. Implement strict guidelines for fish removal. Modeling of broodstocking protocol (see below) will to not impair MSY escapement, which is projected to be exceeded.	Demographic abundance estimates of NOS and HOS: Annual estimates of hatchery- and natural-origin, naturally-spawning Chinook are determined for all key spawning aggregations within the watersheds of the Snohomish basin. Proportions of hatchery- and natural-origin fish estimated from carcass sampling for mark/tag disposition are applied to stratified sub-watershed abundance estimates based on redd counts from aerial, foot and float surveys. Genetic-based abundance estimates of NOS and HOS: Derive DNA-based parentage assignment methods to estimate abundance, the effective number of breeders, successful and unsuccessful spawners by

		origin, time, and location and effective population size for naturally-spawning Chinook by hatchery- and natural-origin, sex, age and location. Hard counts of the number of adult Chinook passed above Sunset Falls are added to the SF Skykomish watershed estimate.
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.	All hatchery production is identifiable in some manner (fin-marks, otolith, CWT) consistent with information needs.	Annual estimates of otolith, coded-wire tag, and adipose fin clip ratios of juveniles released are recorded. Returning adults recovered in fisheries, hatcheries and escapements are examined for the presence/absence of otolith marks, coded-wire tags, and adipose fin clips. Numbers of hatchery- and natural-origin fish are recorded by their mark-tag dispositions annually. Wallace River pHOS goal of between 0.30 and 0.50.
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.	Collection of broodstock is done randomly throughout the entire return period.	Annual run timing, age and sex composition and return timing data are collected.
3.4.2 Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Broodstock collections from natural spawning areas limited to Sunset Falls; (225 fish or <20%, whichever is lower) do not significantly reduce natural production or potential juvenile production in the system. Capacity modeling demonstrates fish removals will not inhibit MSY escapement.	Capacity and simulation modeling does not impact MSY in the one area where NOS are removed. NOS will equilibrate well above current conditions.
3.4.3 Life history characteristics of the natural population do not change as a result of this hatchery program.	Life history patterns of juvenile and adult NOR are stable.	Plan in progress to annually monitor life history characteristics such as size (weight, length, condition factors), body condition, energy, scales, IGF-1 (as growth rate indicators), scales, otoliths and otolith microchemistry (for growth history), age and size-at-age information, out-migrant and adult return timing, morphology.
3.5.1 Patterns of genetic variation	Within and between	Tissue samples of adult and

within and among natural populations do not change significantly as a result of artificial production.	populations, genetic structure is not affected by artificial production.	juvenile Chinook are being collected annually to understand the genetic substructure within and between populations in the basin and represented in the GAPS baseline, and relative to other Puget Sound Chinook populations.
3.5.2 Collection of broodstock does not adversely impact the genetic diversity of the naturally-spawning population.	Collection of NOS for broodstock from the natural escapement is limited to one location, Sunset Falls, with strict limits (225 fish or <20%, whichever is lower) (see HGMP section 7.9). The only other NOS used for hatchery broodstock are those recruiting into Wallace River Hatchery,, which are not enumerated as part of the naturally-spawning population. Broodstock are collected representatively throughout the summer Chinook return period.	Collect tissues from out-migrating smolts and natural- and hatchery-origin adults to analyze genetic diversity of the naturally-spawning population and compare to the hatchery supplemented fish using genetic-based parentage analysis. Assess genetic diversity and population substructure throughout the basin for all spawning aggregations in ongoing DNA baseline studies. DIT groups allow evaluations of MSF, straying, in-stream evaluations of juvenile and adult behaviors, and NOR/HOR ratios 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 demographic ratio of estimated numbers of artificially-produced fish to the total spawning escapement, ($pHOS_D$). The proportion of natural influence derived from direct estimates of gene flow, PNI_G. Estimates of relative productivity of natural- and hatchery-origin Chinook salmon. Sex, location, origin, and age structure of adult fish sampled for tissue for DNA analysis in natural and hatchery escapements and NOR juveniles (fry and smolts in smolt traps, electrofishing, beach seining, fyke netting, etc.	The $pHOS_D$ for the integrated Skykomish population is currently controlled to 30-50% in the Wallace River resulting in $pHOS_D$ <30% and PNI_D > 0.50 for the integrated Skykomish population. Derive DNA-based estimates of relative productivity and gene flow between natural- and hatchery-origin populations and manage risk using DNA parentage assignment methods. Use DNA parentage to estimate abundance, the effective number of breeders, successful and unsuccessful spawners by origin, time, and location, effective population size and genetic-based abundance estimates for naturally-spawning Chinook by hatchery- and natural-origin, sex, and age and by location to derive the genetically effective spatial distribution of spawners. Use same techniques to identify the origins of juveniles in

		freshwater, estuarine and nearshore marine areas, temporal, spatial habitat type and use, relative abundances, co-occurrences. Estimate $pHOS_G$ and PNI_G from direct estimates of gene flow and compare to demographic-based estimates of $pHOS._{D.}$
3.5.4 Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Fish are only released from Wallace River Hatchery.	Annual release information is recorded.
3.5.5 Juveniles are released at fully-smolted stage.	Level of smoltification at release. Forced release type.	Monitor size, number, and 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 egg-take and harvest goals Numbers of surplus hatchery returns are calculated annually.	Numbers of adults returning to the hatchery, broodstock and eggs collected or not collected, fish harvested and surplus returns are recorded annually. The program is optimally-sized to meet broodstocking, egg-take and harvest needs with few to no surplus adult returns.
3.7.1 Hatchery facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols (IHOT, PNFHPC, Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (Revised July 2006), 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 and prior to releases per the Co-manager's Disease Control Policy. Exams performed at each life stage may include tests for infectious viral, bacterial, and parasitic pathogens and/or pathological changes, as needed.
3.7.2 Effluent from hatchery facility will not detrimentally affect natural populations.	Discharge water quality compared to applicable water quality standards under the Clean Water Act per the NPDES permit. WDOE water right permit compliance.	Flow and discharge reported in monthly NPDES reports.
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 the 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. Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (Revised July 2006).	Necropsies of fish to assess fish health, nutritional status, and culture conditions.	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and monitors juvenile fish on a monthly basis and before all releases to assess fish health and detect potential disease problems. As necessary, WDFW's Fish Health Section provides diagnostic services and if necessary, 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.	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Disease Control Policy.
	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.	Control of specific fish pathogens through egg/fish transfers are conducted in accordance with the Co-managers Disease Control Policy.
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 prevention and control policies are followed. See HGMP sections 7.5 and 7.8.	Control of specific fish pathogens through eggs/fish movements, including carcass planting are conducted in accordance with the Co-managers Disease Control Policy. 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. Fish passage above the weir, when applicable, approximates observed return timing. See HGMP HGMP section 6.3.	The Co-managers have established strict guidelines for collection of natural-origin fish that are designed so that the viability of Chinook in the sub-watersheds affected will not be impaired. Takes of listed fish are constrained by limiting sources of natural-origin fish to two specific sub-watersheds

		and limiting the allowable takes from those watersheds based on analysis of natural capacity and productivity under current conditions using Ecosystem Diagnosis and Treatment (EDT) (see HGMP section 7.9).
3.7.7 Weir/trap operations do not result in significant stress, injury or mortality to natural populations.	Trapping operations that handle natural-origin fish from the natural escapement are limited to Sunset Falls. Annual hauling data recorded since the late-1950s indicate very little or no mortalities from hauling. Weir operations at the Wallace River weir have not resulted in any observed stress, injury or mortality to natural populations.	The trap is checked daily. Natural- and hatchery-origin fish condition is observed on a regular basis each year and abundances of live fish and all mortalities are recorded annually All observations of natural-origin fish at hatchery facilities are recorded regularly and reported annually.
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. Relative body size of program fish released and size of prey, especially ESA-listed, zero-age Chinook and steelhead. Relative occurrence, timing, distribution habitat use, stomach contents of hatchery- and natural-origin fish species.	Summarized predation data is not directly available. However, the Tulalip Tribes have operated smolt traps on the Skykomish and Snoqualmie Rivers since 2000 recording the outmigration timing and relative size of all species by hatchery and natural origins. The Co-managers, in cooperation with NOAA fisheries, have conducted beach seining studies in the Snohomish River estuary and nearshore marine areas since 2000 recording relative size, occurrences, outmigration timing, habitat use and stomach contents of natural- and hatchery-origin fish.
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).
3.8.3 Non-monetary societal benefits for which the program is designed are achieved.	Contributes to the cultural benefit that fishing provides. Recreational fishery angler days, length of season, number of licenses purchased. Fish available for tribal ceremonial use.	Agencies and tribes to provide up-to-date information needed to monitor harvests.

1.11) Expected size of program.

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

The escapement goal is 3,200 Chinook. This is the minimum escapement goal projected to result, on average, in meeting the effective spawner and egg-take goals for both the Wallace and Tulalip hatchery programs at a risk level agreed to by the Co-managers, given expected survival rates and other biological factors that affect realized egg-takes for these two programs.

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

Table 1.11.2.1: Proposed annual fish releases.

Life Stage	Release Location	Annual Release Level
Sub-yearling	Wallace River (WRIA 07.0940)	1,000,000
Yearling	Wallace River (WRIA 07.0940)	500,000

Data source: Future Brood Document (2012).

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 adult equivalent survival (AEQ) rates of Wallace Hatchery sub-yearling and yearling Chinook salmon of 0.30% for sub-yearlings 1.42% for yearlings and the programmed release goal of 1,000,000 sub-yearlings and 500,000 yearlings, the estimated average recruitment would be 10,100 adult (see HGMP section 3.3.1).

Wallace Fingerling

Br Year	Releases	AEQ Recov.	Surv.
1996			
1997			
2000	205,008	604.4	0.29%
2001	196,023	388.1	0.20%
2002	145,639	400.6	0.28%
2003	176,427	654.3	0.37%
2004	200,398	1260.9	0.63%
2005	204,637	286.7	0.14%
2006	205,344	345.1	0.17%
		Average:	**0.30%**

Wallace Yearling

Br Year	Releases	AEQ Recov.	Surv.
2001	424,717	4,374	1.03%
2002	381,394	2,885	0.76%
2003	38,053	1,233	3.24%
2004	52,340	419	0.80%
2005	50,287	1,231	2.45%
2006	79,419	173	0.22%
0	83,534	586	0.70%
		Average:	**1.42%**

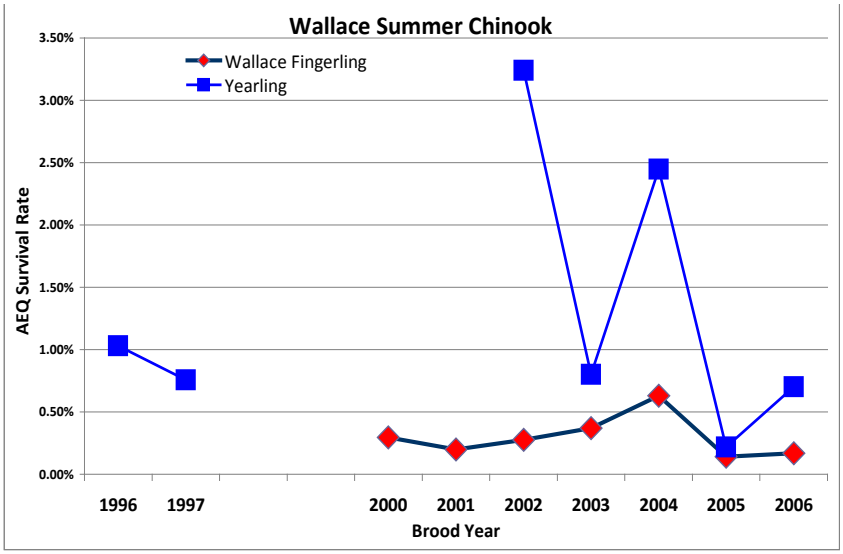

Table 1.12.1. Wallace River Hatchery summer Chinook escapement 2000-2011.

Brood Year	Hatchery Escapement (does not include Sunset Falls transfers)	Fish Returned to River	Hatchery Escapement Less Returned to River
2000	3,577	634	2,943
2001	2,723	786	1,937
2002	2,585†	253	2,332
2003	5,687†	627	5,060
2004	6,192†	328	5,864
2005	3,778	0	3,778
2006	4,313†	412	3,902
2007	6,232†	507	5,724
2008	5,844†	354	5,490
2009	2,014††	58	1,956
2010	2,831††	0	2,831
2011	3,114†	473	2,641
Average	**4,074**	**369**	**3,705**

Data source: *FishBooks* (2012).

† Removed from Hatchery Escapement, added to Wallace River natural escapement.

†† Includes fish removed from Wallace River natural escapement, added to Wallace Hatchery escapement (see Table 1.12 2).

Table 1.12.2. Numbers of adult Chinook salmon passed upstream to the Wallace River escapement from Wallace River Hatchery and returned from Wallace River to the hatchery escapement.

Year	Type of Action	Males	Females	Jacks	Total
2002	Removed from Hatchery Escapement, Added to Wallace River (Passed Upstream Above Hatchery Rack)	150	100	---	250
2003	Removed from Hatchery Escapement, Added to Wallace River (Passed Upstream Above Hatchery Rack)	419	208	---	627
2004	Removed from Hatchery Escapement, Added to Wallace River (Passed Upstream Above Hatchery Rack)	180	148	---	328
2005	Removed from Hatchery Escapement, Added to Wallace River (Passed Upstream Above Hatchery Rack)	---	---	---	---
2006	Removed from Hatchery Escapement, Added to Wallace River (Passed Upstream Above Hatchery Rack)	106	106	400	612
2007	Removed from Hatchery Escapement, Added to Wallace River (Passed Upstream Above Hatchery Rack)	403	104	---	507
2008	Removed from Hatchery Escapement, Added to Wallace River (Passed Upstream Above Hatchery Rack)	149	195	10	354
2009	Removed from Wallace River, Added to Hatchery Escapement	293	237	---	530
2010	Removed from Wallace River, Added to Hatchery Escapement	373	420	46	839
2011	Removed from Wallace River, Added to Hatchery Escapement	242	201	30	473

Data source: *FishBooks* (2012).

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

The current program has been in operation since 1972.

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

Snohomish River watershed -Skykomish River (WRIA 07.0012).

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

Alternative 1: *Reduce summer Chinook release numbers as a measure to decrease genetic and ecological risks to natural-origin Chinook salmonids*. The Co-managers did not pursue this alternative because it would not meet enhancement or harvest objectives for the program and would not meet the goals of either Co-manager, including providing recreational, cultural and subsistence, ceremonial, religious, commercial and non-commercial benefits, nor be compatible with Treaty Indian fishing rights (*US v. WA*) or the Magnuson/Stevens Act for sustainable fisheries.

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 Chinook 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.

Skykomish and Snoqualmie Chinook; listed as *Threatened* as part of the Puget Sound Chinook (*Oncorhynchus tshawytscha*) ESU (PSTRT 2001) 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).

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

In the Snohomish River Basin, the Technical Recovery Team (TRT) has preliminarily delineated three demographically independent populations (DIP) of winter steelhead stocks in the Snohomish watershed (Snohomish/Skykomish, Pilchuck, and Snoqualmie) and two DIPs of summer steelhead (Tolt, and NF Skykomish), which could be incidentally affected by this program. Puget Sound Steelhead ***(****O. 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 steelhead populations in streams of river basins in the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the

north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks.

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")***.**

Wallace River Hatchery summer Chinook in Puget Sound Chinook ESU. NMFS considered this hatchery stock to be part of the ESU, and listed with natural-origin Chinook salmon that are part of the Skykomish population (70 FR 37160, June 28, 2005; NMFS SHIEER 2004). The Wallace River Hatchery stock was derived primarily from locally-obtained natural-origin fish, and was considered by NMFS to be no more than moderately diverged from the donor Skykomish population. See Table 2.2.1, Table 7.4.2, and Table 1b (Appendices) for the numbers and proportions of NOB used in the broodstock for the past seven years of integration.

Table 2.2.2.1: Numbers and proportions of natural-origin fish in the Wallace River Hatchery Chinook broodstock relative to demographic-based estimates of the proportions of hatchery-origin fish on the target natural spawning grounds and demographic-based estimates of the Proportion of Natural Influence (PNI_D) for seven years of broodstock integration (2005-2011).

Year	Wallace NOB	Sunset NOB	Total NOB	Total Integrated	pNOB	pHOS Skykomish Pop		PNI Sky (Demograhic)	PNI Sky-Wall (Demograhic)
						Including Wallace River	Excluding Wallace River		
2011	265	51	316	981	0.32	0.25	0.11	0.56	0.75
2010	83	82	165	699	0.24	0.27	0.16	0.47	0.59
2009	56	36	92	785	0.12	0.19	0.16	0.38	0.42
2008	179	108	287	724	0.40	0.18	0.04	0.69	0.91
2007	279	83	362	708	0.51	0.43	0.27	0.54	0.66
2006	124	108	232	719	0.32	0.17	0.09	0.66	0.78
2005	246	66	312	697	0.45	N/A	N/A	N/A	0.89

Data source: Co-manager's annual escapement estimate and carcass survey unpublished data, Mike Crewson Tulalip Tribes and Peter Verhey WDFW 2012.

Using methods described in Rawson, Kraemer and Volk (2001) applied to Co-manager's annual escapement estimates and carcass surveys for the past seven years, naturally-produced Chinook have made up a sizeable fraction of the spawning abundance, averaging 77.5% for the basin in recent years (2005-2011), which is up from an average of 61.0% from 1997 to 2001 (Table 2.2.2.2). The hatchery-origin fraction of the Skykomish Chinook population in recent years (24.8%; 2006-2011) has dropped by half of what it averaged from 1997-2001 (49.9%). The hatchery-origin fraction of the Snoqualmie Chinook population has remained similar in the years for which data is available, currently averaging 18.4% (2005-2011) and averaged 15.6% from 1997-2001 (Table 2.2.2.1). It is not possible to determine the HOS/NOS fractions for the Skykomish population or the basin from 2002-2005 due to unmarked hatchery releases affecting return years 2002-2004 and no HOS/NOS sampling in the Wallace River in 2005. It is not possible to determine the HOS/NOS fractions prior to return year 1997 due to the lack of 100% marking and tagging.

Puget Sound Chinook salmon: Updated Risk Summary. All Puget Sound Chinook populations are below the TRT planning range for recovery escapement levels. Most populations are also consistently below the spawner recruit levels identified by the TRT as consistent with recovery. Across the ESU, most populations have declined in abundance somewhat since the last status review in 2005, and trends since 1995 are mostly flat. Several of the risk factors identified by Good et al. (2005) are also still present, including high fractions of hatchery fish in many populations and widespread loss and degradation of habitat. Many of the habitat and hatchery actions identified in the Puget Sound Chinook recovery plan are expected to take years or decades to be implemented and to produce significant improvements in natural population attributes, and

these trends are consistent with these expectations. Overall, the new information on abundance, productivity, spatial structure and diversity since the 2005 review does not indicate a change in the biological risk category since the time of the last BRT status review (Ford 2011).

Puget Sound Steelhead. 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 (Ford 2011).

Table 2.2.2.2: Snohomish River basin winter and summer steelhead escapement 2000-2011.

Year	Snohomish System Winter Steelhead			Snohomish System Summer Steelhead		
	Snoqualmie River[1]	Pilchuck River	Snohomish/ Skykomish River[1]	Tolt River	S.F. Skykomish	N.F. Skykomish
2000	674	590	1,558	185	995	NA
2001	1,395	462	1,265	167	513	NA
2002	789	279	1,166	115	948	NA
2003	988	696	1,915	198	303	NA
2004	1,506	1,522	3,404	34	344	NA
2005	1,060	604	2,850	76	318	NA
2006	1,856	580	3,038	120	498	NA
2007	NA	NA	NA	50	NA	NA
2008	NA	646	NA	52	282	NA
2009	NA	344	NA	86	311	NA
2010	662	294	732	116	369	NA
2011	914	848	880	122	328	NA
Average	**1,094**	**624**	**1,868**	**110**	**474**	**NA**

Data source: Peter Verhey WDFW 2012.

- 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.

Table 2.2.2.3: Puget Sound Chinook population average productivity for five-year intervals measured as recruits per spawner (R/S) and spawners per spawner (S/S) for natural origin fish. "ESU" refers to the aggregate Puget Sound Chinook evolutionarily significant unit.

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**
Skykomish	*6.54*	*0.97*	*2.53*	*0.43*	*2.44*	*0.8*	*3.47*	*0.94*	*2.25*	*0.56*	*-0.76*	*-0.03*
Snoqualmie	*4.7*	*0.76*	*8.09*	*1.04*	*3.72*	*1.52*	*3.81*	*1.28*	*1.78*	*0.61*	*-1.01*	*0.00*
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: This is copied from analyses reported by Ford (2011). These analyses incorporate assumptions for years where escapements were not sampled for hatchery: natural-origin ratios that are not necessarily agreed to by WDFW and the Tulalip Tribes. Trend over the intervals is also given.

Table 2.2.2.4: Short and long term population trend and growth rate estimates for the Puget Sound Snohomish Chinook ESU populations.

Regions and 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
Skykomish River	1995-2009	1.036 (0.97 - 1.105)	1.065 (0.688 - 1.65)	0.84	0.952 (0.752 - 1.205)	0.11
	1965-2009	0.99 (0.98 - 1.0)	0.997 (0.934 - 1.064)	0.46	0.921 (0.874 - 0.972)	0.00
Snoqualmie River	1995-2009	1.075 (0.972 - 1.188)	1.043 (0.427 - 2.546)	0.67	1.0 (0.428 - 2.334)	0.50
	1965-2009	1.021 (1.007 - 1.036)	1.021 (0.957 - 1.09)	0.76	0.993 (0.933 - 1.057)	0.40

Source: Ford 2011. These are based on analyses reported by Ford et al. (2011) that are not necessarily agreed to by WDFW and the Tulalip Tribes. "Lambda" is a measure of population growth rate. See Ford (2011) for explanation of the columns.

Table 2.2.2.5: Exp. Steelhead Population Trend ln(nat. spawners) (95% CI).

Population	1985-2009	1995-2009
Snohomish River winter-run	0.963 (0.941 - 0.985)	0.961 (0.878 - 1.050)

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 2.2.2.6: Natural spawning Chinook escapements in the Snohomish basin, 2000-2011.

Year	Skykomish	Snoqualmie	Total
2000	4,668	1,427	6,095
2001	4,575	3,589	8,164
2002	4,327	2,896	7,223
2003	4,239	1,972	6,211
2004	7,614	2,988	10,602
2005	3,203	1,281	4,484
2006	5,693	2,615	8,308
2007	2,648	1,334	3,982
2008	5,813	2,560	8,373
2009	1,414	895	2,309
2010	2,511	1,788	4,299
2011	1,180	700	1,880
Average	**3,990**	**2,004**	**5,994**

Data source: Mike Crewson Tulalip Tribes and Peter Verhey WDFW unpublished 2012 Co-manager's carcass sampling and spawner survey data.

- 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 2.2.2.7. Hatchery- and natural-origin fractions of spawners for the Skykomish and Snoqualmie populations and basin totals; 1997-2011.

Year	Snoqualmie NOS	Skykomish NOS	Snoqualmie HOS	Skykomish HOS	Basin Total NOS	Basin Total HOS
1997	93.7%	70.9%	6.3%	28.6%	81.6%	18.4%
1998	71.9%	33.9%	28.0%	66.2%	45.3%	54.7%
1999	77.4%	40.7%	22.7%	59.3%	51.0%	49.1%
2000	87.5%	38.0%	12.5%	62.0%	49.6%	50.4%
2001	91.5%	66.8%	8.5%	33.3%	77.6%	22.4%
2005	75.7%	N/A	24.3%	N/A	N/A	N/A
2006	82.6%	83.2%	17.4%	16.8%	83.0%	17.0%
2007	88.0%	57.0%	12.0%	43.0%	67.4%	32.6%
2008	85.5%	82.2%	14.5%	17.8%	83.2%	16.8%
2009	72.5%	81.0%	27.5%	19.0%	77.7%	22.3%
2010	88.7%	73.1%	11.3%	26.9%	79.6%	20.4%
2011	72.3%	74.6%	27.7%	25.4%	73.8%	26.2%
1997-2001 Averages	84.4%	50.1%	15.6%	49.9%	61.0%	39.0%
2005-2011 Averages	80.8%	75.2%	19.2%	24.8%	77.5%	22.6%
Overall Averages	82.3%	63.8%	17.7%	36.2%	70.0%	30.0%

Data source: Co-manager's annual escapement estimate and carcass survey unpublished data. Mike Crewson, Tulalip Tribes and Peter Verhey, WDFW 2012.

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

Smolt trap monitoring operations are ongoing in the Skykomish and Snoqualmie Rivers as well as fyke netting and beach seining studies in the Snohomish River estuary, nearshore marine areas, and pocket estuaries, and spawner surveys are conducted throughout the Snohomish basin. These monitoring activities are evaluated and authorized for takes of listed fish through other NMFS ESA consultation processes. All Snohomish regional hatchery production is identifiable through a combination (100%) of coded-wire tagging (representative groups), adipose fin clipping (100% less DIT groups), and thermal otolith mass-marking (100% at Tulalip, 100% being implemented at Wallace).

- 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. This is an integrated program, which includes collection of listed natural-origin fish for use as hatchery broodstock. As of BY 2000, all Wallace River Hatchery Chinook production has been, and will continue to be, marked and tagged (or both) and can be distinguished from natural-origin Chinook (less small numbers of fish that did not retain their marks and/or tags). Returning adult hatchery fish can therefore be distinguished from natural-origin Chinook during broodstock collection activities so that listed Chinook take levels may be determined. Under the 4(d) Rule for listed Puget Sound Chinook salmon, hatchery-origin

Chinook salmon that are marked with an adipose fin clip are not subject to ESA section 9 take prohibitions (70 FR 37160. June 28, 2005), and no take limits apply to such fish. This also includes hatchery fish that are coded-wire tagged that can be identified non-lethally in hatcheries, regardless if they bear external clips.

Program management guidelines have been developed that balance objectives for hatchery production, natural spawner viability, and management of potential adverse genetic and ecological interactions between natural- and hatchery-origin Chinook salmon in the basin. A plan for more consistent natural-origin Chinook production from the Wallace sub-basin is critical to meeting both recovery and hatchery program objectives. To accomplish these objectives and protect the viability of naturally spawning Chinook in the Wallace River, sex-specific "Minimum Natural Spawner Guidelines" (MSG) were developed for the Wallace River (see HGMP section 7.9). These help to guide potential HOS removals and impacts on natural-origin fish in the Wallace River below the hatchery weir while managing for natural spawner viability. These MSGs are in no way intended to replace Recovery Exploitation Rate (RER)-based management with escapement management and they are not goals or targets, but are minimum guidelines (see also HGMP section 7.9).

The hatchery, located at the confluence of May Creek and the Wallace River, operates two adult collection weirs. The May Creek weir is operated from June thru November annually. The Wallace River weir is operated from June through October annually. ESA-listed steelhead may be encountered at the Wallace River weir during this latter period, and measures are applied to limit the risk of adverse capture, handling, and release effects through application of appropriate protocols.

Disease Effects: The risk of increased transmission of infectious fish pathogens from hatchery- to natural-origin fish is thought to be low because these same pathogens co-occur in the natural areas and are thought to be the main source of infection in the hatchery. Disease epizootics are controlled through prevention, early diagnosis, and effective treatment and control strategies. Prevention and control strategies include rearing Chinook at low densities per Co-manager guidelines and implementing the systematic diagnostic monitoring and where necessary, therapeutic treatments as described in the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (Revised July 2006).

Predation/Competition: Potential predation and competition by Wallace River summer Chinook sub-yearlings on naturally-produced Chinook in the Snohomish basin are considered low risks. The fish are roughly the same size at out-migration when the hatchery fish are released in June each year making predation by hatchery fish an unlikely event. The June release occurs after the majority of natural-origin juvenile Chinook have emigrated seaward, limiting the potential for interaction that would lead to competition risks to natural-origin Chinook salmon.

The potential for piscine predation or competition is driven in part by relative body size, time of overlap, and densities of program and natural fish. Predation by sub-yearling Wallace Chinook salmon on naturally-produced Chinook in the Snohomish basin is considered to be a low risk because the size of program fish, while larger, is not much different from natural out-migrants, and program Chinook are not released until June each year. In a recent literature review of Chinook salmon food habits and feeding ecology in Pacific Northwest marine waters, Buckley (1999) concluded that cannibalism and intra-generic predation by Chinook salmon are rare events. Competition among program and natural 0+ Chinook is considered to be a moderate risk because both stock components likely share the same predator base and because their out-migration timing does overlap. Monitoring is focusing on finding out whether or not program Chinook enter the Snohomish estuary or reside in nearshore marine areas, and what are the relative abundances, temporal, and spatial overlap among natural and hatchery juvenile Chinook in this region.

The size, timing, and spatial and temporal overlap among local, ESA-listed and hatchery-origin juvenile out-migrant populations have been monitored annually since 2001 in out-migration studies in the Skykomish River (Nelson and Rawson 2001, Nelson, Kelder and Rawson 2003, Nelson and Kelder 2005a and 2005b, 2006-2012 unpublished data Tulalip Tribes), the Snoqualmie River (Nelson and Kelder 2002, 2004a, 2004b, and Nelson and Finley 2005-2012 unpublished data Tulalip Tribes), and in the Snohomish River estuary, nearshore marine areas, and pocket estuaries (Tulalip Tribes and NOAA Fisheries unpublished data, Mindy Rowse and Casey Rice, NOAA Fisheries; Todd Zackey Tulalip Tribes 2001-2012).

These studies are providing better information on the level of interaction between hatchery-origin summer Chinook sub-yearlings and yearlings released in regional programs with natural-origin, juvenile Chinook in freshwater, estuarine and nearshore marine habitats to assess temporal-spatial overlap between natural- and hatchery-origin fish post release. While findings to date have not indicated a need to revise Chinook release protocols, results from this monitoring have provided direction for applying adaptive management as needed to limit the potential for adverse hatchery-induced ecological effects of program Coho on listed Chinook salmon.

Relative size and temporal overlap are important factors that may affect predation on natural Chinook fry from hatchery-origin Chinook. Nelson and Kelder (2002) found that the mean fork length of 0+ Chinook fry egressing from the Snoqualmie River increased in size from a mean of 42 mm in late April to a mean of 71 mm by the middle of June in 2001. Increases in body length of 0+ Chinook fry were not observed until the first week in May that year.

To examine natural Chinook fry growth (fork length) patterns during this period, size and out-migrant timing data collected in smolt trapping efforts by the Tulalip and Stillaguamish Tribes in the Skykomish, Snoqualmie, and Stillaguamish Rivers were analyzed for 0+ Chinook out-migrants captured from 2001 through 2003. Data for the Skykomish and Snoqualmie Rivers was taken from Tulalip reports (Nelson and Rawson 2001, Nelson and Kelder 2002, Nelson, Kelder and Rawson 2003, Nelson and Kelder 2004a, 2004b, 2005a and 2005b) and from smolt trapping reports and data provided by the Stillaguamish Tribe for 0+ Chinook out-migrants also captured from 2001 through 2003 (Griffith et al. 2001, Griffith et al. 2003, Griffith et al. 2004). Mean fork lengths were calculated for 0+ Chinook emigrants captured before May 24 (“Early”) and after May 24 (“Late”) from Stillaguamish River smolt trapping data among 15-17 different sampling periods each year from 2001-2003. While 0+ Chinook were found to be, on average, larger than Chinook fry emigrating from the Snohomish system during the same time periods, they were also observed to experience a significant increase in size later in May each year, increasing from a mean of 50.4 ± 0.9 mm to a mean fork length of 69.1 ± 0.3 mm after May 24 for the 2001-2003 out-migration years.

Since the out-migration timing of natural Chinook 0+ fry does temporally overlap with the previous release timing goal for Wallace River Hatchery yearling and sub-yearlings, their juvenile estuarine and nearshore residency may also overlap though subsequent ecological interactions identifying substantive predation or competition issues have not yet been identified in estuarine or marine waters to date. However, based on ten years of monitoring to date, temporal overlap among hatchery- and natural-origin Chinook in the Snohomish estuary appears to be of a very short duration, particularly for the yearling hatchery component. While the estuarine residence time of sub-yearling hatchery-origin Chinook is relatively brief, it is thought to be longer than that of the yearling component, which increases the potential primarily for ecological interactions with natural-origin Chinook. However, the potential for negative competitive and predative effects caused by program sub-yearling Chinook on listed Chinook salmon juveniles is mitigated by releasing program sub-yearlings after June 1st each year.

Similarly competition and predation with listed Puget Sound steelhead should be minimal as steelhead juveniles should be outside the size range of prey items for juvenile Chinook. Additionally Chinook are released fully smolted and are expected to emigrate from the watershed

quickly, further minimizing concerns of predation and competition. Telemetry studies by (Moore et al. 2010) have shown that Hood Canal steelhead make relatively little use of river estuaries (typically leave within 1 day) and generally travel through the middle of the channel. As such steelhead smolts are unlikely to be significantly influenced by juvenile Chinook, which make greater use of the nearshore environment.

Genetic Effects: The joint Chinook hatchery program will be managed as a fully-integrated program to reduce the potential risk of genetic divergence between the propagated and natural-origin components of the Skykomish Chinook population, and reduced productivity to the natural population that may potentially result from hatchery-induced selection effects. Hatchery actions were supported by simple simulation modeling as one tool to evaluate expectations for meeting three types of goals (natural escapement viability, hatchery production, and reducing adverse genetic and ecological interactions), which are balanced by the model using realized past escapements and stock composition data, fishery assumptions, and habitat actions including current path habitat capacity and productivity and projections for long-term recovery goals and historic conditions per EDT.

The Co-managers are moving toward direct estimates of gene flow because the use of demographic estimates derived from estimated carcass proportions of hatchery-origin fish found on, or near, natural spawning areas ($pHOS_D$) and proportions of natural-origin fish incorporated into broodstock ($pNOB_D$) as surrogates for gene flow (PNI_D) include numerous uncertainties that cannot be reduced any other way. Attempts to infer gene flow based on carcass surveys employ an indirect method of potential hatchery- origin spawner contribution. Carcass sample proportions are expanded to the whole population according to the spatial distribution of redds to estimate $pHOS_D$. This method produces a point estimate with no confidence interval. Depending on the way the hatchery- and natural-origin fish interact, the same $pHOS_D$ value could lead to gene flow rates ranging from zero to complete mixing. Therefore, our goal is to develop a program to directly estimate gene flow between groups of interest and move away from inferring gene flow from demographic estimates that rely on carcass proportions.

To pursue the direct gene-flow method, we will continue to implement 100% hatchery Chinook marking and extensive monitoring throughout the Snohomish watershed to identify possible hatchery fish influence on natural spawning population genetics. The Co-managers will continue to annually collect tissue samples from natural- and hatchery-origin adult (primarily carcasses in natural spawning areas and hatchery broodstock, predicated on funding and staff availability) and juvenile (primarily from smolt traps or estuary beach seining when funding and staff are available) Chinook Salmon and use the results from genetic analyses of these samples to track gene flow and relative productivity within and between natural- and hatchery-origin Chinook within the Snohomish basin. We will use this information to adaptively manage the hatchery program to reduce identified genetic risks posed by hatchery- to natural-origin fish.

While we will also continue to annually monitor Chinook carcass proportions via demographic data ("D") collected from spawning ground surveys and hatchery broodstock sampling ($pHOS_D$ and $pNOB_D$) to derive a demographic-based estimate of the proportion of natural influence from results of these surveys (PNI_D), the Co-managers will produce an alternate estimate of PNI from direct estimates of gene flow, PNI_G, when practical, for the purposes of evaluating relative productivity of natural- and hatchery-origin Chinook salmon and compare those results to concurrent demographic estimates of PNI_D.

Genetic data can be used to infer gene flow between populations or subgroups, and they can be tested to determine whether there is sufficient statistical power in a given data set to make specific inferences. We will divide the Chinook salmon in the Snohomish basin into four groups, as follows:

1) Wallace River Hatchery: Natural- and hatchery-origin adult broodstock and juvenile out-migrants sampled from smolt traps and estuary juvenile out-migrants, to examine gene flow from/to the hatchery population),
2) Snoqualmie basin: Natural- and hatchery-origin adult carcasses and juveniles sampled from smolt traps and estuary juvenile out-migrants, to examine gene flow between the summer Chinook hatchery population and the native Snoqualmie fall Chinook population,
3) Skykomish basin: Natural- and hatchery-origin adult carcasses sampled from the Skykomish natural spawning escapement excluding the Wallace River and juveniles sampled from smolt traps and estuary juvenile out-migrants, to examine gene flow between the hatchery population and the native Skykomish summer Chinook population), and
4) Wallace River: Natural- and hatchery-origin adult carcasses from the Wallace River within the Skykomish basin and juveniles sampled from smolt traps and estuary juvenile out-migrants, reflecting the extensive naturalization of hatchery fish within the Wallace River composite population; both the native summer Chinook broodstock currently under hatchery propagation, and the potential remnants of the fall Chinook population previously propagated at regional hatchery facilities.

Groups 2 and 3 will be used to assess gene flow to the Snoqualmie and Skykomish populations, respectively. As one example of how we will measure gene flow directly with genetic data and compare it to a surrogate carcass proportion estimate using the methods above for the Skykomish population, we will produce an alternate estimate of PNI_G, using the proportion of natural-origin juvenile or adult F1 generation progeny that are assigned a hatchery parent from Group 3 above for the $pHOS_G$ term in the equation below and the proportion of hatchery-origin juvenile or adult F1 progeny that are assigned a NOB parent from Group 1 above. This will be compared to PNI_D using $pNOB_D$ and $pHOS_D$, also estimated from Group 3 (Table 2.2.3.1).

$$PNI_G = pNOB_D / (pHOS_G + pNOB_D).$$

The proportion of genetic influence of natural-origin fish (*PNI*) in a hatchery-supported system is intended to be used as a function of gene flow; however, the terms within the PNI equation are variables reflecting demographic data that depend on estimates of the numbers of fish in the population that are of hatchery and natural origins, and therefore, the PNI_D equation equates gene flow in the hatchery and on the spawning ground with numerical abundance in the hatchery and on the spawning ground. Gene flow occurs between natural- and hatchery-origin components of a population both in the hatchery and on the spawning grounds, and the proportion of the hatchery broodstock that is of natural origin ($pNOB_D$) and the proportion of natural spawners that is of hatchery origin ($pHOS_D$) are the variables used to define PNI_D. In the demographic approximation of PNI_D, $pNOB_D$ is the ratio of the number of natural-origin broodstock (NOB_D) to total hatchery broodstock (eq. 1), and $pHOS_D$ is the ratio of the number of hatchery-origin natural spawners (HOS_D) to total spawners (eq. 2).

Annual estimates of natural Snohomish Chinook spawning escapement are accomplished using a combination of aerial, boat, and foot surveys of redds throughout the basin. The redd counts are expanded by an assumed ratio of 2.5 fish per redd to derive the estimate of the total number of Chinook salmon spawning naturally in the key watersheds that support Chinook salmon spawning throughout the basin. Since 1997, Snohomish Chinook spawning escapement estimates have been partitioned into natural- and hatchery-origin components by applying the ratios of natural- and hatchery-origin Chinook carcasses to the expanded redd count abundance estimates for each subwatershed, which are then added up for the entire basin. Thermal mark status as determined from otoliths, coded-wire tags, or missing adipose fins are used to classify the Chinook carcasses as being of hatchery origin, and all other unmarked and untagged Chinook are assumed to be of natural origin.

The equation for *PNI* calculated from estimates of demographic variables as defined above, is designated as PNI_D (eq. 3).

$$pNOB = \frac{NOB}{(NOB+HOB)} \tag{1}$$

$$pHOS = \frac{HOS}{(HOS+NOS)} \tag{2}$$

$$PNI_D = \frac{pNOB}{(pNOB+pHOS)} \tag{3}$$

The presence of hatchery-origin carcasses on spawning grounds does not indicate hatchery into natural gene flow, which occurs when progeny of *HOS* individuals successfully spawn naturally and produce viable offspring. Therefore, *pHOS*, as defined above, may be biased. Therefore, we have formulated a new definition of *pHOS*, based on a genetic-based parentage analysis ($pHOS_G$; eq. 4), and to differentiate the two *pHOS* equations, designate *pHOS* in equation 2 as $pHOS_D$.

$$pHOS_G = \frac{HOS_G}{(HOS_G+NOS_G)} \tag{4}$$

To calculate $pHOS_G$, carcasses will be surveyed, as in $pHOS_D$, and fin tissues samples will be collected from each individual for DNA analysis. The progeny from the adult spawners will also be sampled as out-migrant smolts or as returning adults. A genetic-based parentage analysis will then be done to assign the progeny to parents previously genotyped in natural escapement carcass surveys. There are six possible classes to which each offspring can be assigned (Table 2.2.3.1):

Table 2.2.3.1: Classes for genetic-based parentage assignment.

Description	Designation	Number of hatchery-origin parents
natural-parent by natural-parent	(N|N)	0
hatchery-parent by hatchery-parent	(H|H)	2
natural-parent by hatchery-parent	(N|H)	1
natural-parent by unknown-parent	(N|U)	{0,1}
hatchery-parent by unknown-parent	(H|U)	{1,2}
unknown-parent by unknown-parent	(U|U)	{0,1,2}

It is important to note that we are using the progeny to identify individual parents, and the calculation of $pHOS_G$ is based on the parents, not the offspring. It is likely that some individual parents will be identified more than once, if more than one of their offspring are sampled. Therefore, once a parent is identified, any subsequent count of that parent is removed from the analysis. We calculated HOS_G (eq. 5) as,

$$HOS_G = 2(H_{Unique}|H_{Unique}) + (H_{\sim Unique}|H_{Unique}) + (H_{Unique}|N) + \{1,2\}(H_{Unique}|U_{Unique}) + \{0,1\}(H_{\sim Unique}|U_{Unique}) + \{0,1\}(N|U_{Unique}) + \{0,1,2\}(U_{Unique}|U_{Unique}) + \{0,1\}(U_{\sim Unique}|U_{Unique}) \tag{5}$$

with "Unique" indicating the first identification of that parent, and "~Unique" as each subsequent identification of that parent. The presence of $H_{\sim Unique}$ within a variable will reduce, by one, the value for the parameter for that variable. For example, the parameter for an offspring designated ($H_{Unique}|H_{Unique}$) is 2 because that offspring had two hatchery parents not previously identified. The

parameter for an offspring designated ($H_{\sim Unique}|H_{Unique}$) is 1 because that offspring had only one hatchery parent not previously identified. The number of hatchery parents not previously identified is zero for both ($H_{\sim Unique}|H_{\sim Unique}$) and ($H_{\sim Unique}|N$), therefore, these variables are not included in equation 5. Unknown parents (i.e., parents identified by the parentage analysis but not sampled) may be of hatchery- or natural-origin; the parameter associated with a variable that includes an unknown parent takes a set of values equal to the range of possible hatchery-origin parents (see Table 3.5.1.4.2.1 and equation 5). Here, we are interested only in the minimum and maximum values for HOS_G, designated $HOS_{G\text{-}Min}$ and $HOS_{G\text{-}Max}$, respectively, which will provide a range for $pHOS_G$.

$$HOS_{G-Min} = 2\left(H_{Unique}\middle|H_{Unique}\right) + \left(H_{\sim Unique}\middle|H_{Unique}\right) + \left(H_{Unique}\middle|N\right) + \left(H_{Unique}\middle|U_{Unique}\right) \quad (6)$$

$$HOS_G = 2\left(H_{Unique}\middle|H_{Unique}\right) + \left(H_{\sim Unique}\middle|H_{Unique}\right) + \left(H_{Unique}\middle|N\right) + \{1,2\}\left(H_{Unique}\middle|U_{Unique}\right) + \{0,1\}\left(H_{\sim Unique}\middle|U_{Unique}\right) + \{0,1\}\left(N\middle|U_{Unique}\right) + \{0,1,2\}\left(U_{Unique}\middle|U_{Unique}\right) + \{0,1\}\left(U_{\sim Unique}\middle|U_{Unique}\right) \quad (7)$$

It is not necessary to calculate NOS_G as a parallel to HOS_G. The denominator in equation 4 ($HOS_G + NOS_G$) is the total number of unique parents (hatchery- and natural-origin) identified by the parentage analysis.

We assume that *pNOB*, defined above, is an adequate estimate of the gene flow of natural-origin individuals into the hatchery component of the population; this in itself assumes that there is no differential survival of offspring from *NOB* or *HOB*, which can be tested. Therefore, the genetic-based calculation of the *PNI* is:

$$PNI_G = \frac{pNOB}{(pNOB + pHOS_G)} \quad (8)$$

$pHOS_G$ is an improvement over $pHOS_D$ (and therefore, PNI_G is an improvement over PNI_D) because it is based on the actual contribution of natural spawners to the surviving juvenile population. That is, $pHOS_G$ will include only those adult fish that successfully spawned and produced offspring that survived at least to the point of capture as F1 juveniles or adults. However, we emphasize that PNI_G is still an estimate of gene flow in that it does not measure the proportion of natural-origin influence to the subsequent generation. Also, it is assumed that the parentage analysis will provide an unbiased estimate of $pHOS_G$. This requires that both carcass and progeny carcass or juvenile sampling are spatially and temporally random samples of the parent and offspring generations.

The Co-managers have collected carcass proportions to estimate PNI_D since broodstock integration was initiated in 2005 (Table 2.2.2.1). Despite experiencing some of the lowest Chinook escapements on record in recent years to Wallace River Hatchery (see below), which made it difficult to integrate at the current desired minimum rate of 40% (300 NOB), the average PNI_D for the Skykomish population (less the Wallace River) has averaged 0.7 (Table 2.2.2.1), which was the previous long-term PNI_D objective and including the Wallace, has exceeded 0.5, which was the short-term PNI_D objective, before managing gene flow more directly using the PNI_G approach described above.

This is because the Skykomish River $pHOS_D$ for the past six years (average <25%) was less than half of the $pHOS_D$ during the base period (1997-2001) that was used to derive the current 40% NOB guideline (300) to achieve a target PNI_D of 0.5, despite the fact that the actual $pNOB_D$ rates

that were achieved at Wallace River Hatchery from 2005-2010 fell far short of the 300 NOB guideline. In the future, we will use genetic data from these same groups to compute PNI_G along with continuing to compute PNI_D.

Recent Skykomish summer Chinook escapements have been some of the lowest on record. Had we realized anywhere near more normal hatchery escapements and been able to integrate the 40% NOB target during the past six years, PNI_D for the natural Skykomish Chinook escapement with or without including the Wallace River $pHOS_D$ would have averaged well above 0.7 (Table 2.2.3.2).

Table 2.2.3.2: Expected PNI_D in recent years of Wallace Hatchery Chinook broodstock integration (2006-2011) with actual (realized) $pHOS_D$ and projected $pNOB_D$ goal of 0.40 achieved.

Year	pHOS	w/Target pNOB Projected	PNI Sky	PNI Sky+Wall	PNI Wall	PNI Total
2006	0.168	0.40	0.70	0.88	N/A	0.81
2007	0.430	0.40	0.48	0.81	0.62	0.70
2008	0.178	0.40	0.69	0.60	0.33	0.55
2009	0.190	0.40	0.68	0.91	0.35	0.70
2010	0.269	0.40	0.60	0.71	0.43	0.64
2011	0.254	0.40	0.61	0.71	0.36	0.66
		Average PNI	**0.63**	**0.77**	**0.42**	**0.68**

Data source: Mike Crewson, Tulalip Tribes 2012.

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

All Snohomish regional hatchery production is identifiable through a combination (100%) of coded-wire tagging (representative groups), adipose fin clipping (100% less DIT groups), and thermal otolith mass-marking (100% at Tulalip, 100% being implemented at Wallace). Since all returning adult hatchery Chinook can be distinguished from natural-origin Chinook during broodstock collection activities, take levels under the 4(d) Rule for listed fish shown in the Appendix (Table 1a) include unmarked and untagged natural-origin Chinook subject to ESA section 9 take prohibitions (70 FR 37160. June 28, 2005).

The numbers and proportions of natural-origin Skykomish River Chinook incorporated into the hatchery broodstock and mortalities are recorded annually by origin (Sunset or Wallace). NOB collections from Sunset Falls brought to Wallace River Hatchery for holding and integration, and all integration at Wallace, began in 2005. Since that time (2005-2011), the number of NOB returning to the Wallace River Hatchery has ranged from 56 to 279, and averaged 176. The number of NOB returning to the Sunset Falls has ranged from 36 to 108, and averaged 76 and the annual total number of NOB collected for the program has ranged from 92 to 362, and averaged 252. During this same period, the number of NOR mortalities occurring at Wallace River Hatchery has ranged from 15 to 164, and averaged 59 fish collected from Sunset Falls held at Wallace River Hatchery, has ranged from 2 to 40, and averaged 12. The total number of natural-origin mortalities from all sources ranged from 24 to 204, and averaged 70 per year. The total number of natural-origin Chinook from both sources has ranged from 117 to 564 and averaged 336 during this same period.

Under the current plan, no NORs will intentionally be surplused, however, that did occur at low levels in some past years, in some instances due to misidentification. Wallace NORs surplused have ranged from 0 to 127, and averaged 33. Surplused Sunset NORs have ranged from 0 to 3, and averaged 1; total NORs surplused have ranged from 1 to 127, and averaged 34.

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

See Take Table 1a at the end of this document.

- 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.

If, in any year, either pre-season or in-season run size information indicates that the critical escapement level for the Skykomish population will not be reached, the broodstocking protocol will be modified to assure that broodstocking actions will not cause NOS to go below the critical level. No natural-origin Chinook will be removed from Sunset Falls if the natural Skykomish Chinook escapement is in critical status with the possible exception where the Co-managers may consider taking NOS into the hatchery for the purpose of increasing natural production to prevent perceived imminent extinction. The Co-managers will develop, evaluate, and then implement, if agreed, an in-season update model for the natural Skykomish population using Sunset Falls return data for this purpose. This would involve developing a relationship between Sunset falls trap counts in-season at different dates and the post-season estimate of the natural escapement of Skykomish Chinook.

Take Table 1a at the end of this document incorporates the contingency plan for addressing situations where take levels within a given year could exceed planned take levels for the program. The intent is to integrate up to 300 NOB with no NORs intentionally surplused acknowledging there will some level of unintentional take. Take Table 1a therefore lists the intentional take of up to 300 NOB and also unintentional mortalities that could occur during holding prior to spawning. The unintentional take levels shown are considered to be a worst-case scenario because they are based on sex-specific mortality rates applied to the highest numbers of NORs ever observed at Wallace River Hatchery combined with the highest number of NOB that could be collected from Sunset Falls. However in reality, adult returns to the hatchery are handled to best represent the return timing and control the holding densities to not overload the adult holding ponds. Once holding densities become high, the fish are manually sorted and at these times when the fish are being handled, NORs known to be surplus to meeting the NOB integration goal will be returned to the river and therefore high numbers of NORs would not be held full term but rather released prior to spawning. Handling is always minimized to optimize fish health, so direct handling activities will only be done in the best interests of fish health. In addition, we do acknowledge that it is always possible that a catastrophic facility or water supply failure could occur leading to additional take of listed fish, which is why backup systems, including low water alarms and a back-up generator are in place in the case of power loss, and hatchery employees are on standby at the hatchery at all times to monitor hatchery operations and respond to any unexpected events as needed.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

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

WDFW hatchery programs in Puget Sound operate under and adhere to WDFW guidelines, co-manager priorities, legal requirements of the Puget Sound Salmon Management Plan (PSSMP) and the Endangered Species Act (ESA), and recommendations of the Hatchery Scientific Review

Group (HSRG), which are being integrated with harvest and habitat actions specified in the Snohomish Basin Salmon Recovery Plan. Legal requirements, Co-manager priorities and general principles for hatchery management are adapted to the unique genetic and ecological conditions of the Snohomish watershed. Hatchery programs operate in conjunction with harvest management, habitat restoration and protection to achieve near- and long-term goals for natural and hatchery production of salmonids in the Snohomish watershed (see HGMP section 3.4).

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

There is a considerable history of legal decisions, management plans, and MOU Agreements that have outlined the evolution of cooperative salmon enhancement programs between WDFW and the Tulalip Tribes dating back to the Boldt Decision in 1974. This hatchery program, and all other Co-manager hatchery programs within the State of Washington, operate under U.S v Washington (1974). The legal basis for Co-management of salmon in Puget Sound is based on the Puget Sound Salmon Management Plan (PSSMP), which was developed by the Co-managers and adopted as an order of the Federal court in 1985. A series of state-tribal Hatchery MOU Agreements have been signed by the Co-managers dating back to 1997, 2003, 2005, and most recently, in 2012 (dated August 15, 2012), which have set forth the understandings and agreements concerning Chinook and Coho salmon programs of the Bernie Kai-Kai Gobin Salmon Hatchery, operated by the Tulalip Tribes, and the Wallace River Hatchery, operated by WDFW. These Agreements have included escapement, egg-take and release goals, identified the stocks to be used for artificial propagation, described the conditions for marking and tagging and specified other details of this joint state-tribal program which have added significant improvements in operating protocols and organization to both programs.

3.3) Relationship to harvest objectives.

Tribal and non-Tribal commercial and recreational fisheries directed at salmon and steelhead produced through WDFW hatchery releases will be managed to minimize incidental effects to listed Chinook salmon. Compliance with the fisheries management strategy defined in the SCSCI (WDFW and PNPTT 2000) will lead to fisheries on WDFW hatchery-origin stocks that are not likely to adversely affect listed Chinook or listed summer chum.

Each year, state, federal and tribal fishery managers plan the Northwest's recreational and commercial salmon fisheries. The pre-season planning process, known as the Pacific Fishery Management Council (PFMC) and North of Falcon (NOF) planning processes involve a series of public meetings between federal, state, tribal and industry representatives and other concerned citizens. First, fisheries are adjusted in the Fisheries Regulation Assessment Model (FRAM) to not fall below the Low Abundance Threshold (LAT; PSIT and WDFW 2010) for the escapements of both natural-origin Snohomish Chinook populations (1,745 and 521 NORs for the Skykomish and Snoqualmie populations, respectively) as well as the Wallace Hatchery Chinook escapement (3,200 fish). The minimum escapement trigger of 3,200 Chinook for Wallace River Hatchery was designed to meet the broodstocking, egg-take and harvest needs for the joint WDFW-Tulalip Chinook program at a risk level that was agreed-to by the Co-managers, given expected survival rates and other biological factors that affect realized egg-takes.

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.

Table 3.3.1.1: Wallace River Hatchery Summer Chinook Fishery Contributions.

Brood Years: 2000-2004 (Sub-yearling) and 2002-2004 (Yearling)			
Fishery Years:2004-2008 (Sub-yearling) and 2006-2008 (Yearling)			
	Average SAR%*	**0.39**	**2.13**
Agency	***Non-WA Fishery***	***% of total Survival***	
		Sub-yearlings	***Yearlings***
ADFG	All	*0.6*	*0.2*
CDFO	All	*25.5*	*16.0*
NMFS	All	*0.1*	*0.6*
Agency	***WA Fishery***	***Sub-yearlings***	***Yearlings***
WDFW	10- Ocean Troll	*0.3*	*0.4*
WDFW	15- Treaty Troll	*2.0*	*0.5*
WDFW	23- PS Net	*0.7*	*0.8*
WDFW	42- Ocean Sport- Private	*0.1*	*0.3*
WDFW	45- PS Sport	*5.7*	*10.8*
WDFW	46- Freshwater Sport**	*4.4*	*4.0*
Unk	50- Hatchery Escapement	*0.7*	*1.0*
WDFW	50- Hatchery Escapement	*55.0*	*63.2*
WDFW	54- Spawning ground	*4.9*	*2.2*
WDFW	62- Test Fishery Seine	---	*0.0*
	Total	***100.0***	***100.0***

Source: RMIS 2012.
* Average SAR% = (tags recovered/tags released).
** Freshwater Sport based on WDFW Catch Record Card (CRC) data.

3.4) Relationship to habitat protection and recovery strategies.

The purpose of this joint state-tribal hatchery program is to provide harvest opportunity while remaining consistent with the Co-manager's primary management strategy and recovery objectives for local natural salmonid populations as reflected in the integrated recovery plan. This HGMP was designed to be consistent with the strategies and actions specified in the Snohomish Basin Salmon Conservation Plan (Snohomish Basin Salmon Recovery Forum 2005). This plan describes how this hatchery program will operate in conjunction with harvest management, habitat restoration and habitat protection actions to achieve near- and long-term goals for natural and hatchery production of salmon in the Snohomish watershed. The habitat protection and restoration strategies and actions identified in the recovery plan are paramount to the recovery of self-sustaining, natural populations. As natural populations recover through habitat improvements to a level that can support sustainable treaty and non-treaty harvest needs, hatchery program size may be reduced. Additional management criteria such as genetic and ecological benefits and risks (e.g., marine-derived nutrients, prey, predation, and competition), to the extent they have been determined; and environmental regulations, will be addressed as habitat and the production of natural-origin fish are being improved.

*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 and the Snohomish Basin Salmon Recovery Forum (see below). The Board supports salmon recovery by funding habitat protection and restoration projects and related programs that produce sustainable and measurable benefits for fish and their habitat.

Lead Entities: ***(***http://www.rco.wa.gov/salmon_recovery/lead_entities.shtml***):***
The Snohomish Lead Entity is currently working to implement the watershed chapters to the salmon recovery plans formally adopted by NOAA fisheries in 2007. The Snohomish River Basin Salmon Conservation Plan (*Plan* 2005) is a multi-salmonid strategy that emphasizes two Endangered Species Act (ESA)-listed species. The *Plan*, developed by a 41-member Snohomish Basin Salmon Recovery Forum (the Forum), incorporates actions across habitat, harvest, and hatchery management to bring the listed natural populations back to healthy, harvestable levels. Among the many responsibilities held by lead entities, the Snohomish Lead Entity facilitates the annual SRFB grant round to fund habitat and protection actions.

Puget Sound Chinook Recovery Plan:
An ESU-wide recovery planning effort undertaken by the Shared Salmon Strategy for Puget Sound, a collaborative group dedicated to restoring salmon throughout Puget Sound (online at: http://www.sharedsalmonstrategy.org. The Shared Strategy for Puget Sound was discontinued in 2007 after the plan was adopted by NOAA Fisheries and the newly formed Puget Sound Partnership was given the responsibilities for continuing implementation of the Puget Sound Chinook Salmon Recovery Plan (http://www.psp.wa.gov/SR_status.php).

Snohomish Basin Salmon Recovery Forum June 2005.
Snohomish Public Works: Surface Water Management works with citizens, stakeholders and agency representatives to lead recovery planning efforts in the Snohomish Watershed and co-leads efforts in the Stillaguamish Watershed with the Stillaguamish Tribe. Cooperative recovery planning efforts in the basin date back to the mid-1990s. The 41-member Snohomish River Basin Salmon Recovery Forum includes members from Snohomish and King Counties, Tulalip Tribes, 14 cities, many special purpose districts, interest groups ranging from conservation to farming and business, and citizens. The group set the recovery priorities for the basin in the *Snohomish River Basin Salmon Conservation Plan*. The Forum promotes and monitors Plan implementation and will adjust priorities over time. The Forum is also a place to coordinate and exchange ideas and communicate about watershed issues. It is assisted by a Policy Development Committee and the Snohomish Basin Salmonid Recovery Technical Committee. The Forum has actively participated in regional recovery efforts

Snohomish River Basin Salmon Conservation Plan.
Finalized June 2, 2005, this plan guides actions to protect and restore salmon runs in the Snohomish River Basin and responds to listings of Puget Sound Chinook salmon and bull trout as threatened under the federal Endangered Species Act. The Plan addresses the specific needs identified for salmonid recovery in the Snohomish Basin. These include: protection of spawning areas; improvement of juvenile rearing habitat such as, complex edge habitat, quality riparian forests, and connected off-channel habitat; and protection of forest cover across the basin.

3.5) Ecological interactions.

(1) *Salmonid and non-salmonid fishes or other species that could negatively impact the program.* Negative impacts by fish and other aquatic and terrestrial species on Wallace River Hatchery Chinook include potential genetic, demographic or ecological effects such as predation, competition, , or disease transmission that could impact viability of all life stages in freshwater, estuarine or marine habitats during hatchery rearing. Juvenile and adult Chinook originating through the program may serve as prey for a variety of aquatic and terrestrial predators before and after release in both freshwater and marine ecosystems:

- Avian predators, including Bald Eagles, Golden Eagles, Common Mergansers, Double Crested Cormorants, Belted Kingfishers, Turkey Vultures, Ring-Billed Gulls,

California Gulls, Herring Gulls, Western Gulls, Glaucous-Winged Gulls, American Dippers, Stellar's Jays, American Crows, Northwestern Crows, Common Ravens Great Blue Herons, and Night herons.

- Mammalian predators, including Black Bears, Mink, Virginia Opossums, Coyotes, Racoon, Bobcat River and Sea Otters, Harbor Seals, Northern Steller Sea Lions, Killer Whales, Harbor and Dall's Porpoises.
- Cutthroat Trout, Rainbow Trout, Bull Trout, Coho, Chinook and pink salmon, Steelhead, Pacific Staghorn Sculpin, Northern Pike minnow and numerous marine pelagic fish species.

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 Snohomish River 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:

- Orcas
- Sea lions
- Harbor seals
- River otters

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

- Puget Sound Chinook
- Puget Sound steelhead
- Bull Trout

ESA-listed Chinook salmon from the Skykomish and Snoqualmie populations, steelhead from the Snohomish/Skykomish, Pilchuck, Snoqualmie, Tolt, and NF Skykomish populations, and bull trout may be adversely affected by hatchery-origin Chinook salmon produced by the Wallace River hatchery program. Juvenile fish of the these listed species may serve as prey for newly released hatchery Chinook salmon in areas where the species co-occur and if the listed juvenile fish are of a small size, and vulnerable to predation by sub-yearling life stage Chinook. The hatchery fish may also affect the listed species through competition for any limited resources, including food and space for juvenile fish, and spawning areas for adult fish.

(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 Snohomish basin of both natural- and hatchery-origins. Juvenile fish of these species may serve as prey items for program Chinook after their release in freshwater, estuarine and marine habitats. Decaying salmonid carcasses contribute valuable ocean-origin nutrients that increase productivity in the watershed, providing food resources that play a substantial role in the enhancement of terrestrial and aquatic ecosystem life, including the organisms that juvenile program fish feed upon during rearing and during their outmigration. Salmonid adults that return to the Snohomish Basin and any seeding efforts using adult salmon carcasses provide a valuable source of marine-derived 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:* This Chinook program positively impacts numerous terrestrial and aquatic species in freshwater, estuarine and marine habitats. The input of nutrients provided by decaying Chinook carcasses afforded by this program are particularly critical for sustaining stable fry and smolt productivity levels or elevating juvenile productivity to healthy levels and is currently thought to be an important limiting factor in some of the basin's watersheds. Carcasses planted for nutrient enhancement purposes (ongoing annually from Wallace River Hatchery) are an important source of organic and inorganic nutrients affecting water quality as well. This ocean-origin source of nutrient input is considered to be significantly beneficial to the ecosystem. The historical amounts of nutrients available to streams in the Snohomish basin derived from salmon carcasses was likely large and contributed to the enhancement of many forms of aquatic life. This valuable, natural process of environmental nutrient recycling is expected to be increased through this program and contributes to local and regional salmon recovery efforts; increasing annual abundances of local juvenile and adult natural- and hatchery-origin salmonid spawning populations and stocks in the region. All of the predator species previously mentioned benefit from the program fish released from this program. As many as 138 species of birds are either directly connected to feeding on salmon carcasses or indirectly connected to either feeding on the insects that feed on the carcasses or on other birds that feed on the insects or carcasses. Juvenile salmonids may also benefit from the enhanced numbers of salmon carcasses that are provided by this program through increased spawning from improved fish returns. The additional input of nutrients from the carcasses made available to these organisms as a nutrient source through this program increases both nutrients available for the growth of fish as well as riparian, and upland vegetation as well. Additionally, the Southern Resident killer whale (SRKW) DPS was listed as endangered under the Endangered Species Act in 2005. Both United States and Canadian researchers have conducted correlation studies revealing relationships between overall Chinook salmon abundance indices and SRKW survival and fecundity (Ford et al. 2010; Ward et al. 2009). Hanson et al. (2010) published a summary of information on prey consumed by SRKWs, confirming a high percent of Chinook salmon in the diet of Southern Residents in their summer range. As it is now recognized that SRKWs are especially dependent on Chinook salmon, as a preferred prey species this program could provide prey for listed SRKWs in their summer range.

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 Wallace River Hatchery.

Water Source	Available Water Flow (gpm)	Temp. (ºF)	Usage	Limitations
Wallace River (surface)	12,000	34-66	Broodstock collection, incubation, rearing, acclimation	No limitation
May Creek (surface)	5,800	34-66	Broodstock collection, incubation, rearing	No limitation

Water for incubation and rearing at Wallace River Hatchery comes from two sources: Wallace River and May Creek. Both are surface water in origin and exhibit similar temperature profiles

ranging from mid-30s°F to the upper 60s°F. These streams are subject to rapid fluctuations in flow; especially during fall and winter seasons when high levels of precipitation commonly cause flooding events. Water for the hatchery is pumped: the Wallace River can provide as much as 12,000 gallons per minute (gpm); May Creek provides up to 800 gpm.

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.

Chinook are not passed above the May Creek upper weir blocking access above the intake; however, they are passed above the Wallace River weir and intake and are allowed to volitionally move upstream when the weir is removed in the fall each year.

The intake screens on the Wallace River and May Creek are in compliance with state and federal guidelines (NMFS 1995, 1996), but do not meet the current Anadromous Salmonid Passage Facility Design criteria (NMFS 2011). The Wallace River Hatchery is currently scheduled for a facility remodel that will address any deficiencies in the intake structure. WFDW has identified Wallace River has a high priority in the capital budget request to the Legislature. It is currently ranked in the top 5 projects with design and permitting expected in biennium 2015 and construction in biennium 2017. This construction request will not only bring Wallace River into compliance for both adult and juvenile passage and screening requirements (NMSF 2011) but also addresses the adult holding, juvenile rearing ponds and pollution abatement issues identified by the HSRG, with plans to construct a new two-bay pollution abatement pond (see HGMP section 5.8).

Water rights for Wallace River Hatchery are regulated through permits #S1-00109 and #S1-05617 for the Wallace River and May Creek intakes, respectively. Monitoring and reporting of effluent discharge results have been in compliance with NPDES permit number WAG 13-3006.

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 (DOE), WAG 13-3006. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE.

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 4.2.1: Record of NPDES permit compliance at Wallace River 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				
Wallace R WAG13-3006	Y	Y	Y	8/3/2005	3	N	Y

Source: Ann West, WDFW Hatchery Data Unit 2012.

Table 4.2.2: List of NPDES violations at Wallace River Hatchery over the last five years (2008-2012).

Month/ Year	Parameter	Sample Type	Result/ Violation	Permit Limit	Comment	Action
May 2008	TSS	PA Max Grab	108.0 mg/L	100.0 mg/L	Flooding due to snow melt.	NA
August 2008	TSS	PA Max Grab	104.4 mg/L	100.0 mg/L	Undersized abatement pond.	New pond being built in approximately 2014.
April 2009	TSS	EW Max Net Composite	113.6 mg/L	100.0 mg/L	Undersized abatement pond. Heavy rains and snow melt contributed. And the vacuuming system.	

Source: Ann West, WDFW Hatchery Data Unit 2012.
Note: These violations did not result in non-compliance with NPDES permit.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Adults for summer Chinook broodstock are collected at May Creek and Wallace River that recruit into the hatchery and at the Sunset Falls trapping and hauling facility. In recent years, when the hatchery escapement was low, some fish were also collected by seining restricted to the Wallace River immediately below the hatchery rack.

1. *May Creek***.** An in-stream trap located on May Creek measures 70-ft at its widest point and is 110-ft in length. Two step-type ladders are located on the lower end of the trap and a picket-type rack and V-notch weir is located at the upper end of the pond. The trap is dependent on the natural flow of May Creek for its water supply. The trap is operated from June through March.

   After construction of the rack at the mouth of May Creek, the May Creek trap will be eliminated (see HGMP section 5.8).

2. *Wallace River*. The ladder located on Wallace River leads fish to the series of three adult holding ponds, supplied by water pumped from the river. A weir, placed across the Wallace River in the first week in June annually, diverts returning adults into the ladder. The weir is removed each year by approximately October 1, to avoid damage to the structure from seasonal flooding. Captured adults can be passed above the weir for natural spawning, directly from the holding ponds though the series of pipes.

3. *Sunset Falls***.** The Sunset Falls trapping and hauling facility is located on the south fork of the Skykomish River. The facility was built in 1958 to collect fish for release 3.5 miles upstream above three falls (natural migration barriers) into more than 90 miles of quality spawning and rearing habitat (Shared Strategy 2005). The facility is operated every year during the the adult salmon return migration period from July through December. Fish volunteer up the ladder into a holding area containing a hopper. Fish allowed into the hopper are moved to a hauling truck and transported above the falls. Fish collected for the broodstock (up to 225 fish or 20% of the return to the trap, whichever is lower) are transported to the hatchery for natural-origin integration into the hatchery broodstock when the run size is above critical status (see HGMP section 7.9).

4. *River Seining***.** Fish may be collected by seining from the Wallace River immediately below the hatchery intake for broodstock augmentation.

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

There is no tanker truck available at the facility. Totes placed on flatbed trucks are used to move fish under oxygen between May Creek and the adult holding ponds, and to transport fish seined from the river.

Fish captured at the Sunset Falls trap are transported in a 1,000-gallon tanker truck equipped with aerators and oxygen tanks. The tanker truck belongs to the facility at Sunset Falls.

5.3) Broodstock holding and spawning facilities.

Table 5.3.1: Broodstock holding and spawning facilities at Wallace River Hatchery.

Rearing Vessel Type	Number	Width (ft)	Length (ft)	Depth (ft)	Volume (ft^3)
Circular ponds	4	16	16	4.5	1,152
Adult Ponds	3	15	100	5.0	7,500
May Creek in-river pond	1	70	110	3.5	26,950

Wallace River. Adults returning to the hatchery from Wallace River are held in three parallel ponds and are separated based upon the month of their return timing. The ponds are supplied by Wallace River water and equipped with water sprinklers to provide shading. A wall and a roof covered area located at the end of the ponds is used to conduct spawning.

May Creek trap. Adult Chinook returning to the May Creek trap remain in the pond above the weir at lower holding densities and are moved to the three holding ponds where fish returning to the Wallace River are held when densities increase above recommended levels. Adult Chinook allowed to remain in the May Creek holding pond are spawned at the trap side in a covered area. After construction of the rack at the mouth of May Creek, the May Creek trap will be eliminated (see HGMP section 5.8).

Sunset Falls. Adult Chinook collected from the Sunset Falls trap are held separately in covered circular pond supplied by Wallace River surface water. These fish are spawned side-by-side the holding ponds.

5.4) Incubation facilities:

The incubation facility at Wallace River consists of "Heath" style vertical incubators with 1,152 trays. Each incubator receives water from May Creek at 4 gpm.

5.5) Rearing facilities.

Table 5.5.1: Rearing vessels at Wallace River Hatchery.

Type	Number	Width (ft)	Length (ft)	Depth (ft)	Volume (ft^3)
Raceways	6	10	100	3.0	3,200
Standard ponds	4	20	80	1.7	2,667
Klubes pond	1	8	27	2.3	504
Green Monster	1	3	14	2.0	84
Rearing Channels[a]	3	28	1,000	2.3	86,333

[a] The three rearing channels can be sectioned off, as needed (see Table 5.5.2).

Table 5.5.2: Rearing Channels at Wallace River Hatchery.

Designation	Width (ft)	Length (ft)	Depth (ft)	Volume (ft^3)
1A	22.75	704	2.7	43,000
1B	24.5	282	3.6	25,000
2A	22	167	2.3	8,300
2B	23	523	2.7	32,000

2C	26	323	3.6	30,000
3A	24	307	2.6	19,000
3B	25	485	3.3	40,500
3C	27	208	3.8	21,500

5.6) Acclimation/release facilities.

Fish are acclimated on May Creek and/or Wallace River water their entire time in the hatchery.

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

No operational difficulties have led to significant fish loss.

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

A hatchery employee is on standby at the hatchery at all times to monitor hatchery operations and respond to any unexpected events. The facility is equipped with low water alarms and a back-up generator in case of power loss.

Fish rearing is conducted in compliance with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (Revised July 2006) to minimize the likelihood for the take of listed natural fish that may result from disease transmission. Adherence to artificial propagation, sanitation and disease prevention, diagnosis, treatment and control practices defined in the policy prevent or reduce the incidence and intensity of disease during hatchery spawning, incubation and rearing and control the transmission of infectious pathogens between hatchery fish and the potential to infect natural-origin salmonids from hatchery effluent or directly by preventing or reducing releases of infected hatchery fish.

In 2012, the state legislature passed a jobs creation bill that provided WDFW with funding for hatchery capital improvements in addition to the capital budget request. At Wallace River Hatchery, this allowed for the following improvements:

Table 5.8.1: Hatcheries capital improvement projects requested to be funded under the "Jobs Now Act" (2012) for Wallace River Hatchery.

Projects
Construction of new, two-bay pollution abatement ponds.
Construction of a rack at the mouth of May Creek.

The pollution abatement ponds reduce the discharge of pollutants into the receiving waters that minimizes the likelihood for the take of listed natural fish by improving water quality below the hatchery. The purpose of the rack is to force fish upstream in the Wallace River toward the trap, preventing adult upstream migration into May Creek. This would eliminate the adult trap on May Creek and the need to create an in-river adult holding pond. These projects at Wallace River Hatchery are currently ranked in the top 5 projects with design and permitting expected in biennium 2015 and construction in biennium 2017.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

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

6.1) Source.

Adult Chinook salmon collected from Wallace River, May Creek and the Sunset Falls trap located on the south fork of the Skykomish River, and used as broodstock are part of the extant Skykomish River native summer Chinook population delineated by the Puget Sound TRT (PSTRT 2001; Ruckelshaus et al. 2006).

6.2) Supporting information.

6.2.1) History.

Historically, there were a considerable number of hatchery introductions of out-of-basin stocks into the Snohomish system. The most common source originated from Green River-origin fall Chinook salmon. The native-origin summer Chinook stock propagated at Wallace River Hatchery was originally founded from fish that returned to the fish passage facility at Sunset Falls on the Skykomish River in the early 1970s. Since that time, the only source of eggs has been adult fish returning to the trap at the Wallace River Hatchery (SSHAG 2003). The Green River-origin hatchery fall Chinook salmon program at the Wallace River Hatchery was terminated after the 1997 brood year to eliminate the risk of interbreeding between the non-native fall hatchery stock and the native summer Chinook population.

In the past, Chinook returning to the hatchery before mid- to late-August were assumed to be summer Chinook and after September 1, to be fall Chinook. The Co-managers believe that the Green River-origin Chinook stock has largely been eliminated from the basin at this point. The DNA composition of Chinook Salmon in the Snohomish basin, and particularly, the returns to Wallace River Hatchery, was recently studied by origin (hatchery vs wild), return timing (month of return to Wallace River Hatchery and week of return to Sunset Falls), and by their location (Sunset Falls, Wallace River Hatchery, and all of the primary natural spawning aggregations). While Bayesian lineage clustering showed that Chinook returning to Wallace River Hatchery from June through late-September from 2005 and 2006 clustered closely with the native Skykomish River Chinook summer Chinook spawning aggregations including Sunset Falls (all Sunset returns through October), a small number of Chinook returning in October to Wallace River Hatchery had a greater affinity to Snoqualmie or Green River fall Chinook than to Skykomish River summer Chinook as sampled in earlier months (A. Spidle, NWIFC, M. Crewson and K. Rawson, Tulalip Tribes, and P. Moran, NOAA NMFS, unpublished data).

This suggests that conservative efforts to scale Wallace River Hatchery broodstock selection to summer Chinook run timing distribution would select brood fish from June through late-September annually. In years where those months do not provide sufficient spawners for the combined WDFW-Tulalip egg-take, selecting brood fish returning to Wallace River Hatchery in October for the Tulalip program would still be preferable to taking brood from outside the Snohomish basin (A. Spidle NWIFC personal communication October 8, 2012). The use of late-returning fish for the Tulalip hatchery program is prioritized after taking summer Chinook (returning through September), which should go first to the Wallace River Hatchery program, then to the Tulalip program.

6.2.2) Annual size.

A minimum escapement trigger of 3,200 Chinook for Wallace River Hatchery was designed to meet the broodstocking, egg-take and harvest needs for the joint WDFW-Tulalip Chinook program at a risk level that was agreed-to by the Co-managers, given expected survival rates and other biological factors that affect realized egg-takes.

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

Estimation of past levels of natural fish included in the broodstock is unknown prior to the release of 100% mass-marked fish in 2001. See HGMP sections 7.4.2 and 7.9.

6.2.4) Genetic or ecological differences.

Since the Wallace River Hatchery summer Chinook population was founded with native SF Skykomish River summer Chinook salmon collected from Sunset Falls the genetic composition of hatchery- and natural-origin summer Chinook in the Skykomish River are is closely related. Marshall (1997) compared the genetic composition of adult Wallace River Hatchery summer Chinook salmon (a total of 703 summer Chinook samples were collected and compared), of which 444 were of natural-origin, samples were collected from natural-origin summer Chinook in 1989, 1993, and 1996 return years), and 259 samples were of hatchery-origin (samples were collected from hatchery-origin summer Chinook from 1987, 1988, and 1996 return years).

In this study, close genetic relationships were found between the natural- and hatchery-origin summer Chinook populations, which was expected by the author given that the hatchery stock was founded from wild Chinook collected from the Skykomish River. The Puget Sound TRT (2001) concurred with Marshall (1997) in their population ID analysis paper that the genetic composition of the Wallace River Hatchery summer Chinook stock and the native Skykomish River summer Chinook population were not significantly different and were considered to be part of the same population (SSHAG 2003).

The current genetic composition of hatchery- and natural-origin Chinook in the Snohomish basin continues to be analyzed using more sensitive DNA methods as part of several new studies that seek to derive DNA-based parentage assignment methods to estimate genetic-based-relative productivity and abundance estimates, effective number of breeders (successful and unsuccessful spawners by origin, time, and location) and effective population size for naturally-spawning Chinook by hatchery- and natural-origin, sex, age and location, and measures of genetic diversity and spatial distribution. The Co-managers are collecting numerous samples from 14 different Chinook salmon spawning aggregations to accurately represent the listed populations as part of developing the Genetic Analysis of Pacific Salmonids (GAPS) project DNA baseline for Chinook salmon, comprised of populations all along the Pacific Coast.

Ongoing intensive tissue collections and genetic analysis at the subwatershed level will enable analysis of existing and future population substructure for salmon recovery purposes as well as to examine hatchery/natural interactions and look for potential temporal or spatial changes or differences that could inform hatchery, harvest or habitat actions or strategies to protect the extant naturally-spawning populations. These studies have direct application to hatchery adaptive management, providing insight to activities such as the efficacy of broodstock collection and integration methods, pHOS control strategies, or evaluating the relative potential risks posed to all aspects of viability of natural populations from hatchery and harvest activities and habitat degradation.

6.2.5) Reasons for choosing.

The hatchery summer Chinook stock was chosen based on its origin founded from the native Sunset Falls Skykomish summer Chinook population because it is the local natural population that is adapted to the watershed. Retaining local genetic composition in the regional hatchery production reduces the potential risk of genetic divergence between the propagated and natural-origin components of the composite Skykomish Chinook population, and lessens the potential for reduced productivity to the natural population that may potentially result from hatchery-induced selection effects.

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.

Beginning with brood year 1997, summer Chinook have been the sole source of broodstock for on-station releases at Wallace River Hatchery. Adult broodstock are collected at Sunset Falls and the Wallace River Hatchery rack. A weir is typically installed June 1, and operated annually

through September until broodstock goals are met. Excluding returns after this period is done to reduce the risk of including remnant introduced Green River fall Chinook adults in the broodstock. Broodstock are currently selected representatively over the summer Chinook return timing at the Sunset Falls (June through October) and Wallace River Hatchery (June through September) adult trapping sites. As described in HGMP section 6.2.1, a small number of late (October) - returning fish to Wallace River Hatchery in 2005 and 2006 were shown to have a remnant component of Green River-origin fall Chinook, though this was not observed in fish collected from Sunset Falls (A. Spidle, NWIFC, M. Crewson and K. Rawson, Tulalip Tribes, and P. Moran, NOAA NMFS, unpublished data). These late-returning fish may be taken for the egg-take at Tulalip if no other eggs are available within the basin.

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

May Creek/Wallace River. Adults returning to the May Creek and Wallace River racks are collected representatively throughout the summer Chinook return period. Since 2005, the Co-managers developed a broodstock integration and upstream passage policy for the Wallace River Hatchery summer Chinook program. Adult Chinook returning to the hatchery rack are, by definition, not included in the natural escapement and all natural-origin fish returning to the hatchery are either utilized for broodstock integration or returned to the stream, less unintentional mortalities (see HGMP sections 2.2.3 and 7.9).

Table 7.2.1: Sunset Falls fishway Chinook counts 1958-2010, dates of operation and season total salmonids trapped.

Dates of Trap Operation		Number Chinook		Total Salmonids Trapped
From	To	Adults	Jacks	
09/18/58	01/02/59	47	NC	1,706
03/16/59	12/29/59	70	25	2,814
08/30/60	12/30/60	155	13	5,673
08/11/61	01/16/62	165	37	9,535
07/28/62	02/18/63	619	211	12,123
07/08/63	01/06/64	362	161	13,965
06/12/64	02/04/65	454	228	14,857
07/06/65	01/28/66	714	197	14,926
07/15/66	12/28/66	768	191	19,073
08/09/67	12/18/67	915	412	18,797
08/14/68	12/06/68	901	460	22,008
07/08/69	12/27/69	1,313	543	12,893
06/29/70	12/23/70	1,357	753	29,117
06/22/71	12/28/71	1,279	702	26,038
07/07/72	01/05/73	1,257	439	13,925
07/10/73	12/27/73	1,226	289	15,578
07/01/73	12/26/74	1,570	290	20,261
07/07/75	12/19/75	776	269	19,168
07/07/76	12/17/76	888	266	13,670
07/05/77	12/09/77	468	212	20,560
07/25/78	12/15/78	463	110	21,563
07/30/79	12/28/79	463	388	32,808

07/22/80	12/30/80	559	220	26,060
07/14/81	12/11/81	513	120	19,711
08/23/82	12/22/82	187	73	11,639
07/07/83	12/15/83	177	116	24,082
07/10/84	12/13/84	161	126	6,709
07/09/85	12/19/85	307	125	32,996
07/08/86	12/19/86	530	197	21,180
07/06/87	12/17/87	406	52	32,787
07/03/88	12/16/88	690	101	21,015
07/05/89	12/23/89	484	32	39,423
07/09/90	12/20/90	506	107	17,927
07/08/91	12/13/91	555	48	23,158
08/03/92	01/01/93	511	101	21,023
08/02/93	12/24/93	478	152	18,270
08/01/94	12/15/94	531	181	35,540
08/01/95	12/21/95	892	144	33,680
07/29/96	12/05/96	754	60	19,882
07/17/97	12/17/97	699	45	19,039
07/20/99	12/22/98	550	51	23,596
07/19/99	12/15/99	530	192	15,385
07/17/00	12/15/00	712	78	26,799
07/16/01	12/14/01	1,119	42	66,670
07/19/02	12/14/02	765	177	47,210
07/14/03	12/12/03	889	50	52,768
07/12/04	12/10/04	675	41	43,523
07/18/05	12/16/05	523	91	42,303
07/17/06	12/15/06	603	225	10,398
07/16/07	12/14/07	588	118	71,161
07/14/08	12/12/08	707	69	10,480
07/28/09	12/10/09	250	92	124,228
07/27/10	11/19/10	399	80	10,167
Annual Average Totals		**632**	**183**	**25,092**

Data source: Dave Collins, WDFW 2012.
NC = No count

Sunset Falls. Since the stock was founded from native Skykomish Chinook from Sunset Falls, ascending the river system to its upper end at RM 51.3 where there was a trap-and-haul facility already in place, adult Chinook returns to the Sunset Falls trap remain largely of natural-origin and was identified as an ideal and appropriate source of natural-origin broodstock.

The trapping facility at Sunset Falls operates annually from July through December. Chinook for broodstock are collected systematically throughout their entire return period.

Fish are collected systematically over their return timing with strict limits to ensure that the number or proportion of Chinook transferred to the hatchery do not exceed 225 fish, or 20% of the return to the falls, whichever is lower at any time and none are collected if the return is below the low abundance threshold (see HGMP section 7.9 for detailed guidelines for adult Chinook collections at Sunset Falls).

In 2005, 2009, 2010, and 2011, the Chinook escapement to Wallace River Hatchery was projected to be below the minimum number of Chinook required to meet the combined egg-take goal for Co-managers, which includes the on-station production needed at Wallace River

Hatchery and the egg transfer to the Tulalip Tribes' Bernie Kai Kai Gobin Salmon Hatchery. No actions were taken in 2005, which resulted in egg shortages. In an effort to ensure an adequate egg-take for both on-station and tribal program releases in subsequent low returns years in 2009 and 2010, adult Chinook were additionally collected by seining in the Wallace River immediately below the hatchery intake. In 2009, 2010, and 2011, broodstock collections were also initiated at the Bernie Kai Kai Gobin Hatchery when the ladder was opened to attract fish from Tulalip Bay.

7.3) Identity.

All Chinook released from the Wallace River Hatchery program have been consistently mass-marked since release year 2001, less minor numbers of unmarked and/or untagged fish resulting from clipping and tagging (RMIS data). Clipping and tagging goals for Wallace River Hatchery sub-yearlings are currently ad-only (60%), CWT-only (20%), and Ad+CWT (20%; Tulalip and WDFW (MOU 2012). The combined marking and tagging goals for Wallace River Hatchery yearling Chinook include clipping 100% of the production, with 20% also receiving CWTs (see HGMP section 10.7). When this was done in the past (BY's-2002-2008; release years 2004-2010), the yearling release goal was 250K and ~75K (~30%) were AD&CWT with the Ad-Only remaining production comprising ~175K (~70%) with a combined 100% clipping/tagging goal. With the release number now increased to 500K, a 100K tagging goal would result in a tagging rate of ~20%; alternatively, the Co-managers are considering a double-index tagging program for the Wallace River Hatchery yearling production (predicated on funding). Coded-wire tagging of the yearling production was not done in BY 2009 and 2011 (2011 and 2013 releases), however, all were marked, less clip loss, which will continue to be the marking goal.

Coded-wire tagging enables identification as to the hatchery of origin and is required to estimate stock-specific exploitation rates in fisheries.

7.4) Proposed number to be collected:

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

The Chinook escapement goal to Wallace River Hatchery is 3,200 Chinook. This is the minimum escapement goal projected to result, on average, in meeting the effective spawner and egg-take goals for both the Wallace and Tulalip hatchery programs at a risk level agreed to by the Co-managers, given expected survival rates and other biological factors that affect realized egg-takes for these two programs. The 1:1 effective spawner goal needed to achieve the 4.8 million egg-take goal based on average (2002-2011) Wallace River Hatchery summer Chinook fecundity (4,510) would be 2,129, which assumes no holding mortality, a sex ratio of 1:1, and no inter-annual variability in sex ratio or fecundity.

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

Table 7.4.2.1: Fish origin and sex composition of broodstock spawned at Sunset Falls and Wallace River hatchery for summer Chinook program.

Brood Year	Hatchery			Unknown			Natural		
	Male	Female	Jack	Male	Female	Jack	Male	Female	Jack
2000	304	407	3	0	03	0	0	0	0
2001	331	329	8	0	0	0	0	0	0
2002	402	393	6	0	0	0	90	82	0
2003	502	537	6	0	0	0	234	195	0
2004	843	850	0	0	0	0	85	98	0
2005	397	275	4	40	218	0	193	117	2

2006	770	825	1	1	0	0	140	89	3
2007	439	901	0	0	0	0	290	70	2
2008	506	965	2	0	0	0	168	119	0
2009	528	519	13	0	0	0	53	36	3
2010	723	844	43	0	0	0	90	75	0
2011	319	459	1	0	0	0	201	104	11
Avg.	**505**	**609**	**7**	**4**	**18**	**0**	**129**	**82**	**2**

Data source: WDFW Hatchery Database 2009, *FishBooks* 2012.

Note: In 2009, 2010, and 2011, additional Chinook broodstock were collected and spawned at Bernie Kai Kai Gobin Salmon Hatchery. Also, the 2009 and 2010, Wallace River Hatchery collections include fish collected from the Wallace River below the hatchery rack (see Table 1.12.1 and 1.12.2).

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

Hatchery-origin Chinook returning to Wallace River Hatchery in excess of broodstock needs will either be returned to the Wallace River for natural spawning, surplused to the Tulalip Tribes, or possibly to a contracted buyer when in excess of broodstock and natural spawning needs.

Hatchery-origin adult Chinook that may be returned to the Wallace River for natural spawning as described in HGMP section 7.9 when Minimum Spawner Guidelines for the Wallace River are not being met and the combined hatchery production goal are met. For any particular year when the combined egg-take goal for Wallace River and Bernie Kai Kai Gobin hatchery programs have been met, Chinook recruiting to Wallace River Hatchery in excess of the production needs may be returned to the stream in a 3:2 male: female ratio to achieve “Minimum Spawner Guidelines” (MSG). Numbers of adult Chinook that may be returned to the Wallace River as established by the Co-managers are 303 male and 202 female spawners in the lower Wallace River, and 224 and 149 males and females in the upper river (see HGMP section 7.9 for more information). Hatchery-origin fish may be returned to the river in excess of MSG goals, as long as goals for controlling genetic risks can be met.

No hatchery-origin fish returning to the hatchery will be surplused unless the combined hatchery production goal (egg-take goal) for both programs, and the MSG goals, have been met.

7.6) Fish transportation and holding methods.

Wallace Hatchery holding. Adult Chinook returning to the hatchery from Wallace River or collected by seining are held in three parallel 15'x100'x60" holding ponds supplied by Wallace River surface water. Fish are separated based upon their month of return timing.

May Creek trap holding. Adults returning to May Creek are held in-stream above an in-river trap. Fish densities are monitored and when they increase above recommended levels, adults are moved (up to two to four times per month depending on the number returning), to the three raceways where fish returning from Wallace River are held. This will be discontinued with the construction of the rack at the mouth of May Creek, expected to begin in 2013.

Transportation. Chinook returning to May Creek or that are collected by seining from the Wallace River below the rack are transported in totes placed on a flatbed truck. Fish are loaded up to 10 per tote. In both cases, the trip lasts less than five minutes.

Chinook transported to Wallace River Hatchery from the Sunset Falls trap are transported in 1,000-gallon tanks in a fish-hauling truck equipped with aerators and oxygen tanks. The trip lasts ~half an hour. At Wallace River Hatchery, adult broodstock collected from Sunset Falls are held in covered, 16'x4.5' circular ponds supplied by Wallace River surface water.

7.7) Describe fish health maintenance and sanitation procedures applied.

All adults held in holding ponds are injected with erythromycin for Bacterial Kidney Disease (BKD) control. Adults, including those in circular pond, are treated every other day with formalin, at a rate not exceeding 25 parts per million (ppm) at the pond outfall, as a prophylactic to reduce *Saprolegnia* fungal infection.

Fish returning to May Creek held in the in-river pond are not treated with medication and formalin.

7.8) Disposition of carcasses.

Spawned and un-spawned carcasses that have not been exposed to antibiotics or chemical treatment may be surplused to the Tribe or a fish buyer. All other carcasses are buried on-station.

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.

Natural-origin adults will be incorporated into the broodstock with the intent of maintaining the genetic composition of the natural population and reducing the risk of divergence of the populations by reducing the genetic influence of hatchery-origin fish that spawn in the composite population. Still, collection of NOS for broodstock from the natural escapement is limited to one location, Sunset Falls, with strict limits (225 fish or <20%, whichever is lower) to protect the viability of the SF Skykomish population as described below. The only other natural-origin fish that can be used for broodstock are NORs recruiting into Wallace River Hatchery, which are not enumerated as part of the natural spawning escapement. These are believed to be conservative guidelines designed to limit potential effects on genetic and life history diversity (and other viability parameters) of the naturally-spawning SF aggregation. This was modeled using EDT and a simple simulation analysis. This analysis suggested that the NOS above Sunset Falls would equilibrate at approximately 860, well above the current conditions.

The following protocol was designed for collection of NOB from the Sunset Falls trap and Wallace River weir:

> Take up to 225 natural-origin Chinook or up to 20% of the Sunset Falls return, whichever is less, throughout their return timing. If, in any year, either pre-season or in-season run size information indicates that the critical escapement level (currently 1,745 spawners) for the Skykomish population will not be reached, the broodstocking protocol will be modified to assure that the collection of NOB from Sunset Falls will not cause the NOS to go below the critical level. No natural-origin Chinook will be removed from Sunset Falls if the natural Skykomish Chinook escapement is in critical status with the possible exception where the Co-managers may consider taking NOS into the hatchery for the purpose of increasing natural production to prevent perceived imminent extinction.

The Co-managers will develop, evaluate, and then implement, if agreed, an in-season update model for the natural Skykomish population using Sunset Falls return data for this purpose. This would involve developing a relationship between Sunset falls trap counts in-season at different dates and the post-season estimate of the natural escapement of Skykomish Chinook. In addition, NOB recruiting into Wallace River Hatchery can be utilized as well to fulfill the final goal of integrating 300 viable NOB.

The maximum transfer guideline of 20% of the Sunset Falls return, or 225 fish, whichever is less, from the NOS to the NOB category is a conservative guideline designed to limit the effect on natural production of taking natural-origin fish into the hatchery. This guideline was evaluated in two ways. First, an analysis of past return data revealed that if the 20% removal was applied to the observed Chinook numbers that have passed over Sunset Falls in the recent 19-year period before any NOB removals were initiated for integration purposes, it would have resulted in a

range of 274 to 929 NOS in the upper South Fork Skykomish (Table 7.9.1). In the past 19 years, the lower end of this range (number passed if 20% was removed) would have been greater than the maximum sustainable yield escapement for this area from current conditions using EDT analysis (Table 7.9.2) in 18/19 years (Table 7.9.1). For the year where it would have been exceeded had 20% been removed, takes were halted after it became apparent that despite the forecast, in-season data indicated that the escapement might be in critical status, limiting the number removed to just 38 fish that year. Thus, we expect that under this protocol, the MSY escapement level for the upper South Fork Skykomish would be exceeded the great majority of the time. We also used a very simple simulation model to project the NOS above Sunset Falls if this protocol were in place, assuming that the population dynamics of this area operated according to the Beverton-Holt spawner-recruit parameters estimated in the EDT analysis. This analysis suggested that the NOS above Sunset Falls would equilibrate at approximately 860, well above the current conditions MSY escapement level of 332 and in the top quarter of the past 20 years of observations.

Table 7.9.1: Sunset Falls run size, estimated numbers of fish that would have been passed and removed if 20% of the run was hauled for NOB and actual NOB removed.

Year	Total Sunset Falls Runsize	NOS Passed, if 20% Removed	NOB Transferred, if 20% removed	Actual NOB Transferred to Wallace
1993	630	504	126	**No Hatchery transfers prior to 2005**
1994	531	425	106	
1995	1,035	828	207	
1996	860	688	172	
1997	699	559	140	
1998	572	458	114	
1999	722	578	144	
2000	790	632	158	
2001	1,161	929	232	
2002	942	754	188	
2003	939	711	178	
2004	716	573	143	
2005	614	491	123	107 (17.4%)
2006	828	662	166	118 (14.3%)
2007	706	565	141	87 (12.3%)
2008	776	621	155	130 (16.8%)
2009	342	274	68	38 (11.1%)
2010	479	383	96	92 (9.2%)
2011	493	394	99	53 (10.8%)
Averages	**728**	**580**	**145**	

Source: Sunset Falls annual report (Dave Collins, WDFW 2012). Includes all Chinook jacks and adults passed upstream and shipped to Wallace River Hatchery.

As can be observed, the "less than 20%" guideline was not exceeded in any year since collections began for broodstock integration in 2005 and averaged only 89 fish or 61.4% of the 20% guideline, which would have averaged 145 fish over the past 19 years had 20% been removed. Had the 20% removal rate been applied to observed Chinook numbers that were passed above Sunset Falls in the recent 19-year period, it would have resulted in an average number of NOS passed to the upper South Fork Skykomish of 580 and would not have been below the maximum

sustainable yield escapement for this area from current conditions using EDT analysis (Table 7.9.2) in only 1 of the past 19 years.

Table 7.9.2: Results of EDT analysis on components of the Skykomish Chinook population.

Population	Scenario	Diversity Index	Productivity	Capacity	Eq. Abundance	MSY Esc
Upper SF Skykomish	Current conditions	89%	5.8	1,366	1,131	332
	Historic potential	100%	13.4	3,659	3,386	726
Upper Wallace	Current conditions	100%	7.2	309	226	72
	Historic potential	100%	18.3	1,006	951	180
Remainder of Skykomish	Current conditions	77%	3.7	10,132	7,400	2,529
	Historic potential	99%	14.5	48,750	45,397	9,432
Entire Skykomish Population	Current conditions	85%	4.4	11,692	9,013	2,918
	Historic potential	100%	16.0	50,983	47,806	9,550

Controlling the number of hatchery-origin spawners (HOS) in the Wallace River and integrating natural-origin fish into the broodstock is being done with the intent to increase local adaptation to the natural environment and boost productivity and diversity, while managing for abundance, spatial distribution and genetic and life history diversity. All of these practices minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Control of hatchery-origin adult Chinook will only be done in the Wallace River immediately below the hatchery rack following strict guidelines in the attempt to improve productivity and control potential adverse genetic and ecological interactions between natural- and hatchery-origin Chinook while controlling potential adverse effects caused by the removals to other viability targets (abundance, spatial distribution and diversity). To manage abundance while implementing HOS control, a Minimum Natural Spawner Guideline (MSG) of 878 spawners was established for the Wallace River, comprised of 351 females and 527 males, based on the EDT capacity estimate and standard ratio of 3:2 males to females (or 2.5 fish per redd). This results in sex-specific minimum spawner guidelines of 303 and 202 male and female spawners in the lower, and 224 and 149 males and females in the upper, Wallace River. Only NOS recruiting to the Wallace River weir (as distinguished from those that spawn in natural spawning areas) will be used for broodstock and are not counted as part of the natural escapement. On the contrary, the 878 fish passed or retained in the Wallace River give preference to NOS when integration goals have been met and return fish back to the river. When there are not sufficient NOS, HOS will be passed upstream to augment MSG, which provides natural spawning to build future NOS and addresses viability goals for recovery.

To manage spatial distribution and life history diversity, fish removals are limited to below the hatchery rack while the MSG adopted for Wallace River Chinook, considers the spatial distribution of Chinook throughout the Wallace system—above and below the hatchery weir. Estimates of the linear miles of habitat in the Wallace River are 4.2 miles of potential Chinook spawning habitat from the mouth to the Hatchery weir and 3.1 miles above the weir.

SECTION 8. MATING

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

8.1) Selection method.

Chinook used for broodstock for on-station releases will be selected randomly as they ripen and representatively across the entire maturation time frame from hatchery-origin fish. All available unmarked fish will be spawned when ripe.

Fish for broodstock for out of station releases will be selected randomly as they ripen across the entire maturation time frame from hatchery-origin fish and are considered to be integrated one generation out.

The proportion of ripe fish encountered (of the total estimated to be available for spawning) applied to the total egg-take goal will determine the egg-take for the day so that the gametes collected over the spawning period represent the maturation timing.

8.2) Males.

All males collected, including jacks, will be considered for spawning and chosen randomly and representatively on any spawning day. Jacks will be used at a rate of 2% of spawned males.

8.3) Fertilization.

Eggs pooled from five females will be equally spread into five buckets and fertilized with milt from one male (matrix spawning). After 60 seconds of fertilization time, eggs are combined into one bucket. The eggs will then be placed in vertical incubator trays and water-hardened for 1 hour in an iodophor solution of 100ppm.

8.4) Cryopreserved gametes.

Cryopreserved gametes are not 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.

Adults to be spawned will be chosen randomly and representatively from the available gene pool. Every attempt will be made to ensure that the egg-take is representative of the summer Chinook run.

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

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

The current egg-take goal for the Wallace River Hatchery is 4.8 million, with an on-station egg-take goal of 2 million and a green egg transfer goal of 2.8 million to the Tulalip Tribes Bernie Kai Kai Gobin Hatchery. The egg-take from Skykomish Chinook returns will be adjusted by the Co-managers if it is not sufficient to meet on-station release, egg transfer goals, or terminal fishery expectations. In further recognition that there may be shortfalls of Skykomish River Chinook eggs on low return years to provide eggs for on-station releases and the egg transfer to the Tulalip Hatchery, contingency plans for alternative actions to provide the egg-takes are described in the 2012 State-Tribal Hatchery MOU Agreement (WDFW and Tulalip 2012). That suite of actions applies to the combined egg-take goal of 4.4 million and the egg transfer goal of 2.4 million to Tulalip. Above this number, if the remaining 400K eggs are not available at Wallace River Hatchery that are both surplus to the combined production goal and the MSG goal for the Wallace

River natural spawning population, they will have to be supplied by the Tulalip rack to achieve the 2.8 million egg-take level as described below. This will not affect the current agreements between the parties or the egg allocation formula described below:

If egg-take goals are not achieved despite the coordinated management actions of the Co-managers, the minimum production requirements for on-station egg-take goals at the Wallace River Hatchery will be addressed by allocating the first one million eggs to the Wallace River Hatchery for on-station needs. The next 750,000 Chinook eggs taken will be allocated for transfer to Tulalip Hatchery. Additional Chinook eggs, after this first 1.75 million, will be divided evenly between Wallace River and Tulalip Hatcheries until an egg-take at Tulalip of 2.4 million is reached (shown in purple in Table 9.1.1). Up to this point, the Co-managers have a suite of management actions that are available for making these egg-takes and priorities that are described in the August 15, 2012 State-Tribal Hatchery MOU Agreement. Eggs will be provided from Wallace River Hatchery when they are available surplus to production to achieve the remaining 400,000 eggs for Tulalip (shown in red in Table 9.1.1), provided also that the MSG for the natural spawning Chinook population in the Wallace River has been met. If there are not enough fish in the Wallace River Hatchery escapement to meet the overall 4.8 million egg-take or the Wallace MSG, the remaining 400K eggs (above 2.4 million) for Tulalip will be taken from Tulalip Bay.

Table 9.1.1: Egg-take allocation during shortfalls.

Wallace	Tulalip	Wallace Cumulative Total	Tulalip Cumulative Total
1,000,000	750,000	1,000,000	750,000
100,000	100,000	1,100,000	850,000
100,000	100,000	1,200,000	950,000
100,000	100,000	1,300,000	1,050,000
100,000	100,000	1,400,000	1,150,000
100,000	100,000	1,500,000	1,250,000
100,000	100,000	1,600,000	1,350,000
100,000	100,000	1,700,000	1,450,000
100,000	100,000	1,800,000	1,550,000
100,000	100,000	1,900,000	1,650,000
100,000	100,000	**2,000,000**	1,750,000
	100,000		2,950,000
	100,000		2,950,000
	100,000		2,050,000
	100,000		2,150,000
	100,000		2,250,000
	100,000		2,350,000
	50,000		**2,400,000**
	100,000		2,500,000
	100,000		2,600,000
	100,000		2,700,000
	100,000		**2,800,000**
	400,000		

Source: Mike Crewson, Tulalip Tribes 2012.

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

Table 9.1.1.1: Survival from egg take to ponding, Wallace Hatchery summer Chinook, BY 2001-2011.

Brood Year	Eggs Collected	Survival Rates	
		Green-to-Eyed Egg Survival	Eyed-Egg-to-Fry Survival
2001	1,420,000	93.8	94.0
2002	2,114,000	93.5	94.7
2003	3,604,300	95.2	95.2
2004	3,740,000	91.6	96.0
2005	2,697,500	92.8	94.7
2006	4,106,800	96.3	87.9
2007	4,012,731	94.6	96.5
2008	4,266,749	94.8	97.9
2009	2,776,251	99.9	86.9
2010	4,220,600	92.5	72.2
2011	2,350,351	90.0	98.2
Average	**3,145,826**	**94.1**	**92.2.**

Source: WDFW Hatchery Records 2012.

Note: A portion of the egg-takes include eggs shipped to the Tulalip Tribe's Bernie Kai Kai Gobin Salmon Hatchery each year. Additional eggs were collected directly at Tulalip in 2009, 2010 and 2011.

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

No excess eggs will be collected beyond the needs for the joint 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 will be placed in vertical incubators at ~6,000 per tray.

9.1.4) Incubation conditions.

All eggs will be incubated in trays on May Creek water with the flow of 4 gpm per incubator stack. The temperature of inflowing water will be monitored and recorded daily. Dissolved oxygen will be checked when needed. Vexar® layers will be placed in the trays to provide substrate.

The use of surface water causes silt problems. Excess amounts of silt will be removed by "rodding" the trays and brushing the tray screens. This requires constant attention during flooding events.

9.1.5) Ponding.

When 95%+ button occurs up (mid-December, mid-January), swim-up fry will be moved from the trays into 10'x100'x36"raceways or 20'x80'x20" standard ponds and reared on May Creek or a mix of May Creek and Wallace River surface waters.

9.1.6) Fish health maintenance and monitoring.

All fertilized eggs will be water-hardened in an iodophor solution. Opportunistic fungus that grows on dead eggs in the incubators is controlled by formalin drip treatments (15-minutes per day at a target dose of 1,667-ppm formalin) throughout incubation to just prior to hatching. Once eyed, eggs are shocked and dead eggs removed. Eyed egg-to-ponded fry loss will be picked at the time of ponding and then fry mortalities are removed daily afterward.

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.

Chinook eggs retained in the vertical incubator stacks will be held at relatively low loading densities. Mortality due to fungal infection will be controlled and water temperatures and dissolved oxygen levels are monitored. Silt deposition will be closely monitored and removed as needed.

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 from fry-to-sub-yearling/yearling, Wallace Hatchery summer Chinook BY 2001-2011.

Brood Year	Survival Rates (%)	
	Fry-to-Sub-yearling Smolt	Sub-yearling-to-Yearling Smolt
2001	94.4	76.2
2002	86.7	44.9
2003	98.1	53.8
2004	94.2	83.9
2005	90.6	95.1
2006	95.3	60.1
2007	99.9	65.0
2008	96.8	78.7
2009	98.0	77.2
2010	95.4	78.5
2011	91.4	NA
Average	**94.6**	**71.3**

Source: Hatchery Records 2012.

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

Fish rearing densities are maintained at a maximum below 3 lbs of fish/ gpm and under 0.35 lbs/cu.ft (highest densities are just before release).

9.2.3) Fish rearing conditions

When fish size reaches 150 fpp (in May annually), they will be clipped, tagged and moved to the rearing channels for acclimation and release. Fish will be kept separated based on release time. Fish allocated for the 1.0 million sub-yearling releases will be reared until they achieve a size of ~70fpp and released whereas sub-yearlings allocated for the 0.5 million yearling release will be separated into a different rearing channel and reared for an additional year until they reach a size of ~8fpp. The rearing channels will be supplied with Wallace River water.

Table 9.2.3.1: Average surface water temperature (°F), by month, May Creek.

Month	May Creek Average Water Temperature (ºF)
January	42
February	44

March	45
April	46
May	48
June	51
July	57
August	59
September	55
October	52
November	45
December	43

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: Average size (fpp), by month, of juvenile summer Chinook reared at Wallace River Hatchery.

Month	Average Size (fpp)	
	Sub-yearlings	Yearlings
January	850	850
February	400	400
March	250	250
April	150	150
May	100	100
June	70	70
July		60
August		40
September		20
October		18
November		16
December		14
January		12
February		10
March		9
April		8

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).

Summer Chinook will be fed a variety of diet formulations including starter, crumbles and pellets of Bio-Oregon and EWOS brand. Feeding frequencies will vary depending on fish size and water

temperature and usually begin at eight feedings/day, 7 days/week, and end at 2-3 feedings/day, 5 days/week. Feeding rates will vary from 1.0% to 3.0%body weight/day. The overall feed conversion ratios (feed fed/weight gained) for the season will be approximately 0.7 for sub-yearlings and 1.1 for yearlings.

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

Fish health will be monitored on a daily basis by hatchery staff and at least monthly by a state Fish Health Specialist (FHS). Hatchery personnel will carry out treatments prescribed by the FHS. Procedures will be consistent with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State (WDFW and WWTIT 1998, (revised July 2006).

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

The migratory state of the release population will be determined by fish behavior and appearance. Aggressive screen and intake crowding, leaner condition factors, a more silvery physical appearance and loose scales, particularly noticeable during feeding events, are signs of smolt development. Gill 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 will be applied through the program.

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

All reasonable and prudent measures will be employed to minimize rearing and incubation losses. These include the use of high quality feeds for rearing, maintaining rearing densities and pond loadings that conform to best management practices and frequent fish health inspections will be conducted to prevent and control potential disease.

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 number and size at release.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Sub-yearling	1,000,000	70	June	Snohomish Basin Skykomish Wallace River
Yearling	*500,000	8	April	

Source: *Fishbooks* 2012.
Note: sub-yearlings =70 fpp ~ 83 mm fork length; yearlings = 10 fpp ~ 155 mm fork length
*The release size of yearling program was increased from 250,000 to 500,000 in 2012.

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

Stream, river, or watercourse: Wallace River (WRIA 07.0940)

Release point: RM 4.0

Major watershed: Snohomish River

Basin or Region: Puget Sound

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

Table 10.3.1: Actual number and size at release, by age, 2001-2012.

Release Year	Sub-yearlings				Yearlings			
	Number Released	Date(s)	Avg. size (fpp)	CV	Number Released	Date(s)	Avg. size (fpp)	CV
2001	1,223,194	6/29	58	5.7	500,000	4/14	8	8.8
2002	795,123	6/15	72	6.4	218,000	4/18	8	9.4
2003	1,026,559	6/18-20	65	6.7	250,000	4/14	9	7.9
2004	870,000	6/16	71	3.9	133,000	4/19-25	10	12.4
2005	1,067,700	6/1-2	70	6.7	164,843	3/15-31	10	11.7
2006	876,505	6/1-17	62	9.2	246,183	4/1-6	8	8.8
2007	1,115,372	6/11-14	85	6.6	290,000	4/1-24	11	10.1
2008	1,015,000	6/23-25	69	6.4	294,547	4/1-14	12	16.1
2009	1,168,281	6/2-24	70	5.6	261,507	4/1-9	9	10.6
2010	1,251,377	6/7-8	76	7.7	234,516	4/1-11	8	9.7
2011	1,010,000	6/3-5	75	6.6	249,740	4/20-30	9	10.1
2012	1,383,568	6/1-8	77	5.7	240,306	4/1-6	9	8.8

Source: WDFW Hatchery Plants database 2012, *FishBooks* 2012.

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

Hatchery screens will be pulled to start volitional release. After several days, those remaining in the pond are seined towards the pond exit and forced out. Sub-yearling releases are initiated annually in the first week of June; yearlings will be released in April, weather permitting on a day of high flow to encourage downstream migration.

See Table 10.3.1 for release dates.

10.5) Fish transportation procedures, if applicable.

Not applicable. Fish will be released on-station.

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

All summer Chinook will be reared and acclimated on Wallace River/May Creek surface water prior to release.

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

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

Year	Sub-yearlings	Yearling	Mark Type
2012	600,000	400,000	Ad-only
	200,000	[a]100,000	Ad+CWT
	200,000	n/a	CWT-only

Tulalip and WDFW Hatchery MOU Agreement (2012).

[a] Brood year 2009 yearlings were released ad-clipped only. Alternatively, the Co-managers are considering a double-index tagging program for the Wallace River Hatchery yearling production of 100K predicated on funding and manpower as well as a new thermal otolith marking program at Wallace River Hatchery.

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

While survival rates vary from year to year, the guideline is to be within 10% of program release goals. For example, over the past ten years, sub-yearling releases have ranged from 795K to 1.25 million but averaged 1.0 million, which is the goal. Yearling releases have ranged from 133K to 295K over the past ten years, but averaged 242K, less than the 250K goal.

10.9) Fish health certification procedures applied pre-release.

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

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

In the case of a catastrophic event (e.g., such as a major fish kill caused by water interruptions from a drought or flooding), fish could be released early to prevent their loss in the ponds.

Hatcheries Standby Procedures (revised in March 2012), a guideline developed by WDFW, includes information regarding proper actions to follow by hatchery employees in the case of an emergency.

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

The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal delay in the rivers, limiting interactions with listed Chinook. To minimize the risk of residualization and impact upon natural-origin fish, sub-yearlings are released in June (70 fpp) and yearling are released in April (8 fpp), which coincides in time with before and after the peak of the natural juvenile fish outmigration period.

Fish are visually monitored for smolting activities to ensure that they are released fully smolted to ensure actively downstream migration. In addition, a coefficient of variation (CV) for length at release of 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). For releases years 2007-2012, the average CV was 6.46% for sub-yearlings and 11.93% for yearlings.

It was also concluded (Steward and Bjornn 1990), that hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearlings) may have different food and habitat preferences than listed natural-origin fish making it less likely that hatchery-origin fish will be unlikely to out-compete natural-origin fish.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

The purpose of monitoring is to identify and evaluate the benefits and risks from this hatchery program, elements of which are identified in HGMP section 1.10. Snohomish region hatchery programs include extensive monitoring, evaluation and adaptive management and many other actions to monitor and address risks to natural populations, particularly during adult management.

The Tulalip Tribes initiated extensive monitoring and biological sampling focused on juvenile salmonids in the Skykomish and Snoqualmie Rivers and nearshore marine areas and pocket estuaries operating smolt traps in the Skykomish and Snoqualmie Rivers annually since 2000 and 2001, respectively, and have partnered with NOAA Fisheries in an extensive juvenile salmonid sampling effort in the Snohomish estuary since 2001. WDFW has joined in these monitoring efforts, which include the ongoing Sentinel Stock Genetic Mark Recapture Project I collaboration with the Tulalip Tribes. These programs provide valuable information on relative temporal-spatial

co-occurrences, outmigration timing, size, habitat utilization, prey consumption and other important metrics and data that is helping to assess the potential for any adverse ecological interactions between hatchery- and natural-origin Chinook and other species of juvenile salmonids. Also, an extensive adult monitoring program (stream surveys and biological sampling) is conducted annually to document origins (HOR/NOR ratios, contribution and straying rates, estimates of gene flow and relative genetically effective abundance, productivity, spatial structure, diversity), age, sex and size of natural- and hatchery-origin Chinook on spawning grounds throughout the basin.

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

WDFW, the Tulalip Tribes and NOAA Fisheries will continue to monitor Chinook escapement to the Snohomish system to estimate the number of clipped, tagged, and thermally-marked fish escaping to the river each year; e.g., spawning surveys of carcasses sampled for scales, otoliths, adipose-fin clips, coded-wire tags (CWT's) and tissues for DNA analysis.

As previously mentioned, smolt trapping (in the Skykomish and Snoqualmie systems) and estuarine and nearshore marine surveys continues to provide important information on the co-occurrence, out-migration timing, relative abundances and relative sizes of program fish as well as listed fish and non-Chinook species. In addition, WDFW's Wild Salmon Production/Evaluation Unit (WSP/E), in collaboration with the Tulalip Tribes, continues to conduct a genetic mark recapture study on the Snohomish. This project uses Chinook smolts from the Tulalip's Skykomish and Snoqualmie traps and tissues collected from adult fish on the spawning grounds.

Also, a total of 8,000 marked sub-yearlings will be retained, of which 4,000 will be used in four trap efficiency trials of 1,000 Chinook sub-yearlings each above the Skykomish River smolt trap, and another 4,000 will be used in four trap efficiency trials of 1,000 Chinook sub-yearlings each above the Snoqualmie River smolt trap.

To evaluate the potential risk of the relatively small release of 4,000 Skykomish River Chinook smolts into the Snoqualmie River that might contribute unwanted escapement of hatchery fish to the natural Chinook spawning population in the Snoqualmie, an analysis was performed to project how many of these released sub-yearlings might survive to contribute effective female spawners in the Snoqualmie.

As can be seen in the following text and table, an historic marine survival rate for sub-yearling Chinook was applied to the release of 4,000 to get recruitment prior to fisheries, followed by a fishery survival rate (1– the projected exploitation rate), followed by a projected "diversion rate" or proportion of the terminal run size that might return to the Snoqualmie instead of the Skykomish, followed by the historic female:male sex ratio, historic holding mortality, and projected proportion of females that might successfully mate.

The differential marine survival rate, as described in annual Status Reports of the Co-manager's Puget Sound Salmon Management Forecasts and Management Recommendations for the Stillaguamish-Snohomish Region of 0.0043 was first applied to the release of 4,000 sub-yearling Chinook. Sub-yearling Chinook are modeled separately in the Fishery Regulation Assessment Model (FRAM) from yearlings and are forecasted separately due to different databases used in the analyses and because fish size, age, and year of release are different than yearlings. Since an extensive data series for direct survival estimates for Wallace River sub-yearling Chinook were lacking, the Tulalip Hatchery sub-yearling Chinook survival rate was used. Per the Status Reports, adult-equivalent recoveries, by age, based on coded-wire tag groups were used to derive a sub-yearling AEQ survival rate of 0.43%.

Next, a projected fishery mortality rate of 30% was inversely applied (a 70% survival rate was applied to the recruitment), followed by an assumed 50% straying rate of released fish that might

return to the Snoqualmie, rather than the Skykomish where they were hatched, reared, and imprinted for the duration prior to their release, followed by the historic Skykomish summer Chinook female sex ratio of 45.6%, followed by the historic female holding mortality of 80.3%, finally followed by an assumed proportion of females (50%) that might successfully mate with other natural-origin Snoqualmie River Chinook.

Table 11.1.1.1:

Trap Efficiency Chinook Released Into Snoqualmie	Recruitment	Fishery Escapement	Diversion Rate	Females entering the Snoqualmie River	Viable Female Spawners	Effective Female Spawners
Sub-yearling Skykomish River (Wallace River Hatchery) Chinook	Historic AEQ Marine Survival Rate (0.43%; '86-91 CWT recoveries)	(Fishery Mortality @ 30% (70% Survival); Snohomish Chinook Ceiling RER = 24%	50% Diversion to Snoqualmie. Release Site vs. Imprint/Home (Sky.)	(Historic Wallace Chinook Sex Ratio (45.6% Female)	(Historic Holding Mortality: 19.7%, or 80.3% Survival)	Proportion of females that successfully mate (assumes 50%)
4,000	17	12	6	2.7	2.2	1.1
Average natural Chinook escapement to Snoqualmie River:		**1997 to 2011:**	**1,982**	**0.0006**	= Proportion of trap efficiency fish that might contribute to Snoqualmie River population.	
		1988 to 2002:	**2,356**	**0.0005**	= Proportion of effective female spawners expected to contribute to natural Snoqualmie River Chinook spawning population.	

Source: Mike Crewson, Tulalip Tribes 2012.

The result of 1.1 projected viable female spawner was then divided into the average natural Chinook escapement into the Snoqualmie River (1997 to 2011 average is 1,982). The final projection is that the trap efficiency release of 4,000 Chinook sub-yearlings into the Snoqualmie River might contribute about 1 female spawner, which is approximately .0006 of the average, natural spawning population in the Snoqualmie River. WDFW and regional Co-managers will continue to monitor Chinook escapement to the Snohomish system to estimate the number of tagged, untagged, and marked fish escaping to the river each year; e.g., spawner surveys personnel will sample carcasses for scales, otoliths, presence/absence of adipose-fin clips and CWT's. Also, new otolith marking at Wallace River Hatchery will enable the Co-managers to positively identify all regional hatchery production by the hatchery of origin, in addition to specific releases of all fish by brood year, and stock of origin.

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

Funding and resources are currently committed to monitor and evaluate this program.

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.

Monitoring and evaluation, with consultation with NOAA Fisheries, will be conducted utilizing the same methods that have been proven for more than a dozen years to not result in an unauthorized take of listed Chinook -- e.g., Chinook mortalities from smolt trapping operations in

the Skykomish and Snoqualmie rivers averaged less than one percent of the Chinook trapped (Nelson and Kelder, Nelson and Finley, Tulalip Tribes unpublished reports, 2001-2011).

SECTION 12. RESEARCH

12.1) Objective or purpose.

See HGMP section 11 for M & E projects that are taking place in cooperation with WDFW, the Tulalip Tribes and NOAA Fisheries.

12.2) Cooperating and funding agencies.

See HGMP sections 11 and 12.1.

12.3) Principle investigator or project supervisor and staff.

Not applicable.

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

Not applicable.

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

Not applicable.

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

Not applicable.

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

Not applicable.

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

Not applicable.

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

Not applicable.

12.10) Alternative methods to achieve project objectives.

Not applicable.

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

Not applicable.

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

Not applicable.

SECTION 13. ATTACHMENTS AND CITATIONS

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by___ _____ Date:_____

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 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.

Snohomish/ Skykomish 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). Four local populations have been identified in the Snohomish/ Skykomish Core Area, based the distribution of suitable spawning and rearing habitat: North Fork Skykomish River, Troublesome Creek, Salmon Creek and the South Fork Skykomish River. These populations exhibit anadromous, fluvial and resident life history forms and may spawn at the same time and place (WDFW Bull Trout SaSI 2004). Current data indicates that the anadromous form is much more abundant and widespread than the fluvial form in the drainage. This core area does not include any adfluvial populations, but some accessible lowland lakes are utilized by anadromous and fluvial forms as foraging habitat (USFWS 2004). The resident form typically occupies the upper watershed above anadromous reaches and its abundance is unknown. Migratory bull trout are known to spawn in Beckler and the east fork of the Foss River as well as in the upper north fork of the Skykomish River and tributaries. The current status of the Snohomish/ Skykomish bull trout Core Area is healthy based on recent abundance data (WDFW Bull Trout SaSI 2004). The recovered abundance level for bull trout in the Snohomish/Skykomish Core Area has been set at 500 adult spawners, based on current habitat capacity (USFWS 2004).

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

Core Area Population	Abundance Category (individuals)	Distribution Range Rank (stream length miles)	Short-term Trend Rank	Threat Rank	Final Rank
Snohomish & Skykomish Rivers	1,000-2,500	620-3,000	Increasing	Widespread, low-severity	Potential Risk

Source: USFWS 2008.

Table 15.2.2: Bull trout redd counts from the north fork Skykomish River index area and bull trout adult counts at the Sunset Falls trap on the south fork Skykomish River (2000 to 2011).

Year	Number of Redds	Number of Adults
2000	236	51
2001	319	62
2002	538	90

2003	No Data	92
2004	359	128
2005	247	103
2006	247	99
2007	136	53
2008	195	68
2009	93	52
2010	115	97
2011	105	60
Average	**235**	**80**

Data source: WDFW SaSI.

Habitat-- Many of the key spawning and rearing habitats of local bull trout populations within the north fork of the Skykomish River remain in good to excellent condition. Past and recent timber harvest and associated road building has impacted habitats primarily within the south fork Skykomish River local population. Like most major river systems within the Puget Sound Management Unit, habitat complexity has been significantly reduced in the mainstem as a result of various land management and development activities. This has resulted in the degradation of foraging, migration, and overwintering habitat and potentially rearing habitat for the anadromous life history form. Nearshore foraging habitats have been, and continue to be, impacted by development activities. Bull trout within this system were overharvested in the past, but the implementation of more restrictive regulations in the early 1990's have helped allow the population to increase in abundance from the low levels of the late-1980's. Recent returns strongly indicate that this population has likely rebounded near or to recovered levels of abundance (USFWS 2004).

Competition and Predation – Given the life history of bull trout and release strategies used in this hatchery program (see also HGMP section 10) and competitive interactions between hatchery fish and bull trout are likely to be limited. Predation of hatchery fish from this program on bull trout is also likely to be limited, however with listing of Puget Sound Chinook and steelhead hatchery fish may provide an important addition to the forage base for bull trout (see also HGMP section 3.5).

15.3) Analyze effects.

Hatchery activities, including in-river broodstock collection, hatchery trap operations and water intake structures may pose a risk to system bull trout populations. Annual estimates of bull trout encounters through the hatchery activities are recorded and reported.

15.4) Actions taken to minimize potential effects.

Hatchery traps are checked at least daily. Any bull trout encountered at the traps are immediately returned to the stream. Bull trout may be encountered 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) Other Species under USFWS jurisdiction.

Several other listed and candidate species are found in Snohomish 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.

“No effect” for the following listed species:

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

Canada Lynx (*Lynx canadensis*) –Threatened
Gray Wolf (*Canis lupus*) –Threatened
Grizzly bear (*Ursus arctos horribilis*) –Threatened
Marbled murrelet (*Brachyramphus marmoratus*) –Threatened
Northern Spotted owl (*Strix occidentalis caurina*) –Threatened

Candidate Species
Fisher *(Martes pennanti)* – West Coast DPS
North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS
Oregon spotted frog (*Rana pretiosa*) [historic]
Yellow-billed cuckoo (*Coccyzus americanus*)
Whitebark pine (*Pinus albicaulis*)

15.6) 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 I (of II): Puget Sound 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 (OR): 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. Olympia (WA): Washington State Department of Fish and Wildlife.

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

Listed species affected: Chinook *(Oncorhynchus tshawytscha)*	**ESU/Population:** Puget Sound/Skykomish River Summer Chinook	**Activity:** Wallace River Summer Chinook program
Location of hatchery activity: Wallace River Hatchery, Wallace River (WRIA 07.0940), Sunset Falls Fishway, SF Skykomish River (WRIA 07.0012)	**Dates of activity:** June-May	**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)	-	-	2,212	-
Collect for transport b)	-	-	225	-
Capture, handle, and release c)	-	-	1,912	-
Capture, handle, tag/mark/tissue sample, and released d)	-	-	1,912	-
Removal (e.g. broodstock) e)	-	-	Up to 757	-
Intentional lethal take f)	-	-	Up to 300	-
Unintentional lethal take g)	260,000	550,000	Up to 457	-
Other Take (specify) h)	-	-	-	-

Table 1b. Maximum numbers of adult natural-origin listed Chinook salmon that might be handled, with maximum and likely unintentional and intentional takes.

Type Take	Females	Males	Total
Max Handled	827	1,385	2212
Max Unintentional Take (Morts)	212	245	457
Max NOB	150	150	300
Max Take	362	395	757

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

Listed species affected: Steelhead *(Oncorhynchus mykiss)*	**ESU/Population:** Puget Sound/Snohomish River Summer Chinook	**Activity:** Wallace River Summer Chinook program
Location of hatchery activity: Wallace River Hatchery, Wallace River (WRIA 07.0940), Sunset Falls Fishway, SF Skykomish River (WRIA 07.0012)	**Dates of activity:** June-May	**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)	-	-	Up to 3	-
Capture, handle, tag/mark/tissue sample, and released d)	-	-	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g)	-	-	-	-
Other Take (specify) h)	-	-	-	-